Systems Engineering and Project Management (SEPM) Joint Working Group

Guide To SEPM Roles and Responsibilities

Issue 1

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Summary

The Joint Working Group (JWG) on Systems Engineering / Project Management Integration was formed by INCOSE UK and APM in 2013 as a result of a recognition by both organisations that closer integration of the two disciplines should increase the probability of project success. The aim of the JWG is to develop and promote good practice and guidance dovetailing SE and PM, and promote systems thinking across the wider decision making community in the UK.

This document results from the work undertaken to develop an integrated view of the Systems Engineering (SE) and Project/ Programme Management (PPM) roles and responsibilities, and how these evolve through the PPM life cycle. The document defines the responsibilities of each role, explains the similarities and differences in the roles, and describes how the activities associated with these roles change across the life-cycle. The document also considers how these roles may change for different projects depending on project type, scale, complexity and the industry in which the project is undertaken. The document concludes by identifying the 'touch points' and potential 'flash points' between the various roles.

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1. Introduction

Purpose and Scope

This document is the output from the APM/ INCOSE Joint Working Group (JWG) Workstream 4, the Roles & Responsibilities workstream, and is intended to:

- Generate a consolidated set of roles employed across the Programme and Project Management (PPM) and Systems Engineering (SE) communities;
- Define the responsibilities of each role;
- Explain the similarities and differences in the roles;
- Describe how the activities associated with these roles change across the life-cycle; and for different projects depending on type, scale, complexity and the industry;
- Identify the 'touch points' and potential 'flash points' between the various roles.

The approach which has been followed is shown in **Figure 1**.

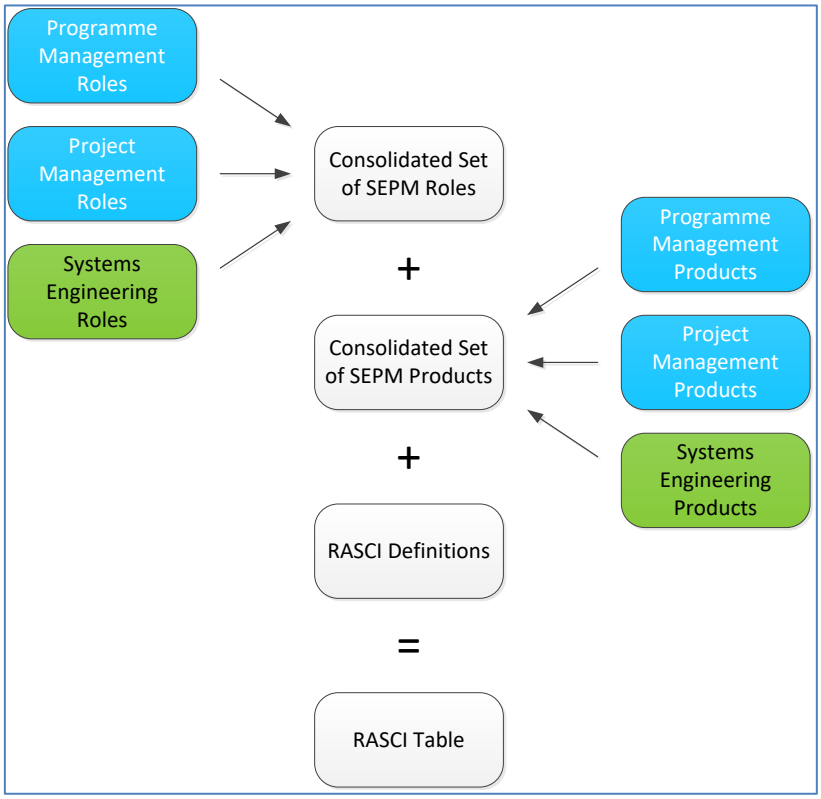


Figure 1: Approach to generating the SEPM Roles RASCI Table

In short, a consolidated set of SEPM roles and a consolidated set of SEPM products have been generated by drawing upon openly available PPM and SE documents and standards, and these have then been combined to create a RASCI Table that defines the responsibilities of each role in terms of the role's contribution to the generation of these products.

The reference documents used to generate the consolidated sets of roles and products have been:

Programme and Project Management

- APM BOK
- Axelos Managing Successful Programmes® (MSP®)
- Axelos PRINCE2®

Systems Engineering

- INCOSE Systems Engineering Handbook: A Guide For System Life Cycle Processes and Activities
- ISO/ IEC 15288
- NASA Project Management & Systems Engineering Competency Framework
- Sarah Sheard's 'Twelve Systems Engineering Roles'

In addition, a consolidated set of SEPM processes has been generated by drawing on the APM BOK and INCOSE SE Handbook.

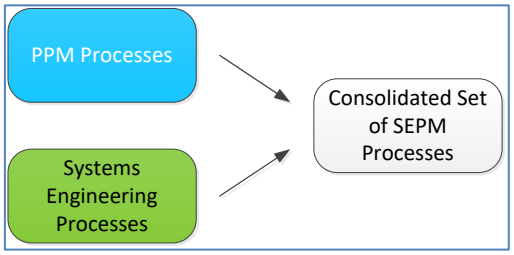


Figure 2: Approach to generating a Consolidated Set of SEPM Processes

Document Structure

The rest of this document is structured as described below:

- Section 2 identifies the Programme and Project Management roles of interest;
- Section 3 identifies the Systems Engineering roles of interest;
- Section 4 provides a consolidated set of SEPM roles;
- Section 5 contains the RASCI (Responsible, Accountable, Support, Consulted, Informed) definitions used to assign responsibilities;
- Section 6 identifies the responsibilities associated with each role by assigning responsibilities in relation to the generation of consolidated list of SEPM products based on Appendices F to I;
- Section 7 contains a series of discussions topics derived from our work such as the similarities and differences between roles, flash points and touch points, etc. The section also describes how these change through the life of a programme/ project and different programme/ project sizes and/or industries.
- Appendices A to I contain various tables which summarise the processes and products derived from the reference documents.

Key References

APM Body of Knowledge, 6th Edition, 2012

Managing Successful Programmes, Axelos, 2011 Edition

Managing Successful Projects with PRINCE2, Axelos, 2009 Edition

Systems Engineering Handbook: A Guide for System Life Cycle Processes and Activities, version 3.2.2, INCOSE, October 2011

ISO/IEC 15288:2008(E) (IEEE Std 15288-2008) System and software engineering – System life cycle process, Second Edition, 01/02/2008

ISO/IEC/IEEE 15288:2015 Systems and software engineering -- System life cycle processes, First Edition 2015-05

Twelve Systems Engineering Roles, Proceedings of the INCOSE Sixth Annual International Symposium (Boston, Massachusetts, USA), 1996, Sarah A. Sheard

NASA Project Management and Systems Engineering Competency Framework, Rev. 3.0, September 24, 2012

NASA Systems Engineering Handbook, SP-610S, June 1995

2. Programme and Project Management Roles

The following table lists the Programme and Project Management roles and associated definitions that have been distilled from the references and considered as within the scope of our work. Each row contains the equivalent or similar roles from each source.

MSP®	PRINCE2®	APM BOK
		Host Organisation - The organisation that provides the strategic direction of the project, programme or portfolio and will be the primary recipient of the benefits.
Sponsoring Group - Those senior managers who are responsible for the investment decision, defining the direction of the business and ensuring the ongoing overall alignment of the programme with the strategic direction of the organisation.		**(Project / P3) Sponsor** - The body or person accountable for ensuring that the work is governed effectively and delivers the objectives that meet identified needs.
Senior Responsible Owner (SRO) - The person accountable to the Sponsoring Group for the programme, ensuring it meets its objectives and realises the expected benefits.	**Project Executive (if the project is not part of a programme)** - The Executive's role is to ensure that the project is focused throughout its life-cycle on achieving its objectives and delivering a product that will achieve the forecast benefits.	
Programme Board - The group responsible for driving the programme forward and delivering the outcomes and benefits.	The Executive, Senior User and Senior Supplier(s) make up the Project Board. The Project Board has authority and responsibility for the project within the instructions (initially contained in the Project Mandate) set by Corporate or Programme Management.	**Steering Group / Board** - The body that provides sponsorship to a project, programme or portfolio, and represents financial, provider and user interests.
Business Change Manager - The person responsible for realising the resultant benefits by embedding the capability business operations and facilitating business changes to exploit that capability.		**Business Change Manager** - The person responsible for benefits management from identification through to realisation.
Programme Manager - The person responsible for leading and managing the setting-up of the programme through to delivery of the new capabilities, realisation of benefits and programme closure.		
Programme Assurance - The independent function responsible for auditing the programme.	**Project Assurance** - The function with delegated responsibility from the Project Board for auditing the project.	**P3 Assurance** - The process of providing confidence to stakeholders that projects, programmes and portfolios will achieve their scope, time, cost and quality objectives, and

MSP®	PRINCE2®	APM BOK
		realise their benefits.
(Project) Executive - The person in overall control of a project, appointed by the organisation's management to take the business perspective.	**(Project) Executive (if the project is part of a programme)** - The person in overall control of the project, appointed by the organisation's management to take the business perspective.	
	Senior User - The person who represents those who use what the project delivers to the Project Board.	**User** - A person who is intended to receive benefits or operate outputs.
	Senior Supplier - The person who represents the teams doing the actual work of the project to the Project Board.	**Provider** - A person or company that provides goods or services.
	Change Authority - The person with delegated responsibility from the Project Board to oversee and approve changes to the project.	
	Project Manager - The person with day-to-day responsibility for the project, and accountable to the Project Board.	**Project Manager** - The person responsible for the day-to-day management of the project via the application of processes, methods, knowledge, skills and experience to achieve the project objectives.
Programme Office - The body responsible for co-ordination of all the programme's information, communication, monitoring and control activities.	**Project Support/ Project Support Office** - The function that provides administrative support to the project.	**Project Support Office** - The organisation that provides administrative support to a project.
		Stakeholders - The organisations or people who have an interest or role in the project, programme or portfolio, or are impacted by it.
	Team Manager – The person with prime responsibility to ensure production of those products defined by the Project Manager to an appropriate quality in a timescale and at a cost acceptable to the Project Board. The Team Manager reports to and takes direction from the Project Manager.	

Table 1: Programme and Project Management Roles

The following is a list of PPM roles to be taken forward as candidates for the consolidated set of SEPM roles derived in Section 4.

- **Programme Sponsor:** The body or person responsible for ensuring the ongoing overall alignment of the programme with the strategic direction of the organisation;

- **Senior Responsible Owner (SRO)**: The role appointed by and accountable to the Sponsoring Group for the programme, ensuring it meets its business objectives and realises the expected benefits;

- **Business Change Manager**: The role responsible for realising the resultant benefits by embedding the capability within 'business as usual' operations and facilitating business changes to exploit that capability;

- **User**: The role responsible for representing those who will use what the programme delivers;

- **Programme Manager**: The role responsible for leading and managing the setting-up of the programme through to delivery of the new capabilities, realisation of benefits and programme closure. The role holds day-to-day responsibility for the programme, and is accountable to the Programme Board;

- **Programme/ Project Sponsor (Executive)**: The role appointed by and accountable to the programme for a project, ensuring it delivers the expected outputs;

- **Project Manager**: The role responsible for leading and managing the setting-up of the project through to delivery of the new system (or system element) and project closure. The role holds day-to-day responsibility for the project, and is accountable to the Project Board;

- **Team Manager / Supplier**: The role representing the teams (or external suppliers) doing the actual work on the project as approved by the Project Board;

- **Change Authority**: The person with delegated responsibility from the Project Board to oversee and approve changes to the project.

