A.O.Smith®
Innovation has a name.

Embarking on A.O. Smith's Lean Product and Process Development Transformation Journey

Agenda

✓ Introduction

✓ Why Lean Product and Process Development

✓ ASONPD

✓ Future

Neil Rolph Vice President of Engineering & Product Management

Product Development Journey

37 Years of Delivering Innovations Across the Space & Water Heating Industry...

17 years I used a Checklist to get projects done... 15 years we used _Stage Gate_...

5 years focused on _Lean Methods_...

Why Lean Product and Process Development?

The Why...

- A.O. Smith was and is a very successful company with a long history of innovation, **150 years!**

  – With a continuous improvement mindset, we realized we could do this better...

  – Coupled with acquisitions over time that brought several different methods...
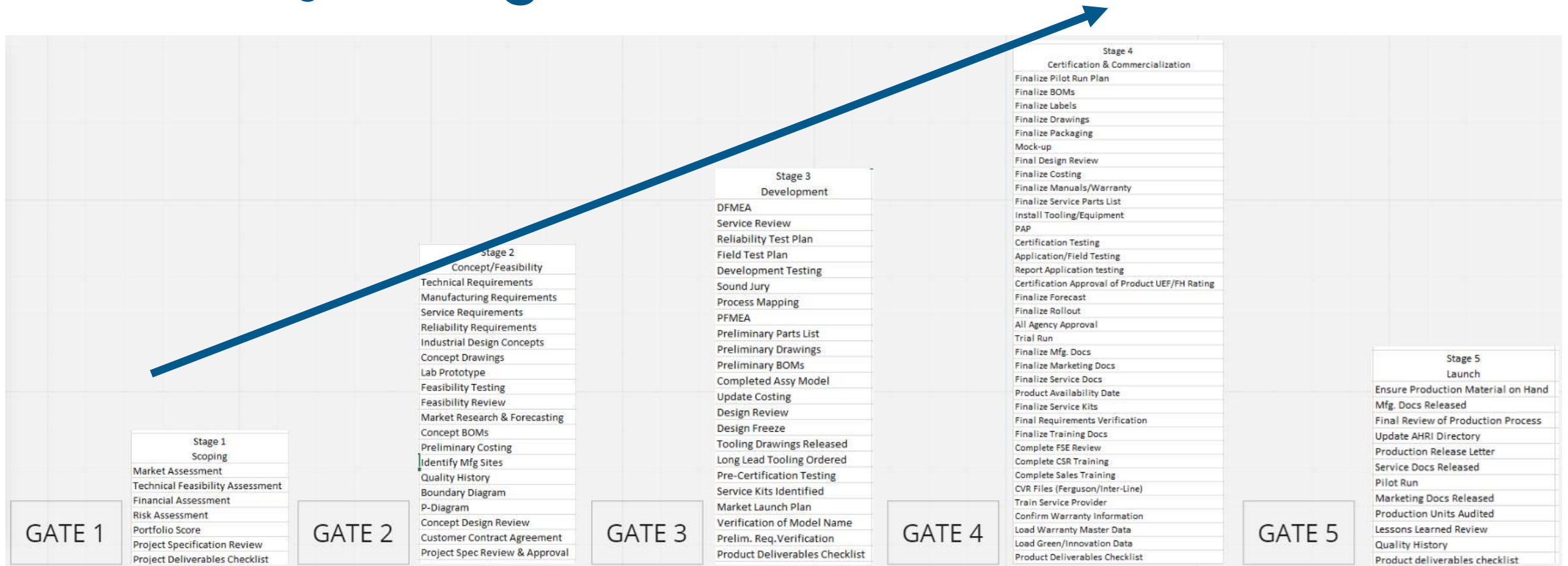
What problem were we trying to solve?

