



**Product
Realization
Group®**

The 10 Best Practices for Agile Hardware Product Realization

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**Product
Realization
Group**

About PRG

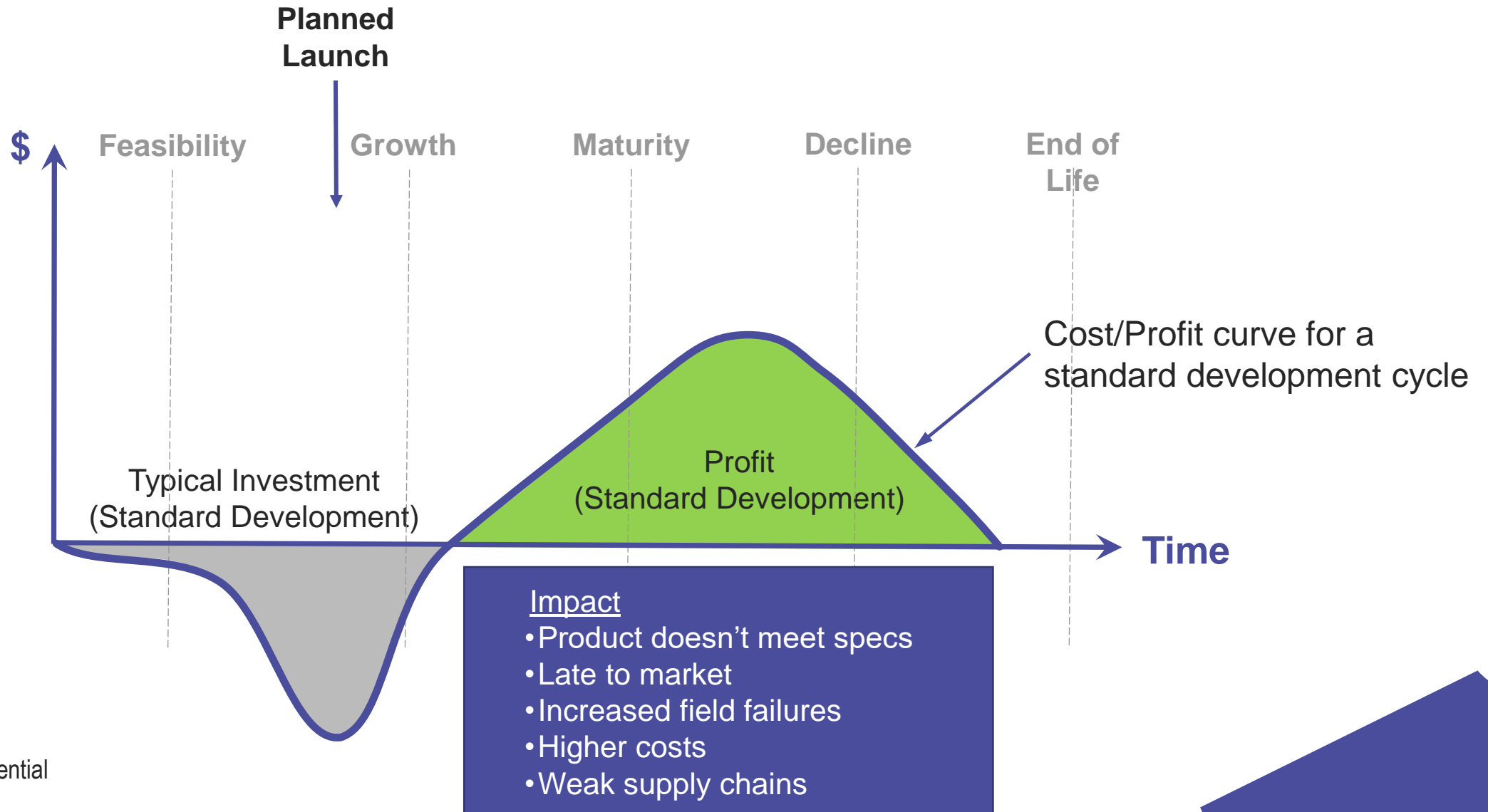
Product Realization Group stands out as an innovative leader in product and process improvement, creating success through solution-based advisory and delivery services.