The following are roles not taken forward as candidates for the consolidated set of SEPM roles on the basis that they are enabling or supporting roles rather than key roles:

- **Programme Management Office**: The body responsible for co-ordination of all the programme's information, communication, monitoring and control activities;

- **Programme Assurance**: The independent body responsible for auditing the programme;

- **Project Office:** The body responsible for providing administrative support to a project;

- **Project Assurance:** The independent body responsible for auditing the project.

3. Systems Engineering Roles

The following table lists the Systems Engineering roles and associated definitions that have been distilled from the references and considered within scope of our work. Note that the shading indicates an overlap with the Programme and Project Management roles identified in Section 2, and that the NASA Competency Framework does not contain explicit role descriptions because each role is defined in terms of the competencies across the life-cycle. The number in brackets for each of the entries in the 'Twelve SE Roles' column are references to the roles in Sarah Sheard's paper (see the list of Key References on p.6).

INCOSE SE Handbook	Twelve SE Roles	NASA Competency Framework
Sponsor - The person responsible for committing funding and resources to a project in order to meet the strategic objectives of the organisation.		
Programme Manager - The person responsible for initiating, evolving and closing projects.		**Program Manager**
Life Cycle Manager (Technical Director) - The person responsible for establishing, assessing and improving the organisation's lifecycle processes.		
		Program Systems Engineer (Chief Engineer)
Project Manager- The person responsible for planning, assessing and controlling the project.	**(Programme Manager)** - The person who controls cost, tracks risk, schedules resources, and maintains support groups such as CM and IT staff.	**Project Manager**
Solution Designer - The person responsible for defining and analysing the system architecture.	**System Designer** - The person who creates the high-level system architecture and design, and selects major components. (2)	**Project Systems Engineer**
System Design Authority - The person with prime responsibility for ensuring the overall engineering solution satisfies the agreed customer requirements and constraints.		
	Customer Interface - The person who represents the point of view of the customer throughout the programme. (7)	
	Glue Among Subsystems - A person who acts as a proactive trouble shooter, looking for problems and arranging to prevent them. (6)	
	System Analyst - A person who confirms that the designed system will meet requirements (usually	

INCOSE SE Handbook	Twelve SE Roles	NASA Competency Framework
	through system performance modelling). (3)	
	Process Engineer - The person who owns and documents the systems engineering process. (10)	
	Co-ordinator - The person who co-ordinates groups (such as subsystem teams) and resolves system issues. (11)	
	Technical Manager - A person who plans, schedules and tracks technical risks (as part of the Programme Management role). (8)	**Subsystem Lead/ Manager**
System Integrator/ Verification Lead/ Validation Lead - The person responsible for planning and leading the integration/ verification/ validation activities.	**V&V Engineer** - A person who plans and implements the system V&V programme to ensure the system, as designed and built, will meet the specified requirements. (4)	
Requirements Manager - The person responsible for eliciting, defining and analysing the stakeholder and system requirements.	**Requirements Owner** - The person who translates customer needs into specific, well-written requirements, and develops the system and subsystem requirements. (1)	
Configuration Manager - The person responsible for planning and leading the configuration management activities.	**Information Manager** - The person who oversees configuration management, data management and metric management. (9)	
	Logistics & Operations Engineer - A person who operates and maintains the system during the operational phase. (5)	
	Classified Ads Systems Engineer - A person who ensures the proper use of the term 'systems engineer' in job adverts! (12)	
		Technical Engineer/ Project Team Member
Quality Manager – The person responsible for ensuring that the products, services and implementations of life cycle processes meet the organisation's quality objectives and achieve customer satisfaction.		
Human Resources Manager – The person responsible for ensuring that the organisation is provided with the		

INCOSE SE Handbook	Twelve SE Roles	NASA Competency Framework
necessary human resources and that their competencies are consistent with business needs.		
Procurement Manager – The person responsible for obtaining a product or service in accordance with the organisation's requirements.		
Infrastructure Manager – The person responsible for ensuring that the organisation is provided with the necessary facilities, tools, and communications and information technology assets consistent with business needs.		

Table 2: Systems Engineering Roles

The following is a list of SE roles, excluding the roles already covered in the PPM list, to be taken forward as candidates for the consolidated set of SEPM roles derived in Section 4.

- **Technical Director**: The business role responsible for establishing, assessing and improving the organisation's lifecycle processes;
- **(Programme-level) Chief Engineer**: The role responsible for ensuring the programme's overall technical solution is capable of delivering the expected benefits.
- **Technical Design Authority**: The role responsible for ensuring the project's technical solution satisfies the user and system requirements;
- **System Element Lead**: A role responsible for ensuring the sub-system solution satisfies the sub-system requirements;
- **System Integration Lead/ Verification Lead/ Validation Lead**: A role responsible for planning and leading the integration/ verification/ validation activities;
- **Requirements Manager**: The role responsible for eliciting, defining and analysing the user, system and system element requirements;
- **Configuration Manager**: The role responsible for planning and leading the configuration management activities associated with the Programme or Project;
- **Technical Engineer/ Project Team Member** – A person who does the actual technical work on a project!

The following are roles not taken forward as candidates for the consolidated set of SEPM roles on the basis that they are enabling or supporting roles rather than key roles:

- **Quality Manager** – The person responsible for ensuring that the products, services and implementations of life cycle processes meet the organisation's quality objectives and achieve customer satisfaction.

- **Human Resources Manager** – The person responsible for ensuring that the organisation is provided with the necessary human resources and that their competencies are consistent with business needs;

- **Procurement Manager** – The person responsible for obtaining a product or service in accordance with the organisation's requirements;

- **Infrastructure Manager** – The person responsible for ensuring that the organisation is provided with the necessary facilities, tools, and communications and information technology assets consistent with business needs.

4. Consolidated Set of SEPM Roles

The candidate roles brought forward from each of the previous two sections are shown in the following table (roles in italics are either subsumed by others or deemed to be out of scope):

	PPM Roles	**SE Roles**
Business-level	Programme Sponsor User	 Technical Director
Programme-level	Senior Responsible Owner (SRO) Business Change Manager Programme Manager *Change Authority* Project Sponsor	 Chief Engineer
Project-level	Project Manager Team Manager / Supplier *Project Team Member*	 Technical Design Authority[1] Requirements Manager[1] *Configuration Manager* System Element Lead[1] I,V&V Lead[1] *Technical Engineer*

[1]Likely to be employed in a supporting role at the programme-level

Table 3: SEPM Roles

The Technical Engineer role can be subsumed into the more general Project Team Member role, but actually is not considered further as the role does not discharge either Programme/ Project Management or Systems Engineering responsibilities.

The Change Authority role can be subsumed into the Chief Engineer role.

Finally, the Configuration Manager is a specialist enabling role which doesn't carry any specific responsibilities for the content of the selected SEPM products included in our list and so can be omitted, leaving a total of fourteen roles.

Allocation to Communities

This consolidated set of roles can be considered in terms of four 'communities':

- **Business Community:** accountable for the execution of the business processes, supports the agreement processes;

- **PPM Community:** Accountable for the execution of the Programme and Project processes, Responsible for the Agreement processes;
- **SE Community:** Accountable for the execution of the Technical processes, Supports the Agreement processes;
- **Supplier Community:** Supports the Project, Technical & Agreement processes, whilst also having their own internal Business, PPM and SE processes (executed by their own Business, PPM and SE communities).

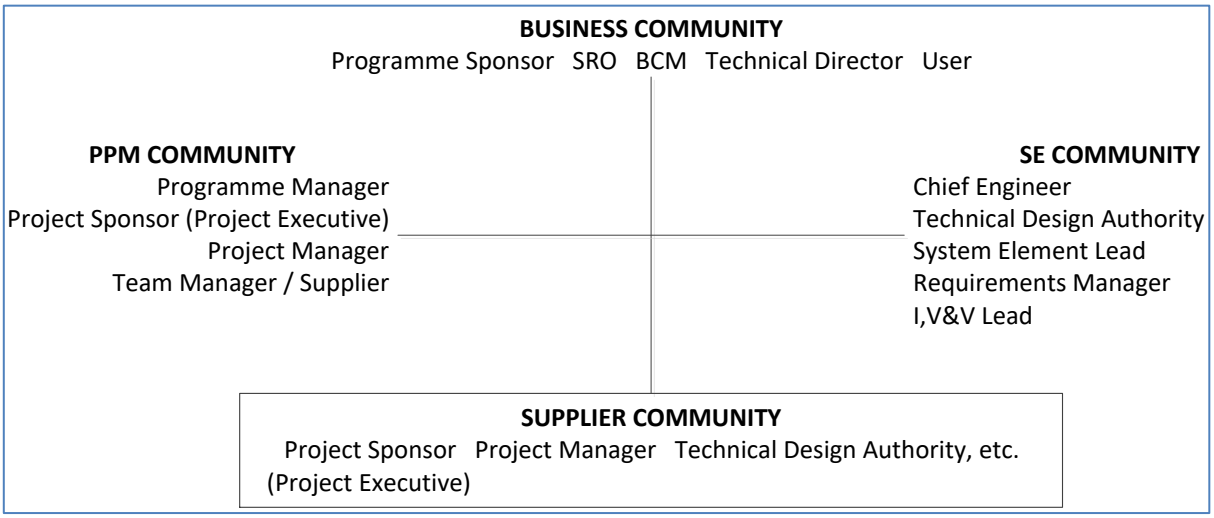


Figure 3: Business, PPM & SE Communities

Business Community Roles and Responsibilities

- **Programme Sponsor**: responsible for ensuring the ongoing overall alignment of the programme with the strategic direction of the organisation;
- **Senior Responsible Owner (SRO)**: appointed by and accountable to the Programme Sponsor for the programme, ensuring it meets its business objectives and realises the expected benefits;
- **Technical Director**: responsible for establishing, assessing and improving the organisation's lifecycle processes;
- **Business Change Manager**: responsible for realising the resultant benefits by embedding the capability within 'business as usual' operations and facilitating business changes to exploit that capability;
- **User**: responsible for representing those who will use what the programme delivers;

Programme and Project Management Community Roles and Responsibilities

- **Programme Manager:** responsible for leading and managing the programme from the setting-up of the programme through to delivery of the new capabilities, realisation of benefits and programme closure. The role holds day-to-day responsibility for the programme, and is accountable to the Programme Board;

- **Programme/ Project Sponsor (Executive):** appointed by and accountable to the programme for a project, ensuring it delivers the expected outputs;

- **Project Manager:** responsible for leading and managing the project from project mobilisation through to delivery of the new system (or system element) and project closure. The role holds day-to-day responsibility for the project, and is accountable to the Project Board;

- **Team Manager/ Supplier**: responsible for leading and managing the project teams doing the actual work on the project. This role may be undertaken by suppliers.