✓ Reduce Time to Market

✓ Better Predict Outcomes of Projects

✓ Ensure what We Design, The Customer Wants

What was our **Approach?**

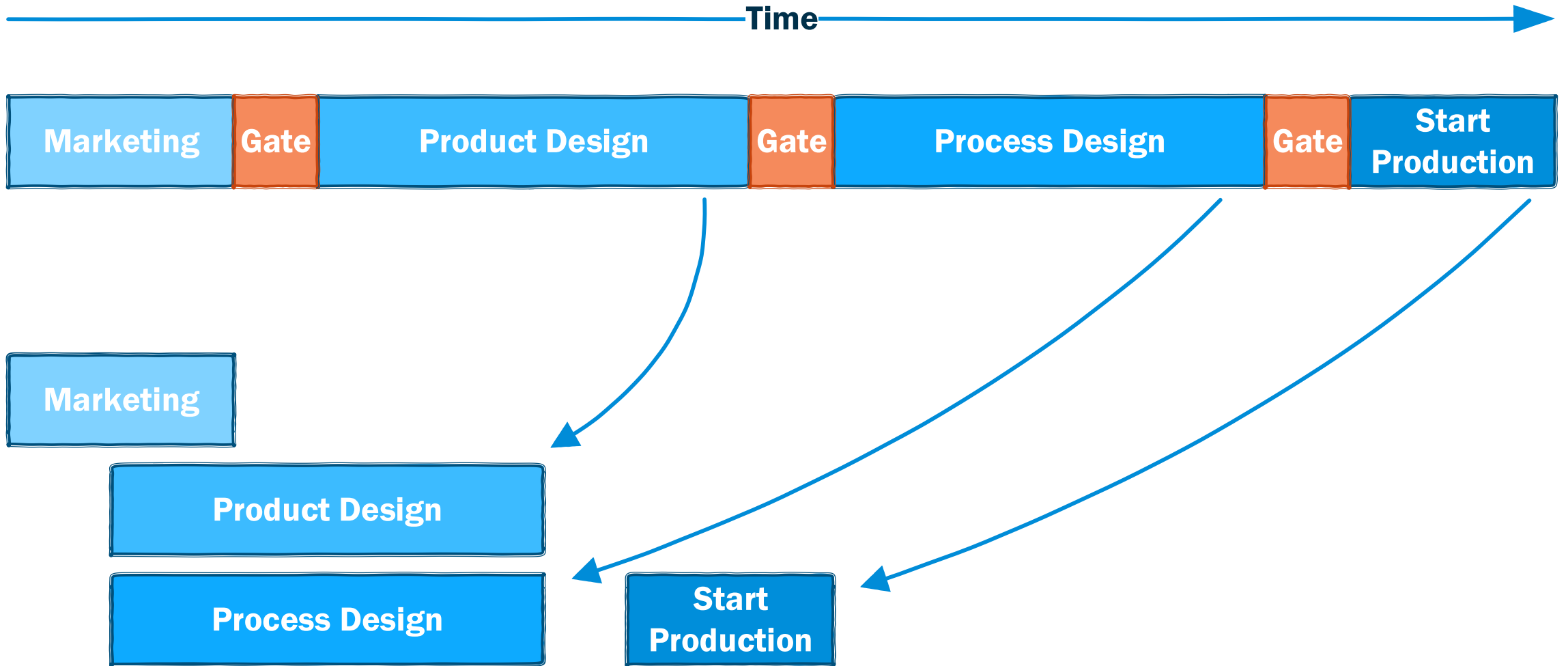✓ Scope Creation

   ✓ Brought in knowledge to guide us

      ✓ Formed a team focused on the process – cross functional

         ✓ Started with new projects – progressed to all projects

            ✓ Aligned functional organization structures

               ✓ Educated ourselves with perspectives from other companies

                  ✓ Created lots of functional processes needed to support

A.O. Smith Original **Stage Gate** Process

GATE 1	Stage 1 Scoping	GATE 2	Stage 2 Concept/Feasibility	GATE 3	Stage 3 Development	GATE 4	Stage 4 Certification & Commercialization	GATE 5	Stage 5 Launch
	Market Assessment		Technical Requirements		DFMEA		Finalize Pilot Run Plan		Ensure Production Material on Hand
	Technical Feasibility Assessment		Manufacturing Requirements		Service Review		Finalize BOMs		Mfg. Docs Released
	Financial Assessment		Service Requirements		Reliability Test Plan		Finalize Labels		Final Review of Production Process
	Risk Assessment		Reliability Requirements		Field Test Plan		Finalize Drawings		Update AHRI Directory
	Portfolio Score		Industrial Design Concepts		Development Testing		Finalize Packaging		Production Release Letter
	Project Specification Review		Concept Drawings		Sound Jury		Mock-up		Service Docs Released
	Project Deliverables Checklist		Lab Prototype		Process Mapping		Final Design Review		Pilot Run
			Feasibility Testing		PFMEA		Finalize Costing		Marketing Docs Released
			Feasibility Review		Preliminary Parts List		Finalize Manuals/Warranty		Production Units Audited
			Market Research & Forecasting		Preliminary Drawings		Finalize Service Parts List		Lessons Learned Review
			Concept BOMs		Preliminary BOMs		Install Tooling/Equipment		Quality History
			Preliminary Costing		Completed Assy Model		PAP		Product deliverables checklist
			Identify Mfg Sites		Update Costing		Certification Testing		
			Quality History		Design Review		Application/Field Testing		
			Boundary Diagram		Design Freeze		Report Application testing		
			P-Diagram		Tooling Drawings Released		Certification Approval of Product UEF/FH Rating		
			Concept Design Review		Long Lead Tooling Ordered		Finalize Forecast		
			Customer Contract Agreement		Pre-Certification Testing		Finalize Rollout		
			Project Spec Review & Approval		Service Kits Identified		All Agency Approval		
					Market Launch Plan		Trial Run		
					Verification of Model Name		Finalize Mfg. Docs		
					Prelim. Req.Verification		Finalize Marketing Docs		
					Product Deliverables Checklist		Finalize Service Docs		
							Product Availability Date		
							Finalize Service Kits		
							Final Requirements Verification		
							Finalize Training Docs		
							Complete FSE Review		
							Complete CSR Training		
							Complete Sales Training		
							CVR Files (Ferguson/Inter-Line)		
							Train Service Provider		
							Confirm Warranty Information		
							Load Warranty Master Data		
							Load Green/Innovation Data		
							Product Deliverables Checklist		

Work & Resources Built up – Left to Right (Shift Right?)