PRG's team of trusted industry experts guide the world's most advanced companies to accelerate delivery of their product, from concept to full market scale.





The Industry Challenge



Why is it so complicated?



Hi-Tech/
Clean Tech and
General Product

Market Validation	Product Management	Tech Prog Management	Operations/Manufacturing Engineering
Go-to-Market	Product Validation/DFX		Supply Chain/Logistics
Portfolio Management	Product Design	Regulatory Services	Product Marketing
MVP Definition	Embedded FW	Reliability Services	
	Financial Modeling	Quality Management Services	
	Commercialization Roadmap Services		
	Product Lifecycle Management Services		

MedTech
Specialization

Market Validation	Medical Quality Management Services		
Go-to-Market	FDA Regulatory Services		Supply Chain/Logistics
	MedTech Tech Prog Management		Product Marketing



Are you experiencing any of these warning signs?

High
Burn Rate

Increasing
Costs

Slipping
Schedules

Feature Creep

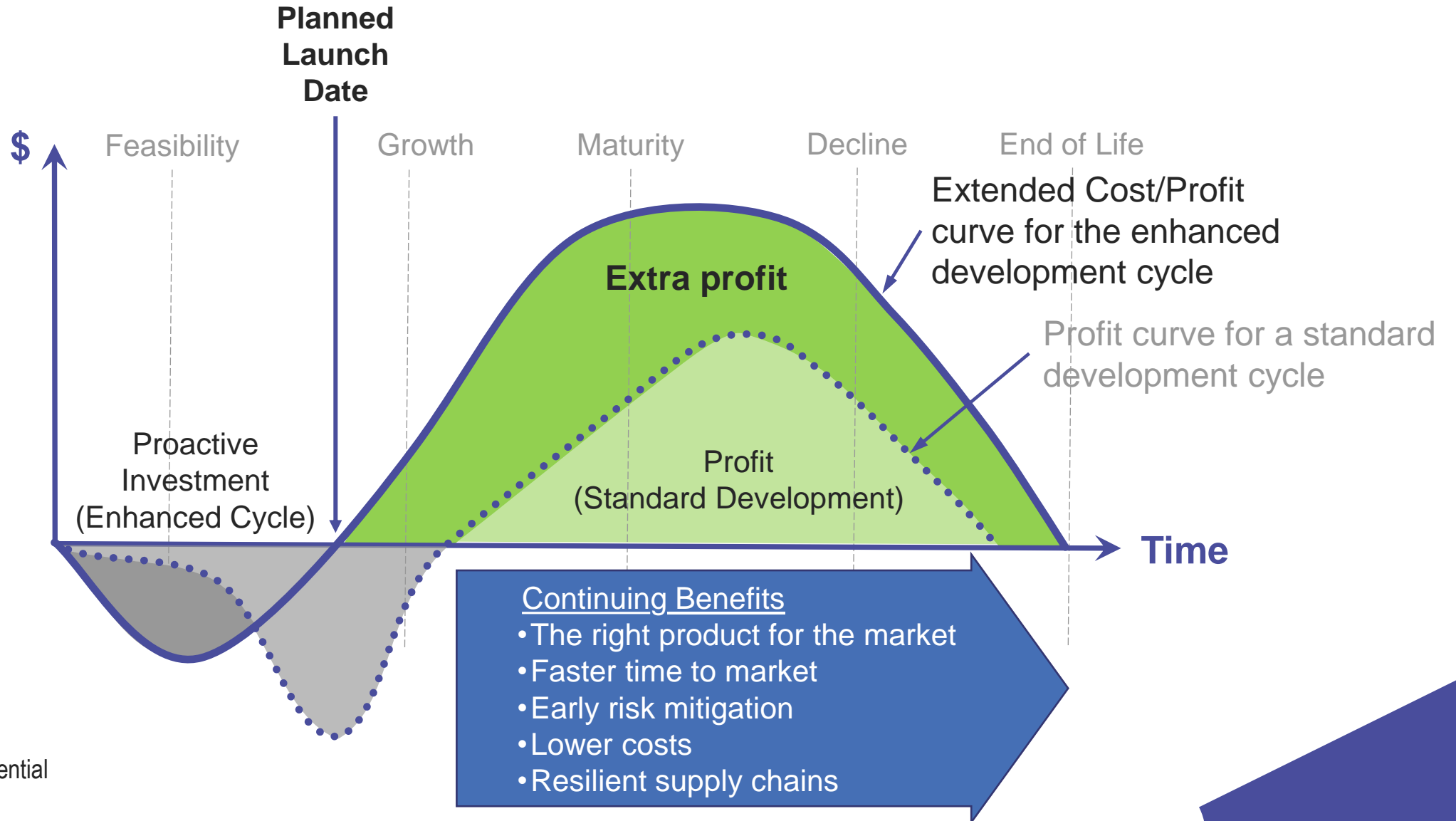
Breakdown of
Communications

High
Failure Rate

Tribal
Knowledge



Using the 10 Best Practices





Understand your Markets

Where are your products shipping?

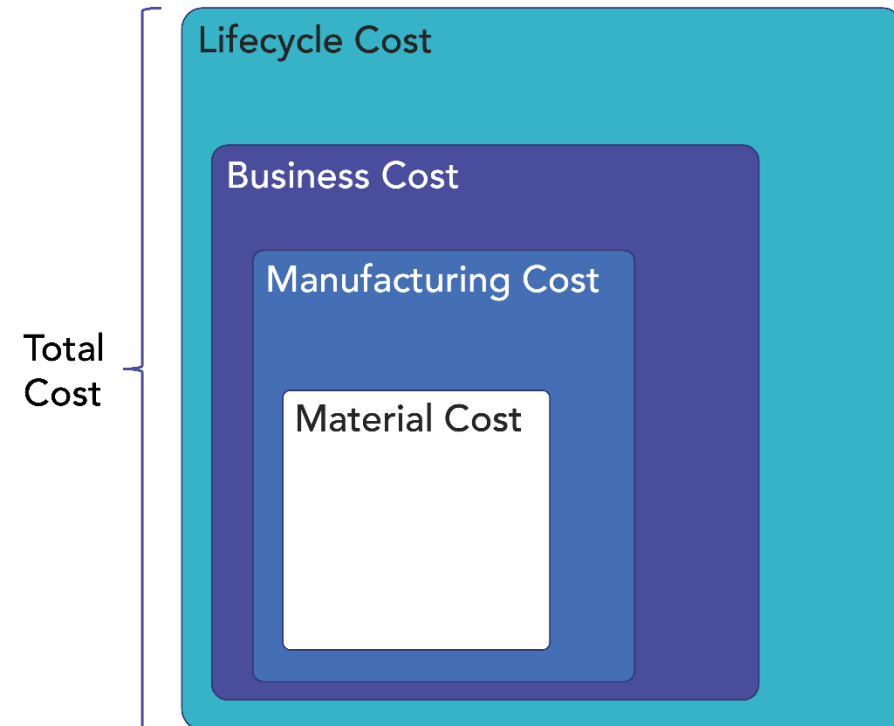
- Are there special requirements or rules in the countries you're targeting?
- What is the true need for your product?
- What does the competition look like?
- Are you really checking product/market fit?
- Are you simply making a better mousetrap?