Systems Engineering Community Roles and Responsibilities

- **Chief Engineer:** responsible for ensuring the programme's overall technical solution is capable of delivering the expected benefits;

- **Technical Design Authority:** responsible for ensuring the project's technical solution satisfies the user and system requirements;

- **Requirements Manager**: responsible for eliciting, defining and analysing the user, system and system element requirements;

- **System Element Lead**: responsible for ensuring a system element solution satisfies system element requirements;

- **System Integration Lead/ Verification Lead/ Validation Lead:** responsible for planning and leading the integration/ verification/ validation activities.

5. RASCI Definitions

The following responsibilities are used in this document.

Responsible (R):

- Those who do the work to complete the activity and/ or ensure that the activity is done as per the Approver.
- There is typically one *Responsible* role, although others can be delegated to assist (Support) as required.
- If it is important to identify any delegation and/ or active "doing" participation in the activity, the *Support* role can be used.

Accountable (A):

- Those who hold the accountability for the correct and thorough completion of the activity and the one to whom Responsible is accountable to/ reports to for the activity.
- The holder of the Accountable role is typically also the Approver or final Approving Authority for the activity.
- There is one and only one *Accountable* specific for each activity.

Support (S):

- Where it is important to include delegation and/ or separately identify those who participate in the activity to undertake work associated with the activity, a *Support* role should be identified.
- Those holding the *Support* role are typically resources allocated to *Responsible*. Unlike the *Consulted* role, which provides input to the activity, the *Support* role undertakes the 'doing' of the activity.

Consulted (C):

- Those whose opinions are actively sought and taken into account while the activity is being undertaken.
- There is typically on-going two-way communication with the *Consulted* role while the activity is being undertaken.
- It should be noted that while the input and opinion of the *Consulted* role is actively sought, the decision on whether/ how this input/ opinions are applied to the activity lies with the *Responsible* role.

Informed (I):

- Those who are kept up-to-date on progress, often only on completion of the activity or when there are major issues.
- Communication with the I*nformed* roles is typically one-way communication only.

6. RASCI Table

The following table defines the responsibilities of each of our consolidated set of SEPM roles in terms of the Key Products (as derived/defined) in the Appendices.

	Programme Sponsor	Senior Responsible Owner (SRO)	Business Change Manager	Technical Director	User	Programme Manager	Project Sponsor	Project Manager	Team Manager / Supplier	Chief Engineer	Technical Authority	System Element Lead	Requirements Manager	I, V & V Lead
Business Community PPM Community SE Community **Key Products**														
Vision Statement	A	R	C											
Programme Mandate	A	R	C											
Programme Brief	A	R	C											
Business Case		A	C			R	S	S		S	S			
Risk Register		A	C	C		R	S	S	S	S	S	S	S	S
Benefits Map		A	R			C								
Benefits Realisation Plan			A			R								
Stakeholder Requirements				C	S	A				S			R	
Stakeholder Use Cases				C	S	A				R			S	
System Boundary				C		A				R				
External ICDs				C		A				R				
Concept Documents				C	S	A				R				
Enterprise Architecture				C		A				R				
Validation Plan				C	S	A				S			S	R
Maintenance Plan				C	S	A				R				
Transition Plan				C	S	A				R				
Programme Definition Document	A	C				R								
Programme Plan		A	C			R								
Output Descriptions		A				S				R				
Projects Dossier		A	C			R								
Benefits Review Report			A			R								
Transition Report					S	A				R				

Key Products	Programme Sponsor	Senior Responsible Owner (SRO)	Business Change Manager	Technical Director	User	Programme Manager	Project Sponsor	Project Manager	Team Manager / Supplier	Chief Engineer	Technical Authority	System Element Lead	Requirements Manager	I, V & V Lead
Realised Capability						A				R				
Validation Test Report					S	A				S				R
System Requirements				C		A				S			R	
System Use Cases				C		A				R			S	
System Architecture				C		A				R				
Verification Plan				C		A				S	S	S	S	R
System Design Specification				C		A				R	S	S		
Internal ICDs				C		A				R		S		
Integration Plan				C		A				S	S	S	S	R
Project Mandates						A	R							
Project Briefs						A	R							
Project Initiation Documents							A	R			S			
Project Plan							A	R			S			
Product Descriptions							A				R			
System Elements									A		S	R		
Integration Test Report								A			S	S		R
Realised System								A			R			
Verification Test Report								A			S	S		R

Business Community
PPM Community
SE Community

Table 4: SEPM RASCI Table

In summary:

The **User** supports the elicitation of Stakeholder Requirements, the development of Use Cases and Concept Descriptions, and the generation of the Transition, Validation and Maintenance Plans and Reports.

A **System Element Lead** is responsible for delivering a System Element, and supports the development of the System Design Specification and Internal ICDs, and generation of the Integration and Verification Plans and Reports.

The **Requirements Manager** is responsible for eliciting the Stakeholder and System Requirements, and supports the generation of the Stakeholder and System Use Cases, and the Integration, Verification and Validation Plans.

The **Integration, Verification and Validation Lead** is responsible for generating the Integration, Verification and Validation Plans and Reports.

The **Programme Manager** is *accountable* for the programme's outputs, the programme's **Chief Engineer** is *responsible* for the programme's outputs, except where responsibility has been delegated to a specialist role.

The **Project Manager** is *accountable* for the project's outputs, the project's **Technical Authority** is *responsible* for the project's outputs, except where responsibility has been delegated to a specialist role.

7. Discussion

This section collates a number of discussion points and observations made during our work. The intention is that these will feed into the consolidated SEPM guidance material that will be generated by the JWG.

Similarities & Differences in PPM & SE Roles

"Common aspirations, different perspectives."

Although Systems Engineering (SE) and Programme & Project Management (PPM) share the same overall goal and are focused on achieving the same outcome (i.e. the achievement of business goals through successful delivery), they have different perspectives which can lead to confusion, and result in inefficient (and sometimes ineffective) delivery. These different perspectives, concerns or priorities can only be reconciled through better understanding and mutual close co-operation.

More specifically, PPM and SE:

- Are often regarded as distinct disciplines that operate as largely independent disciplines;
- Sometimes use different language to mean the same thing and sometimes use the same language to mean different things;
- Require different skill sets and largely use different tools;
- Are delivered by practitioners, who focus on different things, with largely different motivations and philosophies (although in many cases these practitioners come from a common engineering background).

PPM Roles	SE Roles
• PPM focuses on the business requirement: the ***Why***, ***When*** and ***How Much***, although it should be noted that the When is dependent on the ***What*** and ***How***. • PPM roles are responsible for 'designing' and operating the 'control system' to manage the work associated with the solution. • Project Managers for technical projects must understand the technical aspects to a significant level to both understand the ***How*** and to undertake Risk Management. However, this does not mean they do the technical work.	• SE focuses on the business solution: the ***What*** and ***How***, although it should be noted that the ***What*** and ***How*** are dependent on the ***When*** and ***How Much***. • SE roles are responsible for defining, designing and delivering the solution.

Table 5: PPM and SE Perspectives

For 'small' projects the PM and SE roles may be undertaken by the same person. However, as projects increase in scale and complexity it becomes necessary for each of the two roles to be undertaken by

different individuals which requires a clear definition of the '***Who***' in respect of each aspect of the combined role. Although both roles share a common goal, the '***Why***', they have different perspectives and priorities:

- The PM is focused on the business requirement; the '***Why***', '**When**' and '***How Much***' (although the '***When***' is dependent on the '***What***' and the '***How***');
- The SE is focused on the business solution; the '***What***' and the '***How***' (although these are dependent upon the '***When***' and '***How Much***').

This is represented by the Venn Diagram of **Figure 4**. The goal is to ensure that each role has a full appreciation of the other's perspective by promoting a common understanding of all facets of the problem space, i.e. the ***When***, the ***How Much***, the ***What***, the ***How***, the ***Why*** and the ***Who***.

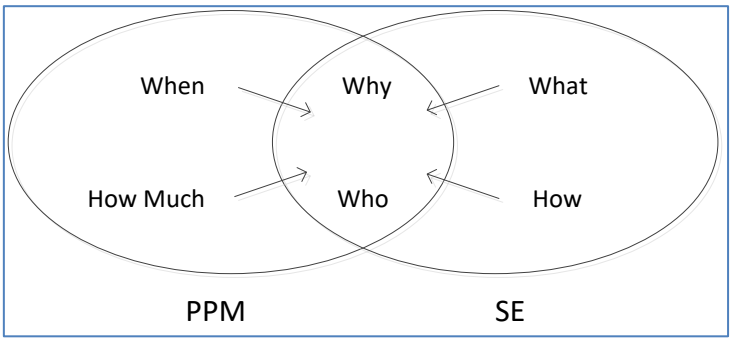


Figure 4: PPM and SE Perspectives

An alternative way of looking at this is to consider the Performance/ Cost/ Time (PCT) envelope. Whilst the PM has overall responsibility for the entire engineering solution, the Systems Engineer has particular responsibility for the Performance (and Safety) of the solution, whilst also being cognoscente of Cost and Time. Typically, trades must be made so that the delivered solution sits within this envelope. To this list can be added Risk, and the management of risk becomes a key touch point between PM and SE.

Engineering (the combination of Systems Engineering and Project Management) is a collaborative undertaking and is not a 'Zero-Sum Game'. One cannot 'win' at the expense of the other: both work to achieve the same overall objective. The Programme/ Project Manager is ultimately accountable for the success of the undertaking and 'delegates' technical aspects to Systems Engineers. However, it is likely to be ill-advised for a Programme Manager to over-rule a Chief Engineer, or a Project Manager to over-rule a Technical Design Authority; particularly where the Chief Engineer or Technical Design Authority calls an SE NOGO.

Finally, while the general responsibilities for PM and SE roles are similar between programmes, they need to be tailored to the specific programme and should be documented in the (programme-level) Systems Engineering Management Plan (SEMP). Our RASCI Table of Section 6 is an attempt to pin down these responsibilities in some detail.

From 'Flash Points' to 'Touch Points'

The potential for flash points between the PPM and SE communities arises because of a failure to appreciate each other's perspectives, roles or terminology, at either a collective or an individual level This is particularly the case in respect of those areas that carry shared responsibilities (as shown in **Figure 5**).