Stage Gate to **LPPD**

Time

Marketing | Gate | Product Design | Gate | Process Design | Gate | Start Production

Marketing

Product Design

Process Design
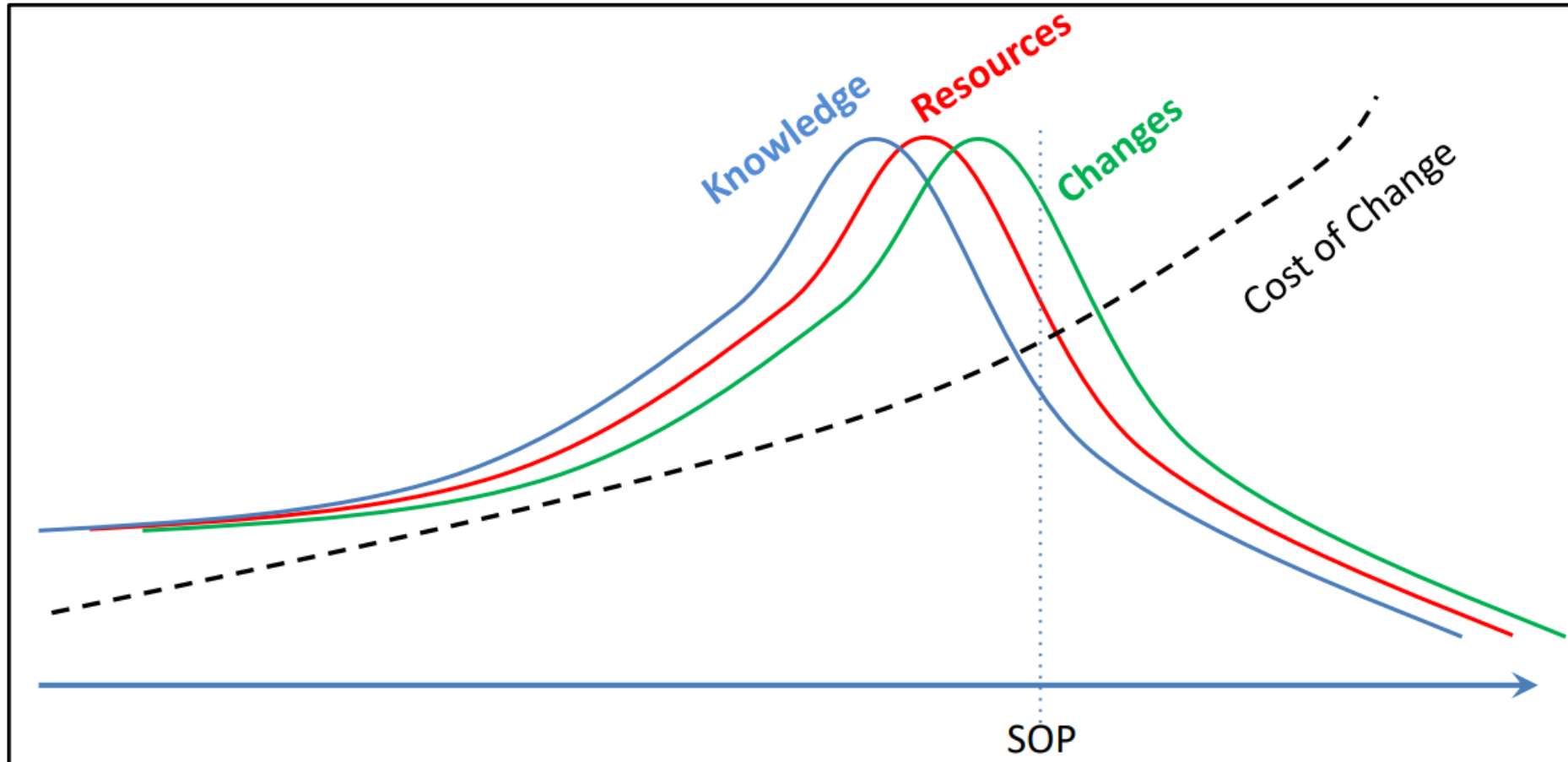
Start Production

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Stage Gate to **AOSNPD**
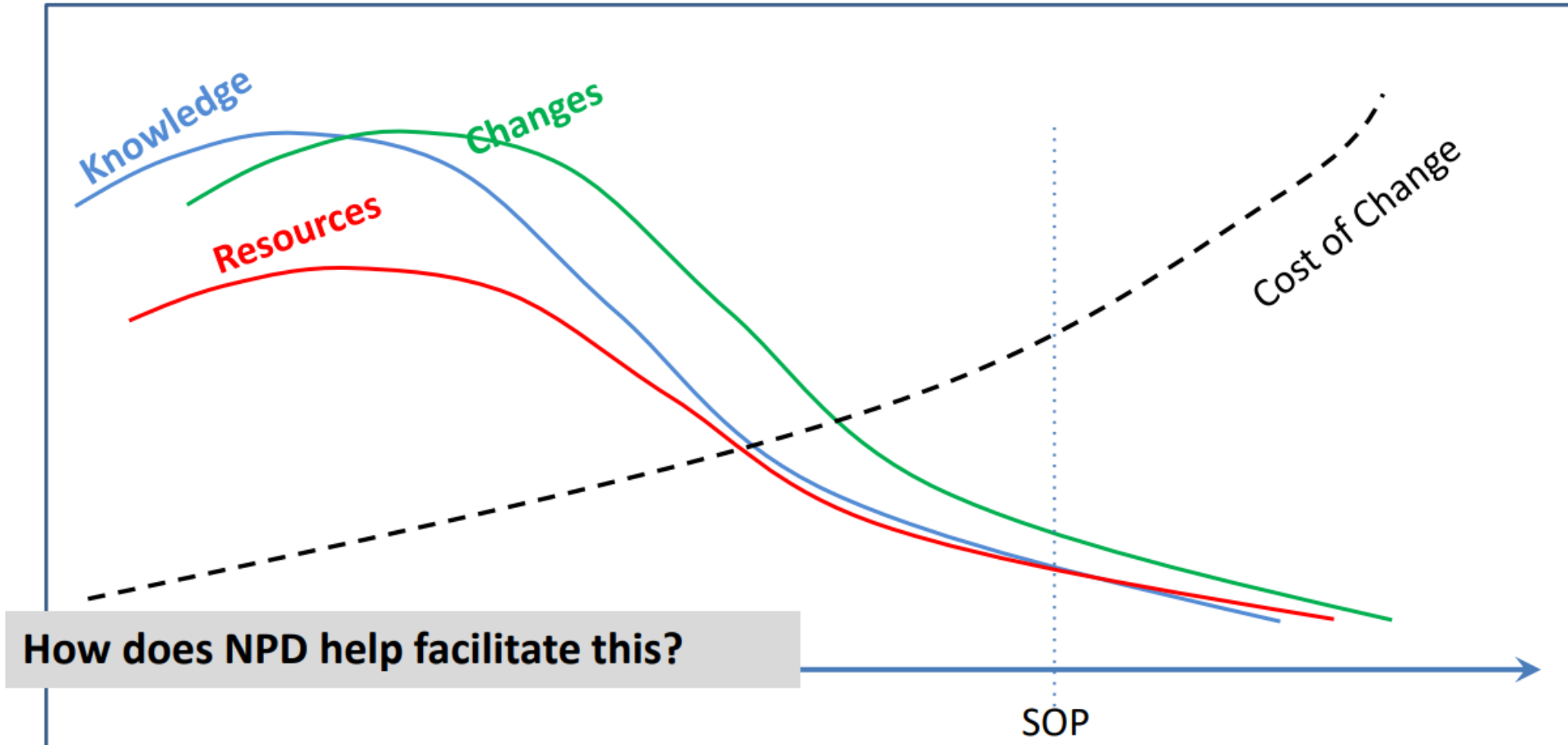
- Create a world class product development **environment**