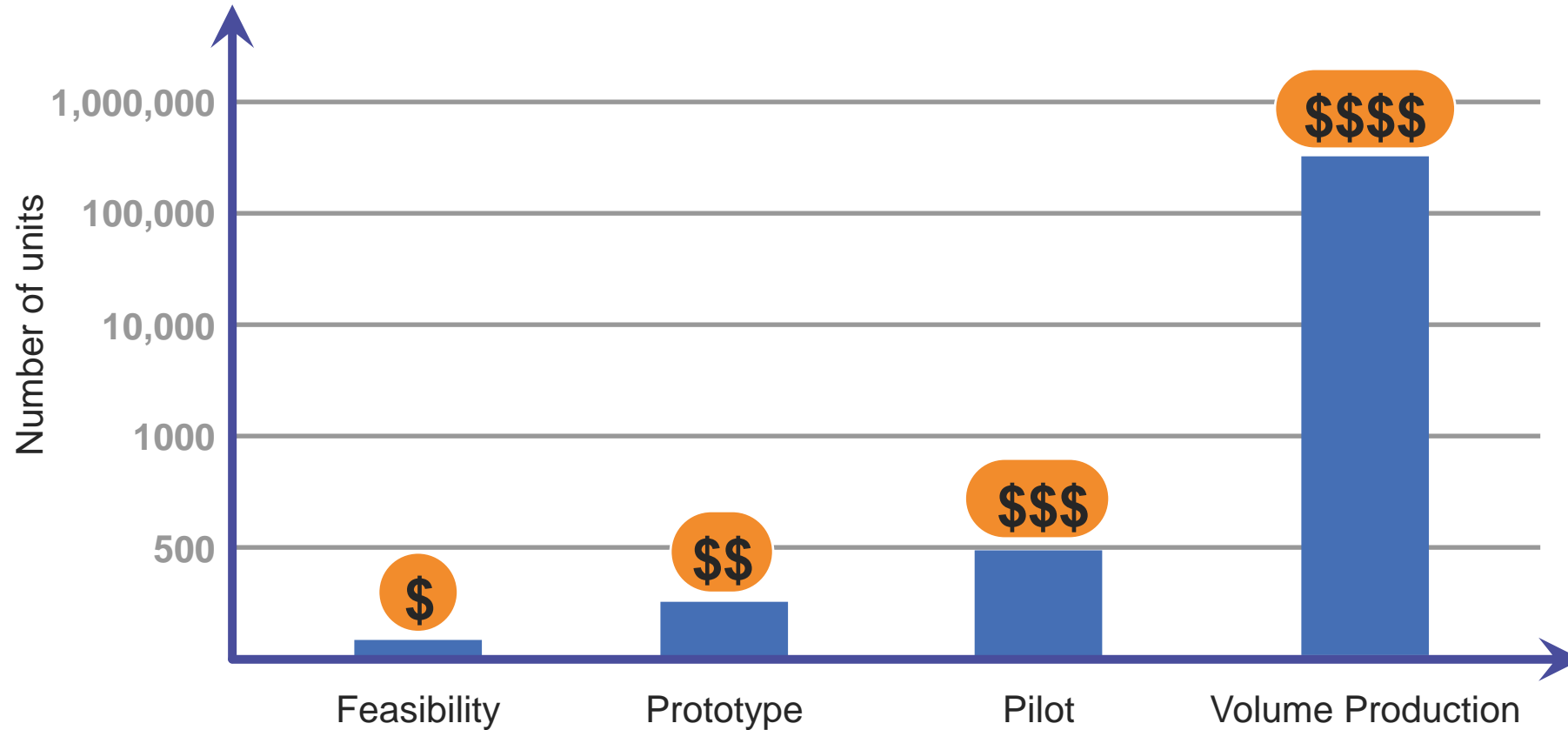
How do you know what the total product cost could be?