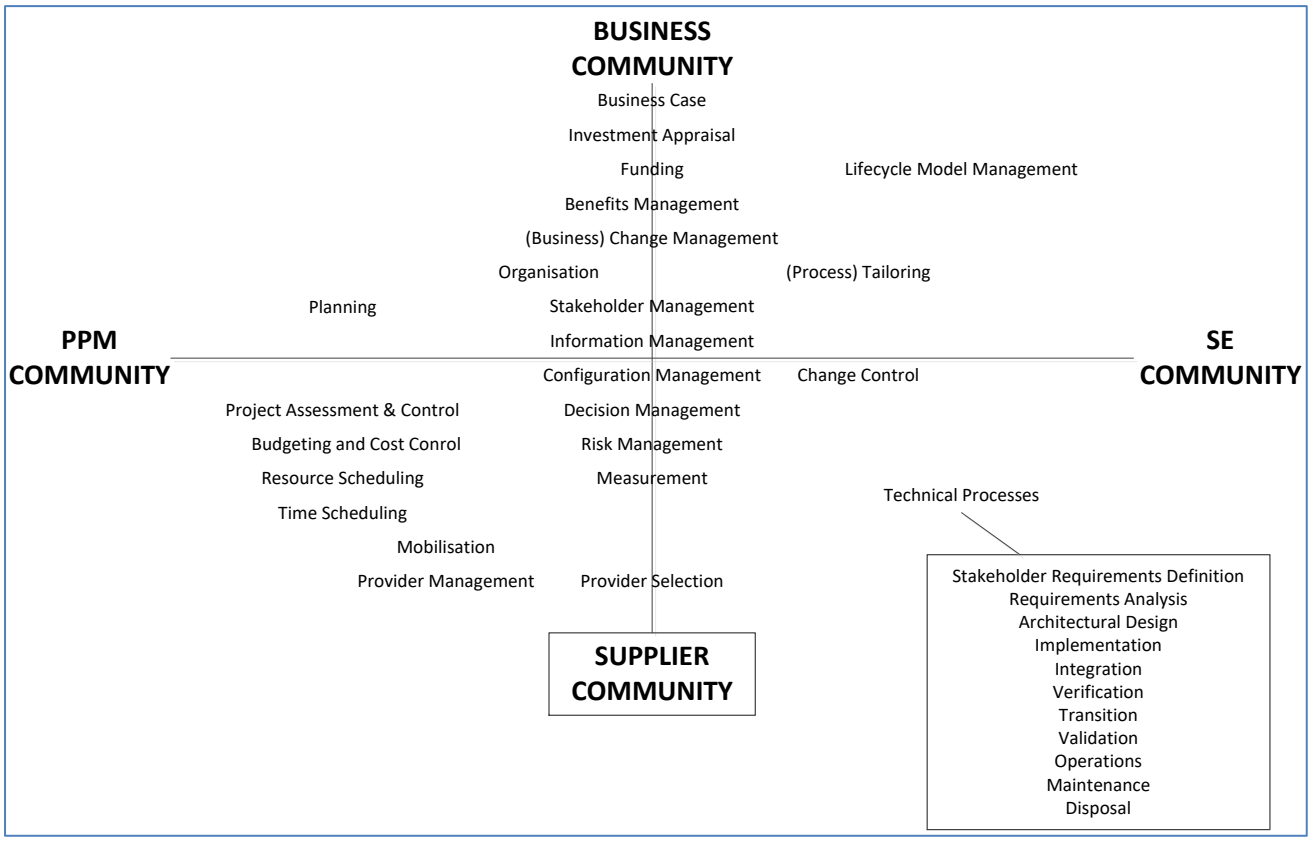


Figure 5: Mapping of SEPM Processes to Communities

This diagram maps the consolidated set of SEPM processes of Appendices D and E to the representation of the four communities of interest introduced in Section 4. The PM-dominated processes (Planning, Project Assessment & Control, Resource and Time Scheduling, Mobilisation and Provider Management) are shown towards the LHS of the diagram whilst the SE-dominated processes (Lifecycle Model Management, Process Tailoring, Change Control and all the Technical Processes) are shown to the RHS of the diagram. This isn't to say that there isn't any contribution from the 'other' community but ownership and leadership is clear.

Similarly, the Business-dominated processes (Business Case, Investment Appraisal, Funding, Benefits Management and Business Change Management) are shown towards the top of the diagram where primary ownership and leadership lies with the Business Community. Finally, the shared responsibilities are shown in the centre of the diagram and these are the areas where there is more contention and thus greater potential for flash points occurring between the different communities, e.g.

- Stakeholder Management - where issues may arise over 'ownership' of stakeholders and the regulation of access to them;
- Information Management and Configuration Management – which are both enabling processes but where issues may arise in respect of the control of access to information;

- Decision Management – where it is imperative that decisions consider the different perspectives and are based on objective evidence;
- Risk Management – where both programmatic and technical risks need to be given full consideration when determining what actions are necessary in the management of risk;
- Provider Selection – where the trade-off of anticipated performance, cost, quality and risk must be considered when choosing a supplier;
- Measurement – objective measurement to support decision and risk management activities.

The best way of avoiding these flash points is to ensure a common understanding and establish common expectations, and the following is a list of ways of helping to achieve this, broken down into organisational- and programme/project-level aspects:

Organisation-level

- Awareness Training; making PMs aware of the key principles and concepts of Systems Engineering and making Systems Engineers aware of the key principles and concepts of Programme/ Project Management;
- Adoption of common terminology; encapsulated within the organisational-level lifecycle model and processes;
- Adoption of common infrastructure, e.g. the tools and standards to be used (e.g. for Risk Management, Configuration Management);

Programme or Project-level

- Sharing of a common vision: At the programme-level this is captured in the Programme Vision, but this also sets the context for each project within the programme and so should be understood and accepted by all those performing PPM and SE roles. Establishing a common vision (the '***Why***') for the project in the Project Brief will help ensure everyone is bought into the same goal;
- Clear definition of PPM and SE Roles: These should be defined within a Project Management Plan with a specific emphasis on areas of overlap which have the greatest potential for conflict;
- Integrated Planning: The collaborative definition of the project outputs or products (captured in the form of a Product Breakdown Structure) and the activities to realise these products (Work Breakdown Structure) helps to consolidate a common understanding of the '**What**' and the '***How***', and also ties into the Cost Breakdown Structure, determination of the '***How Much***', and the Project Plan (the '***When***');
- Clear definition of the project lifecycle and processes: These should be defined within the Project Management Plan (or within a Systems Engineering Management Plan that either forms part of, or is referenced from the Project Management Plan) to avoid ambiguity, etc. and consolidate the understanding of the '***How***'. The Review Gates to be adopted by the project should be clearly defined with entry and exit criteria, and depending on the nature of the review incorporate both PM and SE metrics in order to support evidence-based decision making.

Touch Points between PPM and SE include products that have a key role in ensuring a common understanding between the different communities;

- Programme Vision and Project Brief: captures the ***Why***;
- Product Breakdown Structure: captures the ***What*** in terms of the products required to satisfy the project requirements;
- Work Breakdown Structure: derived from the Product Breakdown Structure and captures an overview of the ***How*** in terms of the activities needed to deliver the ***What***;
- Project Management Plan and Systems Engineering Management Plan: defines the project lifecycle, processes and reviews, and therefore captures the ***How*** in more detail, and also the ***Who*** in terms of roles and responsibilities;
- Project Schedule: captures the ***When*** and ***Who*** as well as the ***What*** and ***How Much***;
- Cost Breakdown Structure: derived from the Work Breakdown Structure and the Project Schedule (particularly for Resource costs) to capture the ***How Much***;
- Risk Register: captures the risks which informs decisions around the ***What***, ***How***, ***When*** and ***How Much***.

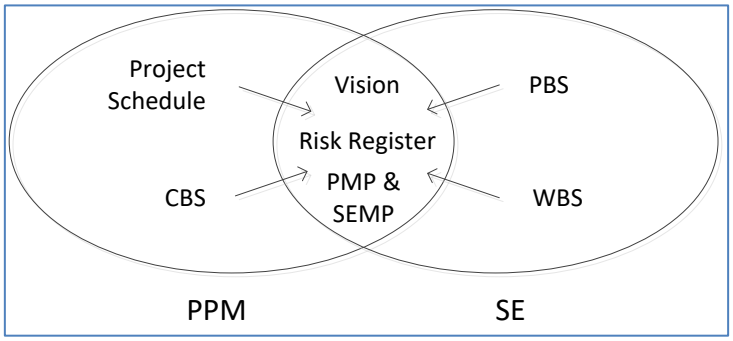


Figure 6: PPM and SE Touch Points

These touch points are represented in the Venn Diagram of **Figure 6** which is similar to **Figure 4** in that it proposes a shared appreciation of the contents of SEPM products identified in order to promote a common understanding.

Changes in PPM & SE Roles Through the Life-Cycle

This section considers how the roles change through the life-cycle and the potential causes of conflict between the PPM and SE communities. The section also outlines possible approaches to the management of this conflict.

There is a change of emphasis across the roles as the ' flow of accountability' moves from the Business Community (who define the scope and objectives) to the PPM Community (who define and manage the approach), to the SE Community (who realise the solution) and back to the Business Community (who operate the solution to realise business benefit) through the life-cycle. At each life-cycle stage, the community that will take Accountability next should Support or be Consulted in order to obtain their input and prepare them to take Accountability. On completion of their Accountability for a stage each community should support the next community that takes Accountability.

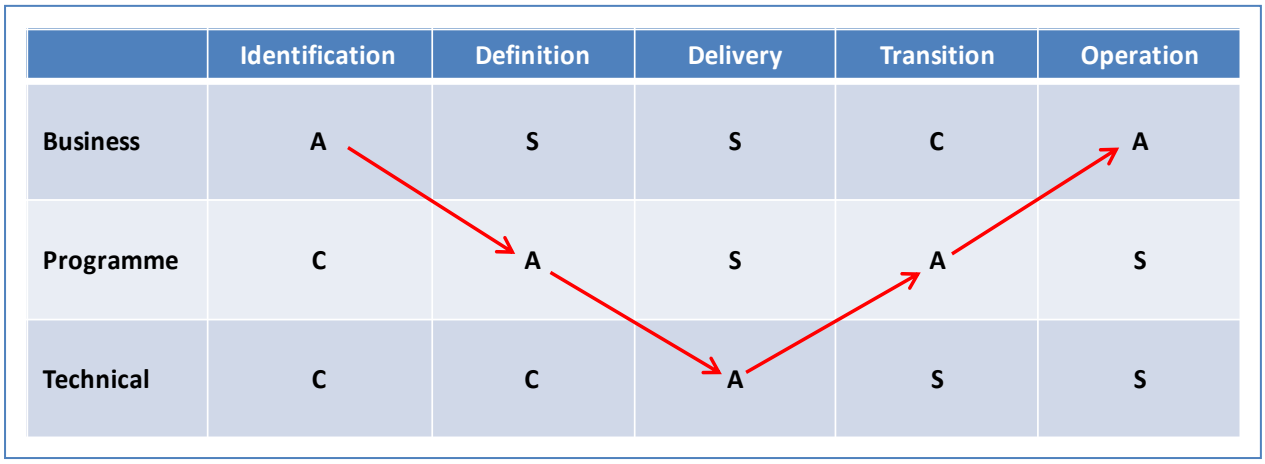


Figure 7: Flow of Accountability Through the Life-Cycle

The changes in accountability through the life-cycle are outlined in Figure 7. Note that there is also a change in the type of behaviour required from those responsible for achievement of objectives at the management level (the SRO, the Programme Manager and the Chief Engineer respectively for each of the three communities) when working with their teams. These are described below:

Life-Cycle Phase	Identification	Definition	Delivery	Transition	Operation
Management Behaviour	Facilitate	Focus	Direct	Support	N/A

Figure 8: Management Behaviour Through the Life-Cycle

Identification: management behaviour facilitates the coming together of communities to identify the scope, objectives and potential business benefits to be achieved. The scope of the programme and the potential solutions remains open for as long as possible to give time and space for new ideas to be developed.