  ✓ Deliver products our customers want to buy

 ✓ Improve time to market

  ✓ Live our motto – "Innovation Has a Name"

	Scope (S)			Design (D)						Implement (I)					
	Project Charter	Concept Paper	Concept Creation	Concept Elimination (Coarse Filter)	Concept Elimination (Fine Filter)	Concept Refinement	Design Freeze		Drawing Release & Cert. Comp.	Product Line Document Release	Manufacture Mock-up	Manufacture Trial	Manufacture Pilot	Full-Rate Production
Milestones	S1	S2	D1	D2	D3	D4	D5		I1	I2	I3	I4	I5	I6
Gates		G1						G2					G3	

Stage Gate Representation

AOSNPD Representation of **Shifting Left**

AOSNPD Representation of **Shifting Left**
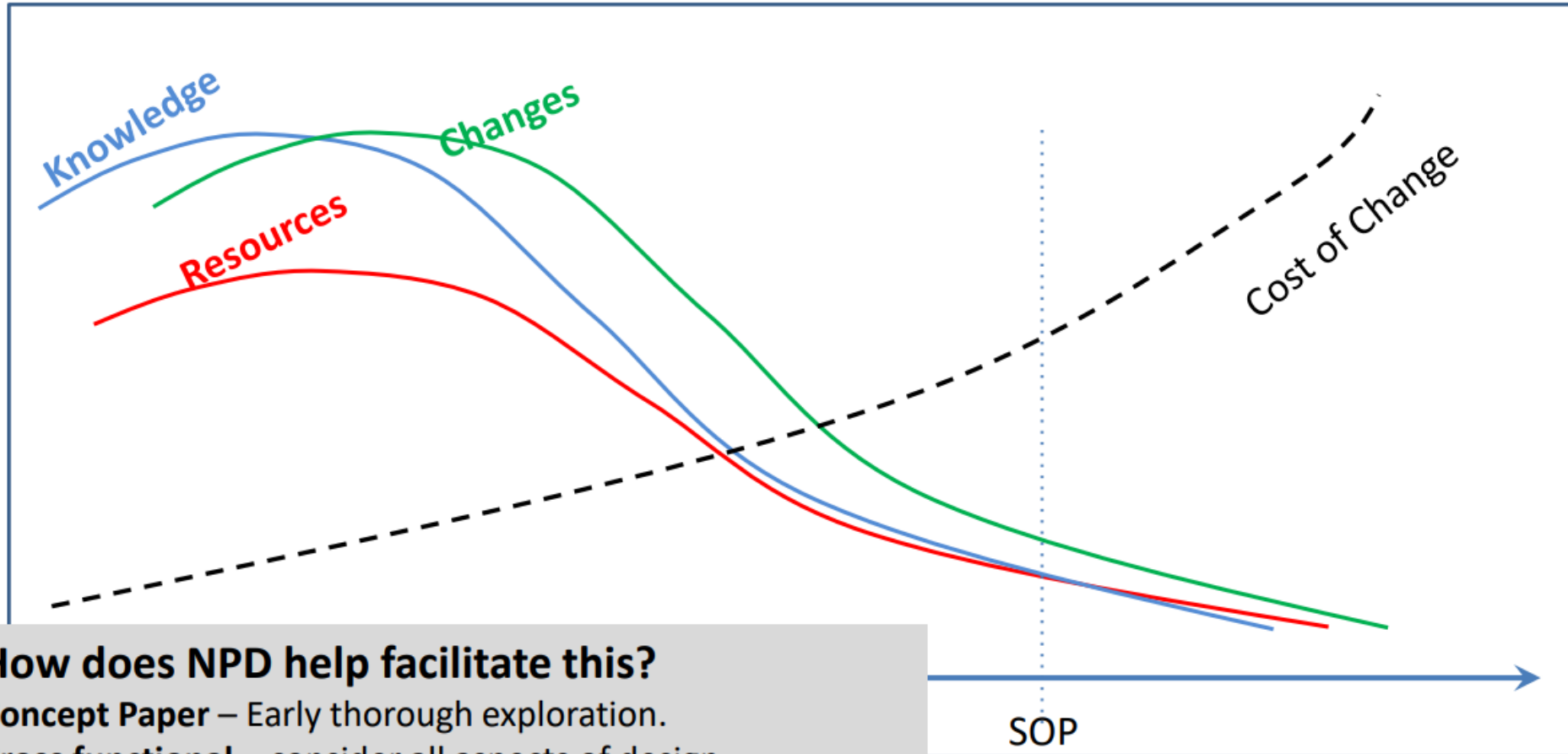
How does NPD help facilitate this?