Definition: management behaviour focuses on defining the approach and work required to achieve the scope and business benefits identified in the previous stage. While the approach may be open, the scope and objectives are not and management must focus the team on how these will be achieved.

Delivery: management behaviour is intended to ensure that the components required to achieve the objectives are delivered to scope, quality, time and cost.

Transition: management behaviour is intended to support the user communities taking the outputs from the delivery stage and putting them into operation in order to realise the business benefits.

Influence of Programme Type, Size, Complexity and Industry.

While the character of the overall roles, accountabilities and responsibilities do not significantly change for different programme types, sizes, complexities and industries the way in which they are discharged does and is discussed in this section.

Programme Type

Different programme/project types are considered below.

New Product Development Programmes and Projects: New Product Development (NPD) programmes and projects are aimed at bringing a new 'product' to market. In this context, the product can be tangible (something physical) or intangible (a service).

- New Product Development programmes are driven by the SE Community (for technically complex programmes) or the PPM Community (for further application of previously used technologies).
- The Chief Engineer/ Technical Lead role is pivotal and the Technical Lead may undertake the Programme Manager role in some cases.
- The primary SE aspect is associated with developing and realising an acceptable technical solution to the programme requirements within the programme time and cost constraints.
- The life cycle used is typically waterfall based for the first version of the product, although there may be further developments of this that use other life cycle types.
- Where there are significant technical risks/uncertainties, the approach adopted is likely to include demonstrators and/ or prototypes to address these risks/ uncertainties and build experience/ confidence in application of the technologies.
- Programme risks are primarily associated with achieving a technical solution within cost and time. The NASA Systems Engineering Handbook 'System Engineer's Dilemma' applies:
  - At each cost-effective solution:
    - To reduce cost at constant risk, performance must be reduced.
    - To reduce risk at constant cost, performance must be reduced.
    - To reduce cost at constant performance, higher risks must be accepted.
    - To reduce risk at constant performance, higher costs must be accepted.

    In this context, time in the schedule is often a critical resource, so that schedule behaves like a kind of cost.

Product Enhancement Programmes and Projects: Product Enhancement programmes and projects are aimed at introducing a new and improved version of an existing product, in order to improve its operation or extend its life. In this context, the product can be tangible (something physical) or intangible (a service).

This type of project has many variants, and is particularly common for software development projects where an incremental approach is used to 'enhance' existing products/ services.

- Product Enhancement programmes are often driven by the PPM Community if the enhancement is incremental and/or does not involve significant technical development. It may be driven by the SE Community if the enhancement is technically complex and/ or involves application of new technologies.
- The Programme Manager role is pivotal.
- The primary SE aspect is associated with developing and realising an acceptable technical solution typically while the product being enhanced continues to operate. Knowledge of product operation and configuration is important.
- The life cycle applied is typically multi-phased in order to deploy enhancements in stages.
- Where there are significant technical risks/uncertainties, the approach adopted may include demonstrators and/or prototypes to address these risks/ uncertainties and build experience/confidence in application of the technologies.
- Programme risks are primarily associated with achieving a technical and operational solution within time and/or cost.

Transformational Change Programmes and Projects: Transformational Change programmes and projects are aimed at making fundamental changes to how a business conducts its operations. The need for these changes may be due to external changes in the market such as an organisation's products or services being out of date, funding or income streams being changed, new regulations coming into force or market competition becoming more intense. Typical objectives of such projects are to:

- Increase revenue or market share
- Improve customer satisfaction
- Cut business operation costs

These objectives are typically achieved by realigning the way staff work, how the organisation is structured and/or how technology is used. The following observations are made:

- Transformational Change programmes are driven from and by the Business Community, who must:
  - Recognise that change is necessary
  - Agree what change is necessary (including defining a vision to describe the better future).
  - Support the design of the new organisation in terms of its required capabilities, ways of working, support and management.
  - Bed-down the change so that the organisation achieves the intended benefits and does not move back to how it was.
  - While most Transformational Change programmes include a significant IT element, the primary SE aspect is associated with defining and deploying the new business model/ operation and the 'Chief Engineer' may be referred to as the Business Architect.
- The Business Change Manager (BCM) role is pivotal and the BCM may undertake the Programme Manager role in some cases.
- The life-cycle used is typically based on a number of phases with new capabilities implemented. tested and rolled-out in waves.

- The approach adopted is likely to include ‘quick wins’ to help build confidence in and acceptance of the new ways of working by users.
- Programme risks are primarily associated with user acceptance and buy-in of both the need for the organisation to be transformed in the first place and their acceptance of the new ways of working developed by the programme.

Programme Size

This section considers the impact of programme/ project size on the PPM and SE approaches applied.

- Smaller projects often:
  - Combine PPM and SE roles: typically the Technical Lead is also the Project Manager.
  - Are likely to be planned end-to-end, often using the 'standard' waterfall life-cycle.
  - Use PPM and SE processes relatively informally.
  - Use a shared corporate PMO, Configuration Manager and Technical Design Authority that supports multiple projects.
- Larger programmes and projects often:
  - Separate PPM and SE roles and introduce mechanisms to support the associated communications ‘overhead’ (e.g. meetings, status reports). Good communication between teams and common ways of working becomes vital for the success of large programmes.
  - The number of people working on the programme and the diversity of disciplines may require specific management of resources in the various areas (people and/or facilities). This may require a dedicated structure to enable it to be managed effectively.
  - The programme is likely to be planned in stages against an overall ‘Roadmap’/ ‘aspirational schedule’ with the overall end-to-end detailed plan only becoming visible and available as the project reaches its conclusion. While the 'Roadmap' supports programme-wide communications, people working on the project must be comfortable with this 'uncertainty' at the detailed level.
  - The level and importance of Programme Assurance increases as it is vital that the many elements handed from one team to another cover the required scope and are of the required quality.
  - Typically have a number of suppliers. The Design Authority becomes more important than in smaller projects to ensure that overall technical coherence is maintained.
  - Organisations that frequently undertake large and/ or complex programmes are often set up as a Matrix Organisation, operating sub-organisations with responsibility for delivering programmes and managing staff.
  - Have a dedicated PMO, Configuration Manager and Technical Design Authority.

Programme Complexity

This section considers the impact of programme/project complexity on the PPM and SE approaches applied. Programme and project complexity comes in many forms. Examples are:

- Scale/ scope of the requirement, with a larger scale/scope resulting on a more complex programme.

- The number of components required to realise the solution, with a larger number of components resulting in a more complex programme.
- Diversity of disciplines required to meet the requirement, with a broader range of disciplines resulting in a more complex programme.
- The number and type of contractual boundaries, with a larger number of boundaries resulting in a more complex programme.
- Diversity of stakeholders, with a more diverse range of stakeholders resulting in a more complex programme.
- Clarity and/ or stability of requirements, with unclear/ unstable requirements resulting in a more complex programme. Lack of clarity in the requirements can also be introduced by a need to support (as yet undefined) mid-life updates to a product during its initial development.
- Technology readiness/ previous experience of the technologies being used to meet the requirement, with immature technologies and/ or little previous experience resulting in a more complex programme.
- The level of interworking with legacy systems/ components, with greater interworking resulting in a more complex programme.

Less complex programmes/ projects are likely to:

- Be driven primarily by the Programme and Project Management community as there is likely to be little technical risk.
- Combine roles (e.g. Project Manager and Chief Engineer).
- Use a waterfall based life-cycle model.
- Be managed by a 'generalist' programme/ project manager rather than a specialist.

More complex programmes/ project are likely to:

- Require a greater emphasis on Risk Management and Trade Studies.
- Place emphasis on staged Integration, Verification and Validation (IV&V) approaches.
- Require greater emphasis on defined processes and common ways of working due to the broader range and number of participants.
- Be planned in stages or phases against an overall ‘Roadmap’/ ‘aspirational schedule’ with the overall end-to-end detailed plan only becoming visible and available as the project reaches its conclusion.
- Require active programme-wide communications to ensure all participants are aware of the latest developments and/or issues.
- Engage more actively with the SRO and Technical Director to ensure the organisation understands the nature of the complexity being addressed and the approach being taken.
- Be driven from an emphasis on SE processes, with the PPM processes supporting these if the programme is technically complex and/ or involves application of new technologies.

- Require a Programme/Project Manager who understands the technical elements in significant detail in order to manage the programme/ project (particularly the management of risks). In some organisations, Programme Managers have previously undertaken the role of Chief Engineer.
- Be driven from an emphasis on PPM processes, with the SE processes supporting these if the programmes is complex due to the numbers of stakeholders and/or resources (but are not applying or developing significant new technologies).

Industry

The Industry in which the programme/ project is being undertaken in can impact the approach taken primarily due to the regulatory requirements of the Industry.

Highly regulated Industries (e.g. Aviation, Military, Nuclear, Rail) can:

- Introduce accreditation and certification requirements that drive the programme approach.
- Introduce additional formalities for roles (particularly for the SE Community) by requiring individuals to have specific competencies and experience to undertake programme roles.
- Require a greater level of assurance of both the components of products being developed and the overall product itself.

Other Industries (e.g. telecoms) typically operate levels of technical collaboration and/ or commercial collaboration in the industry. This level of collaboration can:

- Introduce significant stakeholder management requirements.
- Agreed common technical and programme architecture definition and interface controls
- The definition of governance mechanisms that enable participants to work to their PPM and SE processes internally, but efficiently integrate their technical and management (e.g. reporting) outputs with those of other organisations in the collaboration.

PPM & SE Behaviours & Conflict Management

While there may be significant philosophical differences between Systems Engineers and Programme/ Project Managers there are also considerable overlaps. While both disciplines share many common aspirations, they are likely to approach the achievement of their goals from different perspectives. Those responsible for shaping the direction of the future work are likely default to the viewpoint of their discipline.

- Programme and Project Managers are often keen to ensure the work is planned and organised to meet the customer's time and cost requirements, but may not give the technical scope and quality aspects sufficient consideration.
- Chief Engineers are also keen to ensure the work is planned and organised, but may focus on scope and quality without fully considering the time and cost aspects.

Both types of role require the strength of character to provide direction and gain the commitment of staff undertaking the project work. It might be considered inevitable that such similar roles with such differing

focus result in poor communication, indifferent results and conflict. Adopting constructive behaviours provides the opportunity to overcome these.