Concept Paper – Early thorough exploration.
Cross functional – consider all aspects of design.
Integration events – generate knowledge gaps early.
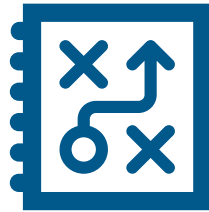**Set-Based Design** – investigate broad options early.
Milestones and Andon – pace work and assure progress.

Support **Infrastructure** for Launch

Training

- Provides team:
  - Process definitions
  - Baseline know-how
  - Broad view of process from start to finish

Coaching

- AOSNPD coach assigned to the project team
- Provides hands-on coaching and process guidance

SharePoint

- Key resource for process information, templates, & best practices
- Provides team an AOSNPD project site and digital work environment

Experience

- AOSNPD Model Lines trailblaze the way for new project teams
- Lessons learned and best practices are shared back to new project teams via coaches & SharePoint

Training – AOSNPD Simulation Event

- Comprehensive introduction to the AOSNPD process

- Experience the process from Scope phase to entry into full-rate production with a cohort of peers.

- Competing teams are tasked to Scope, Develop, and Implement an "egg carriage" product providing hands-on process experience from project emergence to project completion.

- Duration: 5 days

- At course completion students will have a full understanding and hands-on experience of the AOSNPD process from start to finish.

Chief Engineer Creation

1. **Integrate work of AOSNPD teams – at project level**
   - Provide vision
   - Make trade-off decisions
   - Recognize abnormal

2. **Drive Product Portfolio Improvements**
   - Own 3-year product roadmap process
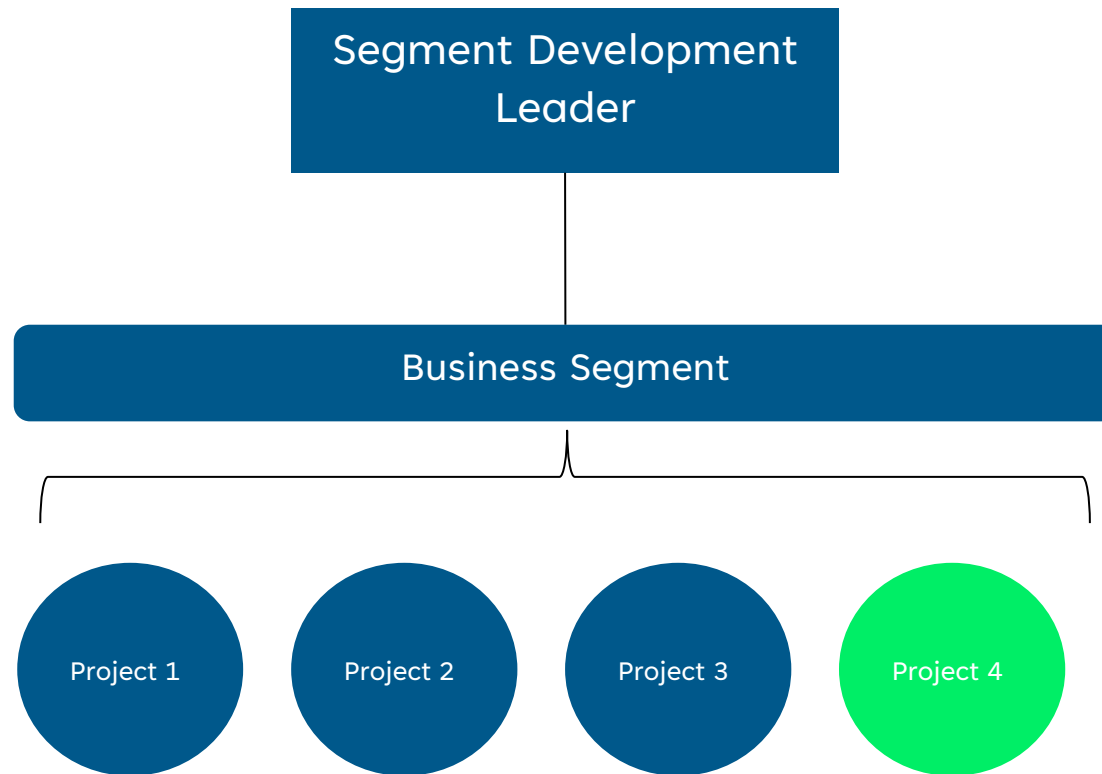   - Create and maintain 3-year roadmap for product segment

3. **Provide Single point of accountability for Product Segment**
   - Represents all aspects of product segment
   - Directs work to Product Managers and NPD teams
   - Business Unit contact