The disciplines may interpret the vision, requirement and approach according to their own perception or 'mental map' of how they believe things are and should be. Such perceptions can be heavily influenced by the individual's training, experience, personal and political bias. To achieve the best solution for the customer, it is essential to obtain a greater appreciation of each perspective. The most effective method of working is to combine talents and develop a synergistic solution that all accept and work with. A starting point may be to ask "What do we have in common" (e.g.):

- A desire to achieve the customer's requirements
- A desire to be seen as adding value to the organisation
- A desire to exceed expectations?

This should be followed by exploring the concerns each has about the way forward and requires deep listening and a willingness to find alternatives that both disciplines can accept i.e. a "third way". Some ground-rules for achieving this could be:

- To accept that common goals and shared responsibility are necessary for success.
- To listen without judgement to each perspective. Sincere listening increases trust and demonstrates care and attention to the needs of others.
- Seek a "Win-Win" approach to finding a solution. This is does not mean a compromise should be sought. Using the creativity of both disciplines will achieve a better result.

The approach described is not easy and requires significant effort, determination and emotional maturity from all those involved to make it work. It requires a strong desire to achieve the customer's requirement, confidence, and belief in the abilities of the overall team. It also requires the ability to listen, reflect and provide honest feedback. Like many things, it can be uncomfortable initially, but gets easier the more it is practised.

8. Appendices

This section contains nine appendices which are the source material for the main body of this document. They are included here both for completeness and as potential source material for further development.

Appendix A: APM BOK Process Definitions: A list of the APM processes and their definitions

Appendix B: ISO/IEC 15288 Processes: A 'mind map' of the 15288 processes

Appendix C: INCOSE SE Handbook Process Definitions: A list of the INCOSE (also 15288) processes and their definitions

Appendix D: APM BOK and INCOSE SE Handbook Processes (APM BOK Perspective): A consolidated set of the APM BOK and INCOSE processes from the APM perspective

Appendix E: APM BOK and INCOSE SE Handbook Processes (APM BOK Perspective): A consolidated set of the APM BOK and INCOSE processes from the INCOSE SE Handbook perspective

Appendix F: Axelos MSP® Products and RASCI Table: A list of the MSP products and their definitions, and RASCI mappings across the Programme Management Roles

Appendix G: Axelos PRINCE2® Products and RASCI Table: A list of the PRINCE2 products and their definitions, and RASCI mappings across the Project Management Roles

Appendix H: APM BoK Products and RASCI Table: A list of the APM products and their definitions, and RASCI mappings across the Programme and Project Management Roles

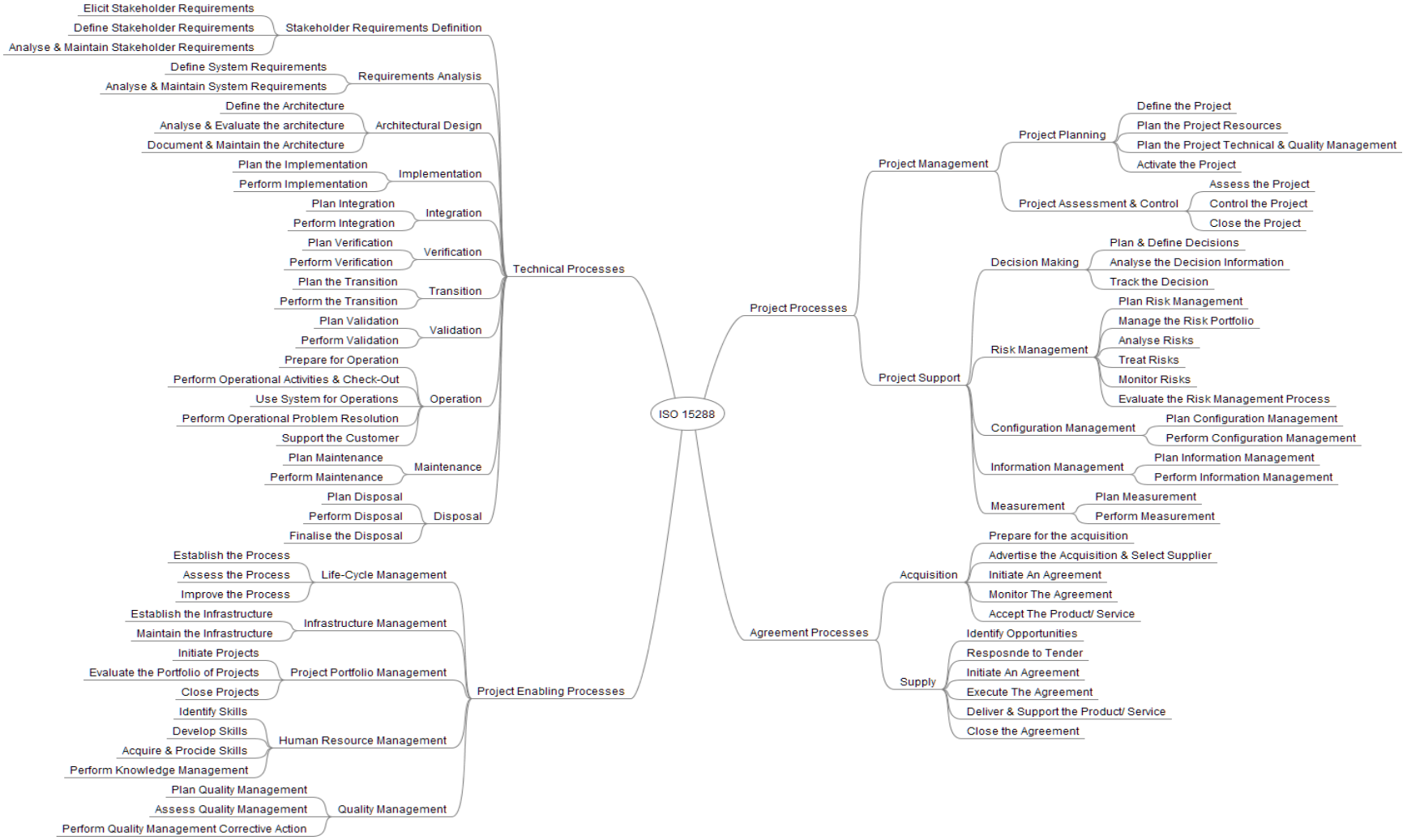
Appendix I: INCOSE Products and RASCI Table: A list of the INCOSE products and their definitions, and RASCI mappings across the Systems Engineering Roles

Appendix A: APM BOK Process Definitions

APM BOK Process	Definition
Business Case	The development of the justification for undertaking a project or programme.
Control	The tracking of performance against agreed plans and taking the corrective action required to meet defined objectives.
Information Management	The collection, storage, dissemination, archiving and destruction of information.
Organisation	The management structure applicable to the project, programme or portfolio and the organisational environment in which it operates.
Planning	The determination of what is to be delivered, how much it will cost, when it will be delivered and who will carry it out.
Stakeholder Management	The systematic identification, analysis, planning and implementation of actions designed to engage with stakeholders.
Benefits Management	The identification, definition, planning, tracking and realisation of business benefits.
Change Control	The process through which all requests to change the baseline scope of a project. Programme of portfolio are captured, evaluated and then approved, rejected or deferred.
Configuration Management	The administrative activities concerned with the creation, maintenance, controlled change and quality control of the scope of work.
(Business) Change Management	The structured approach to moving an organisation from the current state to a desired future state.
Requirements Management	The capturing, assessing and justifying stakeholders' wants and needs.
Solution Development	The determination of the best way of satisfying requirements.
Resource Scheduling	The calculation of the resources required to deliver the work, and when they will be required.
Time Scheduling	The development and presentation of schedules that show when work will be performed.
Budgeting and Cost Control	The estimation of costs, the setting of an agreed budget, and management of actual and forecast costs against that budget.

APM BOK Process	Definition
Funding	The means by which the capital required to undertake a project, programme or portfolio is secured and then made available as required.
Investment Appraisal	The identification of the attractiveness of an investment.
Risk Context	The understanding of the institutional and individual environment, attitudes and behaviours that affect the way risk arises and the way it should be managed.
Risk Techniques	The identification, assessment and planning of responses to individual risks and overall risk.
P3 Assurance	The provision of confidence that projects, programmes and portfolios will achieve their scope, time, cost and quality objectives, and realise their benefits.
Reviews	The critical evaluation of a deliverable, business case or P3 management process.
Contract	The making of an agreement between two or more parties that creates legally binding obligations between them.
Mobilisation	The mobilisation of organisational and technical infrastructures and mechanisms for putting resources in place.
Procurement	The acquisition of products and services from an external provider for incorporation into the project, programme or portfolio.
Provider Selection and Management	The identification, selection, appointment and supervision of providers throughout the P3 lifecycle.

Appendix B: ISO/IEC 15288 Processes



Appendix C: INCOSE SE Handbook Process Definitions

INCOSE Process	Definition
Acquisition	The acquisition of a product or service in accordance with the acquirer's requirements.
Supply	The provision of a product or service that meets the agreed requirements.
Life Cycle Model Management	The definition, maintenance, and assuring the availability of policies, life cycle processes, life cycle models, and procedures for use by the organization with respect to the scope of [ISO/IEC 15288:2008].
Infrastructure Management	The provision of the enabling infrastructure and services in support of the organisation and project objectives throughout the life cycle.
Project Portfolio Management	The initiation and sustainment of necessary, sufficient and suitable projects in order to meet the strategic objectives of the organisation.
Human Resource Management	The provision of the necessary human resources and to maintain their competencies, consistent with business needs.
Quality Management	The provision of assurance that products, services and implementations of life cycle processes meet organization quality objectives and achieve customer satisfaction.
Project Planning	The production and communication of effective and workable project plans.
Project Assessment & Control	The determination of the status of the project and direct project plan execution to ensure that the project performs according to plans and schedules, within projected budgets, to satisfy technical objectives.
Decision Management	The selection of the most beneficial course of project action where alternatives exist.
Risk Management	The continuous identification, analysis, treatment and monitoring of risks continuously.
Configuration Management	The establishment and maintenance of the integrity of all identified outputs of a project or process.
Information Management	The provision of relevant, timely, complete, valid and, if required, confidential information to designated parties during and, as appropriate, after the system life cycle.
Measurement	The collection, analysis, and reporting of data relating to the products developed and processes implemented within the

INCOSE Process	Definition
	organization.
Stakeholder Requirements Definition	The definition of requirements for a system that can provide the services needed by users and other stakeholders in a defined environment.
Requirements Analysis	The transformation of the stakeholder, requirement-driven view of desired services into a technical view of a required product that could deliver those services.
Architectural Design	The synthesis of a solution that satisfies system requirements.
Implementation	The realisation of a specified system element.
Integration	The combining of system elements to form a complete or partial system configuration in order to create a product specified in the system requirements.
Verification	The confirmation that the specified design requirements are fulfilled by the system.
Transition	The establishment of a capability to provide services specified by stakeholder requirements in the operational environment.
Validation	The provision of objective evidence that the services provided by a system when in use comply with stakeholders' requirements, achieving its intended use in its intended operational environment.
Operations	The use of the system in order to deliver its services.
Maintenance	The sustainment of the capability of the system to provide a service.
Disposal	To end the existence of a system entity.
(Organisational) Tailoring	The adaptation of external standards in the context of the organizational processes.
(Project) Tailoring	The adaptation of organizational processes for the unique needs of the project.