Chief Engineer at AOS became **Segment Development Leader**

Segment Development Leader - **Responsibilities**


```
Segment Development
        Leader
           |
    Business Segment
           |
  ┌────────┬────────┬────────┐
Project 1  Project 2  Project 3  Project 4
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Characteristics/Skills
- Lead by influence
- Drive collaboration across all functions within the business
- Facilitate decision making with appropriate stake holders
- Provide teams with a sense of urgency
- Work independently yet collaborate cross-functionally
- Ability to build and maintain positive relationships
- Strategic Thinker, Passionate and Driven by Success
- Technical understanding of major sub-systems & processes
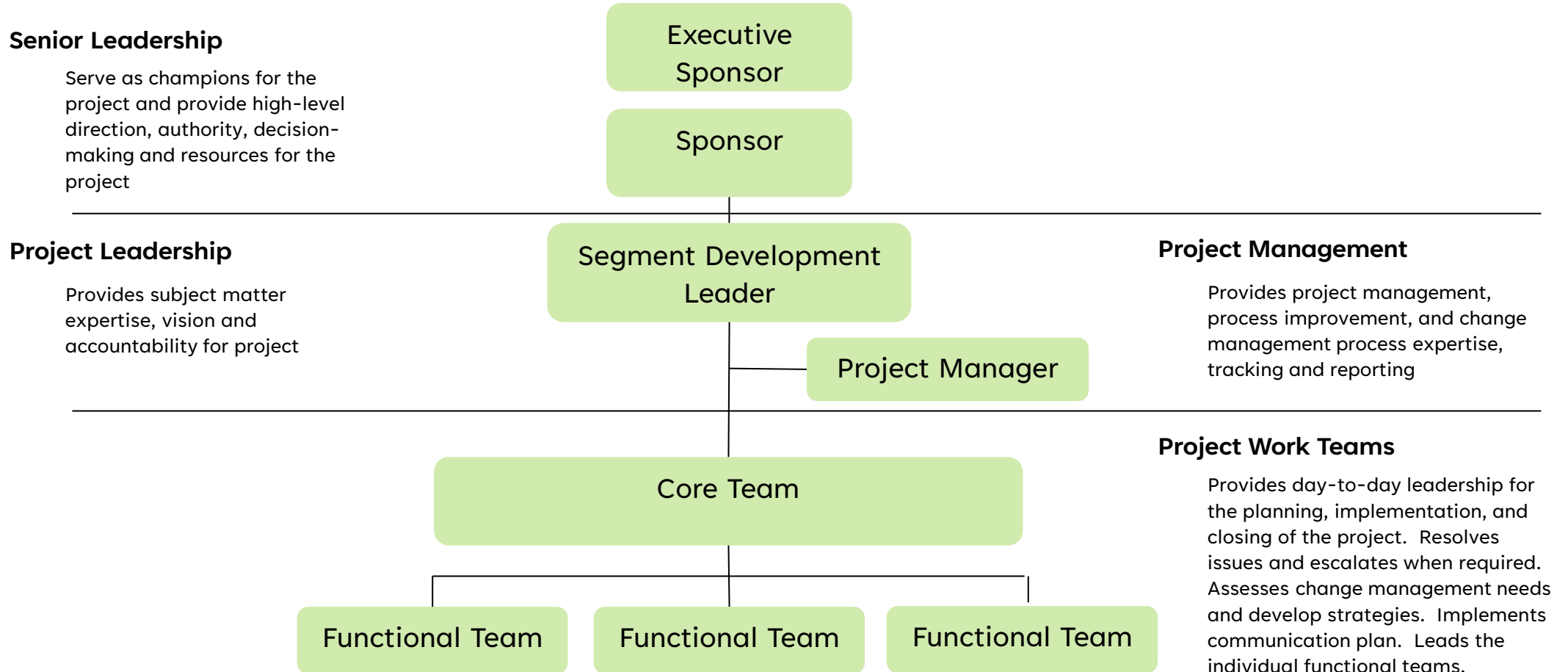- Great Communicator

Segment Level
- Directs the vision for the product segment
- Owns the 3-year Product Roadmap
- Brings Market/Customer/Business aspects to NPD
- Utilizes relationships with cross functional business leaders

Project Level
- Integrates the work of the development team
- Owns the vision for the product
- Owns the trade off decisions
- Ability to recognize and manage the abnormal

Responsibilities are carried out via the Product Development Teams and the support of the Product Managers reporting to the Segment Development Leader

Project Level **Organization** Chart

Senior Leadership

Serve as champions for the project and provide high-level direction, authority, decision-making and resources for the project

Executive Sponsor

Sponsor

Project Leadership

Provides subject matter expertise, vision and accountability for project

Segment Development Leader

Project Management

Provides project management, process improvement, and change management process expertise, tracking and reporting

Project Manager

Project Work Teams

Provides day-to-day leadership for the planning, implementation, and closing of the project. Resolves issues and escalates when required. Assesses change management needs and develop strategies. Implements communication plan. Leads the individual functional teams.

Core Team

Functional Team

Functional Team

Functional Team

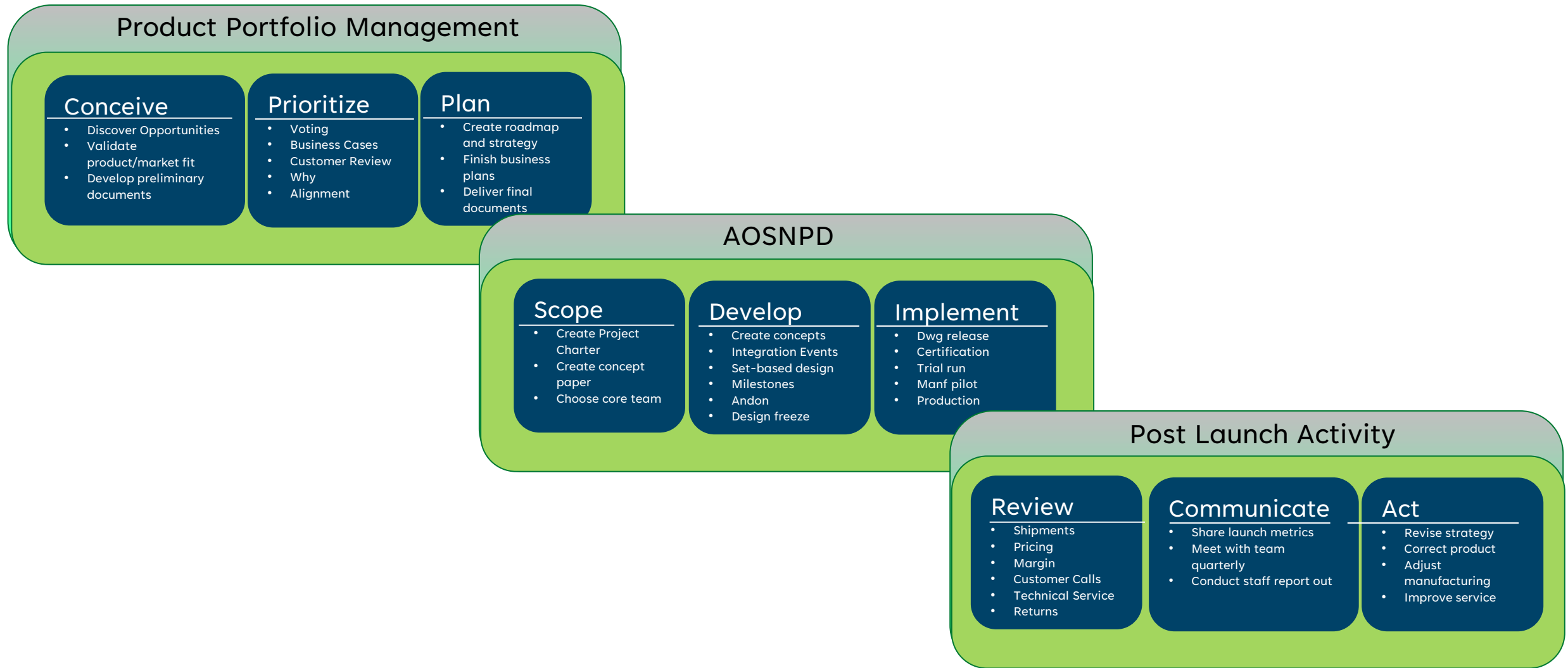# What has worked and what is changing

Working well

- Concept Paper – Driving VOC and Business Case
- Andon