Appendix D: APM BOK and INCOSE SE Handbook Processes (APM BOK Perspective)

APM BOK Category	APM BOK Process	Equivalent INCOSE SE Handbook Process	Superset
Integrative Management	Business Case		Business Case
	Control	Project Assessment & Control	Project Assessment & Control
	Information Management	Information Management	Information Management
	Organisation		Organisation
		Life Cycle Model Management	Life Cycle Model Management
		Tailoring	Tailoring
	Planning	Project Planning	Planning
	Stakeholder Management		Stakeholder Management
	-	Decision Management	Decision Management
	-	Measurement	Measurement
Scope Management	Benefits Management		Benefits Management
	Change Control	Configuration Management	Change Control
	Configuration Management		Configuration Management
	(Business) Change Management		(Business) Change Management
	Requirements Management	Stakeholder Requirements Definition	Stakeholder Requirements Definition
		Requirements Analysis	Requirements Analysis
	Solution Development	Architectural Design	Architectural Design
		Implementation	Implementation
		Integration	Integration
		Verification	Verification
		Transition	Transition
		Validation	Validation
		Operations	Operations
		Maintenance	Maintenance
		Disposal	Disposal
Schedule Management	Resource Scheduling		Resource Scheduling

APM BOK Category	APM BOK Process	Equivalent INCOSE SE Handbook Process	Superset
	Time Scheduling		Time Scheduling
Financial & Cost Management	Budgeting and Cost Control		Budgeting and Cost Control
	Funding	Project Portfolio Management	Funding
	Investment Appraisal		Investment Appraisal
Risk Management	Risk Control	Risk Management	Risk Management
	Risk Techniques		
Quality Management	P3 Assurance	Quality Management	Quality Management
	Reviews		
Resources Management	Contract		Contract
	Mobilisation		Mobilisation
	Procurement	Acquisition	Procurement
	Provider Selection and Provider Management	Supply	Provider Selection
			Provider Management
		Infrastructure Management	Infrastructure Management
		Human Resource Management	Human Resource Management

Appendix E: APM BOK and INCOSE SE Handbook Processes (INCOSE SE Handbook Perspective)

INCOSE SE Handbook Category	INCOSE SE Handbook Process	APM BOK Process	Superset
Agreement Processes	Acquisition	Contract	Acquisition (*or Procurement)*
		Procurement	
		Provider Selection and Provider Management	Provider Selection
			Provider Management
	Supply	Contract	Supply
Project-Enabling Processes	Life Cycle Model Management		Life Cycle Model Management
	Infrastructure Management		Infrastructure Management
	Project Portfolio Management	Business Case	Business Case
		Benefits Management	Benefits Management
		(Business) Change Management	Business Change Management
		Funding	Funding
		Investment Appraisal	Investment Appraisal
	Human Resource Management		Human Resource Management
	Quality Management	P3 Assurance	Quality Management *(including Programme and Project Assurance)*
		Reviews	
Project Processes	Project Planning	Planning	Project Planning
	-	Mobilisation	Mobilisation
	-	Resource Scheduling	Schedule Management
	-	Time Scheduling	
	-	Budgeting and Cost Control	Budgeting and Cost Control
	Project Assessment & Control	Control	Project Assessment and Control
	Decision Management		Decision Management
	Risk Management	Risk Context	Risk Management
		Risk Techniques	
	Configuration Management	Configuration Management	Configuration Management
		Change Control	Change Control
	Information Management	Information Management	Information Management

INCOSE SE Handbook Category	INCOSE SE Handbook Process	APM BOK Process	Superset
	Measurement		Measurement
Technical Processes	Stakeholder Requirements Definition	Requirements Management	Requirements Management
	Requirements Analysis		Requirements Analysis
	Architectural Design	Solution Development	Architectural Design
	Implementation		Implementation
	Integration		Integration
	Verification		Verification
	Transition		Transition
	Validation		Validation
	Operations		Operations *(including Maintenance and Disposal)*
	Maintenance		
	Disposal		
Tailoring Processes	(Organisational) Tailoring		Organisational Tailoring
	(Project) Tailoring		Project Tailoring
APM BOK Processes that don't easily map to INCOSE Processes	-	Organisation	Organisation
	-	Stakeholder Management	Stakeholder Management

Appendix F: Axelos Managing Successful Programmes (MSP®) Products and RASCI Table

Product	Description	Sponsoring Group	SRO	Programme Board	Programme Manager	Business Change Manager	Programme Office	Programme Assurance
Benefit Profile	Used to define each benefit (and dis-benefit) and provide a detailed understanding of what will be involved and how the benefit will be realised.			R	S	A	I	I
Benefits Management Strategy	Defined the approach to realising benefits and the framework within which benefits realisation will be achieved.		A	R		C	I	I
Benefits Map	Illustrates the sequential relationship between benefits.			R		A	I	I
Benefits Realisation Plan	Used to track realisation of benefits across the programme and set review controls			A	S	R	S	I
Blueprint	Used to maintain focus on delivering the required transformation and business change.		A	S	R	S	I	I
Business Case	Used to provide the initiation of the programme and the ongoing viability of the programme.		A	R	S	S	I	I
Information Management Plan	Sets out the timetable and arrangements for implementing and managing the information management strategy.		A	I	R	I	S	I
Information Management Strategy	Describes the measures, systems and techniques that will be used to maintain and control programme information.		A	C	R	S	I	I
Issue Management Strategy	Used to describe the mechanisms and procedures for resolving issues.		A	C	R	S	I	I
Issue Register	Used to capture and actively manage programme issues.		CI	CI	A	S	R	I
Monitoring & Control Strategy	Describes how the programme will apply internal controls to itself.		A	C	R	S	I	I
Organisation Structure	Description of the management roles, responsibilities and reporting lines in the programme.		A	C	R	S	I	I
Programme Brief	Used to assess whether the programme is viable and achievable.	C	C	A	R	S	I	I
Programme Communications Plan	Sets out the timetable and arrangements for implementing and managing the stakeholder and engagement strategy.			CI	S	AR	S	I

Product	Description	Sponsoring Group	SRO	Programme Board	Programme Manager	Business Change Manager	Programme Office	Programme Assurance
Programme Definition Document	A document that is used to consolidate or summarise the information that was used to define the programme.	**A**	**S**	**R**	**R**	**S**	**S**	**I**
Programme Mandate	Used to describe the required outcomes from the programmes based on strategy and policy objectives.	**A**	**R**	**S**	**NA**	**NA**	**I**	**I**
Programme Plan	Used to control and track the progress and delivery of the programme and resulting outcomes.	**C**	**C**	**A**	**R**	**S**	**S**	**I**
Programme Preparation Plan	A plan that detai.ls how Defining A Programme will be undertaken.	**C**	**C**	**C**	**A**	**S**	**S**	**I**
Projects Dossier	Provides a list of projects required to deliver the Blueprint, with high level information and estimates.			**I**	**A**	**S**	**S**	**I**
Quality & Assurance Plan	Sets out the timetable and arrangements for carrying out the quality and assurance strategy.		**I**	**I**	**A**	**S**	**S**	**S**
Quality & Assurance Strategy	Used to define and establish the activities for managing quality across the programme.		**A**	**C**	**R**	**S**	**I**	**C**
Resource Management Plan	Arrangements for implementing the Resource Management Strategy.		**A**		**R**	**S**	**S**	**I**
Resource Management Strategy	Used to identify how the programme will acquire and manage the resources required to achieve the business change.		**A**	**S**	**R**	**S**	**I**	**I**
Risk Management Strategy	Defines the programme approach to Risk Management.		**A**	**C**	**R**	**S**	**I**	**I**
Risk Register	Used to capture and actively manage the risks to the programme.	**IC**	**IC**	**IC**	**A**	**S**	**R**	**I**
Stakeholder Engagement Strategy	Used to define the framework that will enable effective stakeholder engagement and communication.	**C**	**A**	**C**	**S**	**R**	**I**	**I**
Stakeholder Profiles	Used to record stakeholder analysis information.			**S**	**S**	**AR**	**S**	**I**
Vision Statement	Used to communicate the end goal of the programme, could be seen as providing an external ‘artist’s impression’ of the desired future state.	**A**	**R**		**I**	**I**	**I**	**I**

Appendix G: Axelos PRINCE2® Products and RASCI Table

Product	Description	Executive	Senior User	Senior Supplier	Project Manager	Team Manager	Project Assurance	Project Support
Benefits Review Plan	A plan that defines how and when a measurement of the achievement of the project's benefits can be made.	**A**	**C**	**C**	**R**		**C**	
Business Case	The justification for an organisational activity (project) which typically contains costs, benefits, risks and timescales, and against which continuing viability is tested	**RA**	**C**	**C**	**C**		**C**	
Checkpoint Report	A progress report of the information gathered at a checkpoint, which is given by a team to the Project Manager and which provides reporting data as defined in the Work Package.				**A**	**R**		
Communications Management Strategy	A description of the means and frequency of communications between the project and the project's stakeholders.	**A**	**A**	**A**	**R**			
Configuration Item Record	A record that describes the status, version and variant of a configuration item, and any details of important relationships between them.				**A**	**C**	**C**	**R**
Configuration Management Strategy	A description of how and by whom the project's products will be controlled and protected.	**A**	**A**	**A**	**R**		**C**	
Daily Log	Used to record problems/concerns that can be handled by the Project Manager informally.		**C**		**R**			
End Project Report	A report given by the Project Manager to the Project Board that confirms the handover of all products and provides an updated Business case and an assessment of how well the project has done against the original Project Initiation Documentation.	**A**	**A**	**A**	**R**		**C**	
End Stage Report	A report given by the Project Manager to the Project Board at the end of each management stage of the project.	**A**	**A**	**A**	**R**		**C**	
Exception Report	A description of the exception situation, its impact, options, recommendation and impact of the recommendation.	**C**	**C**	**C**	**R**		**C**	

Product	Description	Executive	Senior User	Senior Supplier	Project Manager	Team Manager	Project Assurance	Project Support
Highlight Report	A time-driven report from the Project Manager to the project Board on stage process.	C	C	C	R		C	
Issue Register	A register used to capture and maintain information on all the issues that are being managed formally.				AR		C	R
Issue Report	A report containing the description, impact assessment and recommendations for a request for change, off-specification or a problem/concern.				R		C	
Lessons Log	An informal repository for lessons that apply to this project or future projects.	C	C	C	R		C	
Lessons Report	A report that documents any lessons that can be usefully applied to other projects.	A	C	C	R		C	
Project Brief	Statement that describes the purpose, cost, time and performance requirements, and constraints for a project.	A	C	C	R		C	
Project Initiation Documentation	A logical set of documents that brings together the key information needed to start the project on a sound basis and that conveys the information to all concerned with the project.	A	A	A	R		C	
Project/Stage Plan	A detailed proposal for a project/stage showing the major products, when they will be delivered and at what cost.	A	A	A	R	C	C	
(Specialised) Product Description	A description of a product's purpose, composition, derivation and quality criteria.	A	A	A	R		C	
Project Product Description	A special type of Product Description used to gain agreement from the user on the project's scope and requirements, to define the customer's quality expectations, and to define the acceptance criteria for the project.	A	A	A	R		C	
Project Status Account					C		C	R
Quality Management Strategy	A strategy defining the quality techniques and standards to be applied, and the various responsibilities for achieving the required quality levels, during a project.	A	A	A	R		C	