- Integration Events
- Parallel Workstreams
- Set Based Design
- Segment Development Leader
- Coaching

Not Working so well

- Obeya
- Remaining Gates
- Missing Feasibility (knowledge gaps)
- Connection to Portfolio
- Knowledge Sharing

How Portfolio Management Relates to AOSNPD

Product Portfolio Management

Conceive
- Discover Opportunities
- Validate product/market fit
- Develop preliminary documents

Prioritize
- Voting
- Business Cases
- Customer Review
- Why
- Alignment

Plan
- Create roadmap and strategy
- Finish business plans
- Deliver final documents

AOSNPD

Scope
- Create Project Charter
- Create concept paper
- Choose core team

Develop
- Create concepts
- Integration Events
- Set-based design
- Milestones
- Andon
- Design freeze

Implement
- Dwg release
- Certification
- Trial run
- Manf pilot
- Production

Post Launch Activity

Review
- Shipments
- Pricing
- Margin
- Customer Calls
- Technical Service
- Returns

Communicate
- Share launch metrics
- Meet with team quarterly
- Conduct staff report out

Act
- Revise strategy
- Correct product
- Adjust manufacturing
- Improve service

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Future State – Connecting Portfolio Management to AOSNPD

Portfolio Management Tools

Opportunity Portfolio - Projects that are in the Opportunity Assessment Phase

Potential Projects Portfolio - Prioritized list of projects that have gone through the opportunity Assessment Phase, and are awaiting assignment of resources

Very Specific Learning Portfolio - Prioritized list of projects that are actively in R&D, AD, or Business Case Development

Pending NPD Portfolio - Prioritized list of projects that are ready for S1 pending resources or in the S1-S2 charter writing phase

Includes project duration time and resource needs

Active NPD Portfolio - Phased Gantt chart of active, post S2 NPD projects

Opportunity Assessment Phase

Ideation and Business Review

50+ opportunities

Market Opportunity Assessment

10-20 opportunities

Project Feasibility Assessment

5-10 opportunities

- Develop list of potential opportunities
- Use simple vetting form to qualitatively asses the opportunity size, technology availability, and strategic fit
- Prioritize down with Business Unit Staff to those projects worth a more detailed market opportunity assessment