Product	Description	Executive	Senior User	Senior Supplier	Project Manager	Team Manager	Project Assurance	Project Support
Quality Register	A register containing summary details of all planned and completed quality activities.				**A**	**C**	**C**	**R**
Risk Management Strategy	A strategy describing the goals of applying risk management, as well as the procedure that will be adopted, roles and responsibilities, risk tolerances, the timing of risk management interventions, the tools and techniques that will be used, and the reporting requirements.	**A**	**A**	**A**	**R**		**C**	
Risk Register	A record of identified risks relating to an initiative, including their status and history.				**A**		**C**	**R**
Work Package	The set of information relevant to the creation of one or more products.				**R**	**A**	**C**	

Appendix H: APM BOK Products and RASCI Table

Product	Description	Project Steering Group	Sponsor	Project Manager	Programme Manager	Project Team	Project Support	Stakeholders
Project Management Plan (PMP)	Documents the outcome of the planning process and provides the reference document for managing the project.	**I**	**A**	**R**		**S**		**I**
Communication Management Plan	Identifies what information is to be communicated to whom, when, where, how, through which medium and the desired impact.		**A**	**R**	**R**	**S**		
Business Case	Provides justification for undertaking a project or programme. It evaluates the benefit, cost and risk of alternative actions and provides a rationale for the preferred solution.		**A**	**R**	**R**	**S**		
Information Management Plan	Describes the systems, activities and data that allow information in a project to be effectively acquired, stored, processed, accessed, communicated, archived and destroyed.			**R**		**S**	**S**	
Organisational Breakdown Structure (OBS)	Shows the organisational structure of the project, the communication routes and reporting links.			**A**		**S**		
Responsibility Assignment Matrix (RAM)	A combination of the OBS and WBS, used to assign the work packages to the people, organisations or third parties responsible for creating the project's outputs.			**A**		**S**	**S**	
Product Breakdown Structure (PBS)	A hierarchy of deliverables that are required to be produced on the project.			**A**		**S**		
Work Breakdown Structure (WBS)	Shows the work required to produce the project deliverables.			**A**		**S**		
Risk Management Plan	A document defining how risk management is to be implemented in the context of a			**R**	**A**	**S**		

Product	Description	Project Steering Group	Sponsor	Project Manager	Programme Manager	Project Team	Project Support	Stakeholders
	particular project concerned.							
Benefits Management Plan	Explains how the benefits will be managed. It sets out the policies for aspects such as measurement, roles and responsibilities, priorities and key performance indicators (KPIs)	**C**	**A**	**R**	**R**	**S**		**C**
Configuration Management Plan	Describes any specific procedures and the extent of their application during the life cycle.			**R**				
Requirement	A statement of the need that a project has to satisfy. It should be comprehensive, clear, well structured, traceable and testable.	**C**	**A**	**R**		**S**		**C**
Schedule	The timetable for a project, programme or portfolio. It shows how the work will progress over a period of time and takes into account factors such as limited resources and estimating uncertainty.			**R**	**A**	**S**		
Cost Breakdown Structure (CBS)	Used to breakdown the costs (direct/indirect) on a project.			**A**		**S**		
Quality Management Plan	Describes the processes and metrics which will be used to produce quality deliverables.	**C**	**C**	**R**		**S**		**A**
Resource Management Plan	Used to communicate when the acquisition and deployment of the internal and external resources is required to deliver the project, programme or portfolio.	**I**	**S**	**R**	**A**	**S**		**I**
Health and Safety Policy	Identifies the health and safety strategies and procedures to be used on the project.		**A**	**R**		**S**		
Security	The identification, assessment and mitigation of the risks posed to information assets and people.		**A**	**R**				**C**

Appendix I: INCOSE SE Handbook Products and RASCI Table

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
Acquisition Strategy	Approaches, schedules, resources, and specific considerations required to acquire system elements.	**A**	**R**	**S**				
Invitation to Tender	A formal request for supply of a product or service.	**A**	**R**	**S**				
Tender Selection Criteria	The criteria used to assess responses to a formal request for supply of a product or service.	**A**	**R**	**S**				
Tender Response(s)	A formal response to a request for supply of a product or service.	**A**	**R**	**S**				
Acquisition Agreement	An understanding of the relationship and commitments between the project organisation and the supplier (varying from formal contracts to less formal inter-organisational work orders).	**A**	**R**	**S**				
Project Lifecycle	A definition of the stages, processes and activities that will be used to manage the project throughout its life cycle, including a definition of the business and other decision-making criteria regarding entering and exiting each life cycle stage.	**A**	**R**	**S**				
Project Mandate	-	**A**	**R**	**S**				
Project Business Case	-	**A**	**R**	**S**				
Project Management Plan	Approaches, schedules, resources and specific considerations required to define a project.	**A**	**R**	**S**				

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
Work Breakdown Structure (WBS)	The decomposition of a project into smaller components that provides the necessary framework for detailed costing and control	**A**	**R**	**S**			**S**	**S**
Project Plan	A linked list of the project's milestones, activities, and deliverables with intended start and finish dates.	**A**	**R**	**S**				
Quality Plan	The overarching guidance that explains the organisation's quality philosophy, policies and procedures.	**A**	**R**	**S**				
Issue Register	An account prepared for interested parties of the status, results and outcomes of the issue management activities.	**A**	**R**	**S**				
Project Status Report / Account	An account prepared for interested parties in order to communicate the status, results, and outcomes of the overall project activities.	**A**	**R**	**S**				
Exception Report	An account prepared for interested parties of the status, results and outcomes of the project's exceptions.	**A**	**R**	**S**				
Risk Management Strategy	Approaches, schedules, resources and specific considerations required to define and perform risk management for a project.	**A**	**R**	**S**	**S**	**S**	**S**	**S**
Risk Register	An account prepared for interested parties of the status, results and outcomes of the issue management activities.	**A**	**R**	**S**	**S**	**S**	**S**	**S**
Configuration Management Plan	Specifies the policies and procedures for performing configuration management on a project.	**A**	**R**			**S**		
Information Management Plan	The specification of the policies and procedures for performing information	**A**	**R**			**S**		

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
	management on a project.							
Communications Plan	The specification of the policies and procedures for managing communications on a project.	**A**	**R**	**S**				
Project Metrics	An account prepared for interested parties to communicate the project's status, results and outcomes.	**A**	**R**	**S**	**S**	**S**	**S**	**S**
Stakeholder Management Plan	Specifies the policies and procedures for performing stakeholder management on a project.	**A**	**R**	**S**				
Stakeholder Requirements	The set of requirements from various stakeholders that govern the project, including the required system capabilities, functions, and/or services, quality standards, system constraints, and cost and schedule constraints.	**A**		**R**	**S**			
Concept of Operations (CONOPS)	A textual and/or graphical statement that describes the assumptions or intent regarding the overall operation of the enterprise, including any new capability.	**A**		**R**				
System Requirements	The set of requirement statements that specify the system characteristics and constraints, and are unambiguous, clear, unique, consistent, singular and verifiable.			**A**	**R**			
Subsystem Requirements	The set of requirement statements that specify the subsystem characteristics and constraints, and are unambiguous, clear, unique, consistent, singular and verifiable.			**A**	**R**		**S**	
System Boundary	A textual and/or graphical statement that defines the system of interest and identifies the functional interfaces with systems that are external to this boundary.	**A**		**R**	**S**			
System Use Cases	A set of textual and/or graphical statements that describes the assumptions or intent	**A**		**R**	**S**			

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
	regarding the behaviour of the system of interest.							
Interface Control Documents (ICDs)	The definition of a shared boundary between two systems or system elements, defined by its functional characteristics, common physical interconnection characteristics, signal characteristics, and other characteristics as appropriate.	**A**		**R**			**S**	
System Architecture	The fundamental concepts or properties of a system within its operational environment embodied in its elements, relationships, and in the principles of its design and evolution.	**A**		**R**				
System Design Specification	The specification of the selected system design, including the identification and definition of the system elements.	**A**		**R**			**S**	
Implementation Strategy	The approaches, schedules, resources and specific considerations required to realise system elements that satisfy the system requirements, architecture, and design.		**A**	**R**				
Integration Strategy	The approaches, schedules, resources and specific considerations required to integrate the system elements.		**A**	**R**	**S**		**S**	**S**
Integration Plan	The specification of the policies and procedures for performing integration of the system elements on a project.		**A**	**R**	**S**		**S**	**S**
Integration Results / Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the integration activities.		**A**	**R**	**S**		**S**	**S**
Verification Strategy	The approaches, schedules, resources and specific considerations required to accomplish the selected verification actions that minimise costs and risks while maximising operational coverage of system behaviour.		**A**	**R**	**S**		**S**	**S**

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
Verification Plan	The specification of the policies and procedures for performing system verification on a project.		A	R	S		S	S
Verification Results / Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the system verification activities.		A	R	S		S	S
Installation and Commissioning (Transition) Strategy	The approaches, schedules, resources and specific considerations required to transition the system into its operational environment.	A	R	S	S			S
Installation and Commissioning (Transition) Plan	The specification of the policies and procedures for transitioning the system into its operational environment.	A	R	S	S			S
Installation and Commissioning (Transition) Results / Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the transition activities.	A	R	S	S			S
Validation Strategy	The approaches, schedules, resources and specific considerations required to accomplish the selected validation actions that minimise costs and risks while maximising operational coverage of system behaviours.	A	R	S	S			S
Validation Plan	The specification of the policies and procedures for performing system validation on a project.	A	R	S	S			S
Validation Results / Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the system validation activities.	A	R	S	S			S
Maintenance Strategy	The approaches, schedules, resources and specific considerations required to perform corrective and preventative maintenance in conformance with operational availability requirements.	A	R	S				

Product	Description	Project Sponsor	Project Manager	System Design Authority	Requirements Manager	Configuration Manager	Team Leader	Test Team Leader
Maintenance Plan	The specification of the policies and procedures for maintaining the system within its operational environment.	**A**	**R**	**S**				
Maintenance Results / Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the maintenance activities.	**A**	**R**	**S**				
Disposal Strategy	The approaches, schedules, resources and specific considerations required to ensure that the system or system elements are deactivated, disassembled, and removed from operations.	**A**	**R**	**S**				
Disposal Plan	The specification of the policies and procedures for performing disposal of the system or system elements.	**A**	**R**	**S**				
Disposal Report	An account prepared for interested parties in order to communicate the status, results, and outcomes of the disposal activities.	**A**	**R**	**S**				