- Begin to define the opportunity using the AOSNPD Concept paper (note that same Concept Paper is used through AOSNPD, with version control to capture history)
- Product Management leads a core team to gather high-level information on market potential, knowledge gaps, level of effort needed
- Prioritize down with Business Unit Staff to those key projects to move forward into project feasibility assessment

- Use AOSNPD Concept Paper to begin defining the project
- Product Manager leads a core team to complete a preliminary, detailed Concept Paper
  - unknowns are expected, and should be captured as knowledge gaps
  - wide ranges in estimates are expected, to be refined as project progresses

Decision Point - Based on identified knowledge gaps, determine which process is the appropriate next step.

There may be multiple projects for multiple knowledge gaps.

Very Specific Learning Phase

R&D / CTC Ideation process

Used when there is unknown feasibility or foundational technical knowledge needed

Advanced Development (Technology / Manufacturing / Supply)

Know of likely feasible solutions, but need to close technical knowledge gaps

Advanced Development / Business Case Development

Need to close business / market knowledge gaps before AOSNPD Concept

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NPD S1

We know everything that is needed to complete the Concept Paper. Any remaining knowledge gaps are at an acceptable risk level.

Project Manager leads team to complete Concept Paper

NPD S2

Concept paper is complete, team commits to timeline and deliverables

AOSNPD Development and Implementation Phases

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Current State

- Detailed Process Map

- Hundreds of Functional Processes

- Projects:

  - ✓ 17 Active projects across 3 divisions
  - ✓ 3 Completed
  - ✓ 2 Paused
  - ✓ 2 Cancelled

- Engaged AOSNPD Core Team

- Continuous Improvement Mindset

Detailed Process Map
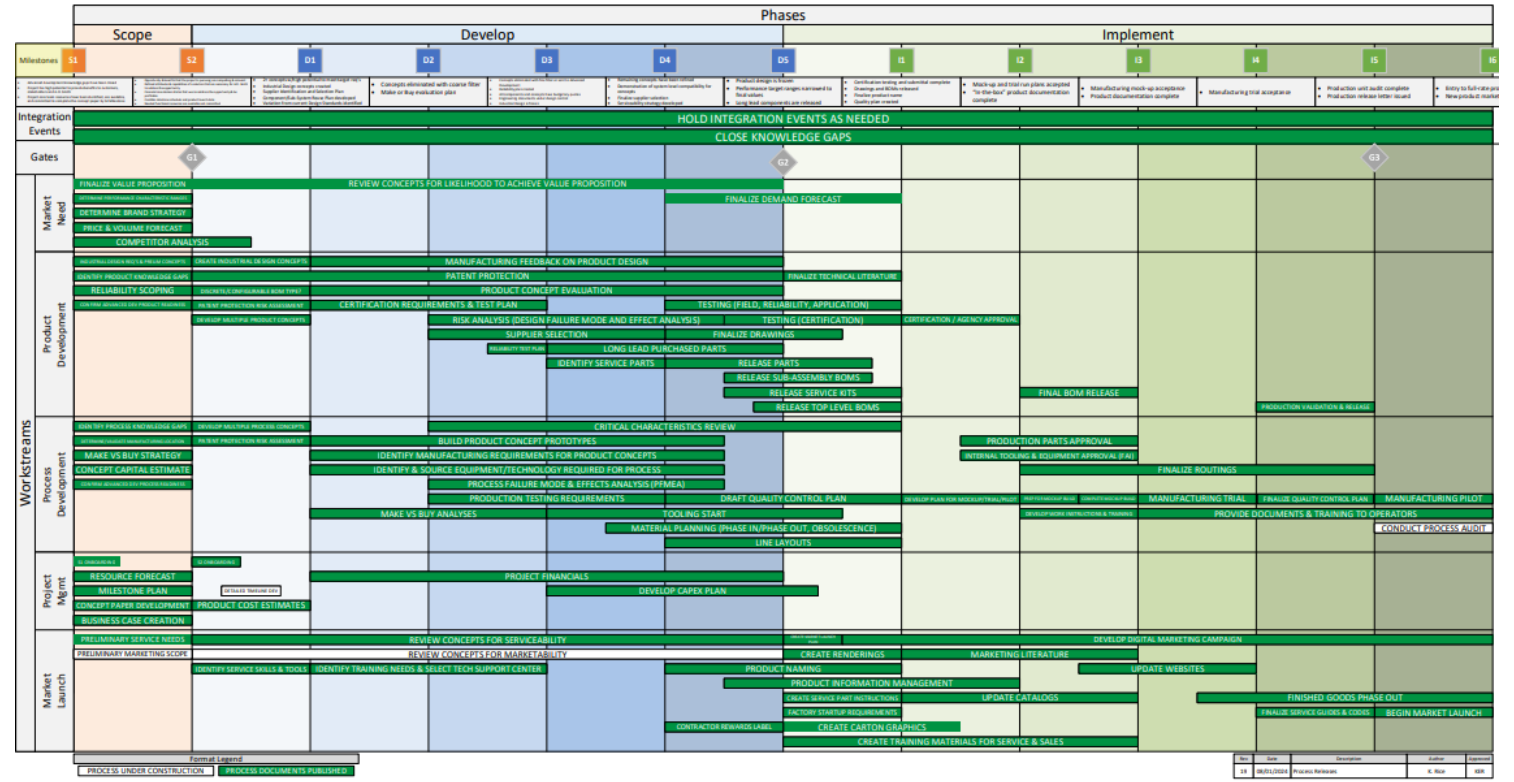
Keys to **Success**

- ✓ Top-down education, support and drive

- ✓ Understanding of what problem(s) you are trying to solve

- ✓ Making NPD a Company process and not an Engineering process

- ✓ Training on the Process – Simulation – need to "Feel" the process

- ✓ Coaching

- ✓ Managing change with People

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