When you have a working prototype:

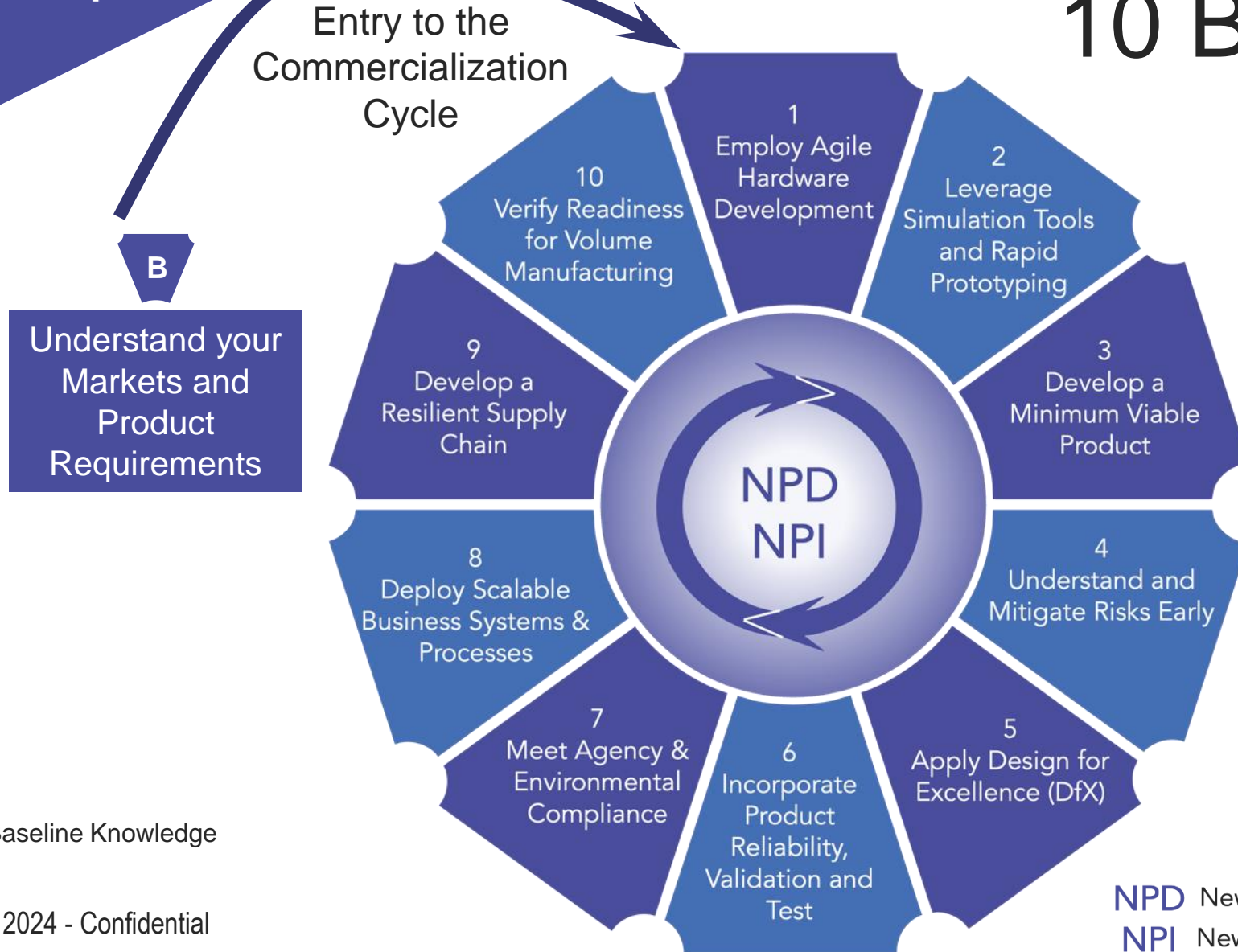
- Material Cost
 - Parts
- Manufacturing Cost
 - Labor
 - Manufacturing Overhead
- Business Cost
 - Marketing, Sales
 - Finance, HR, Admin.
 - Insurance
 - Capital Equipment
- Lifecycle Cost
 - Support
 - Warranty (repair, replace, recall)



Impact of Cost Escalation through the Product Life Cycle



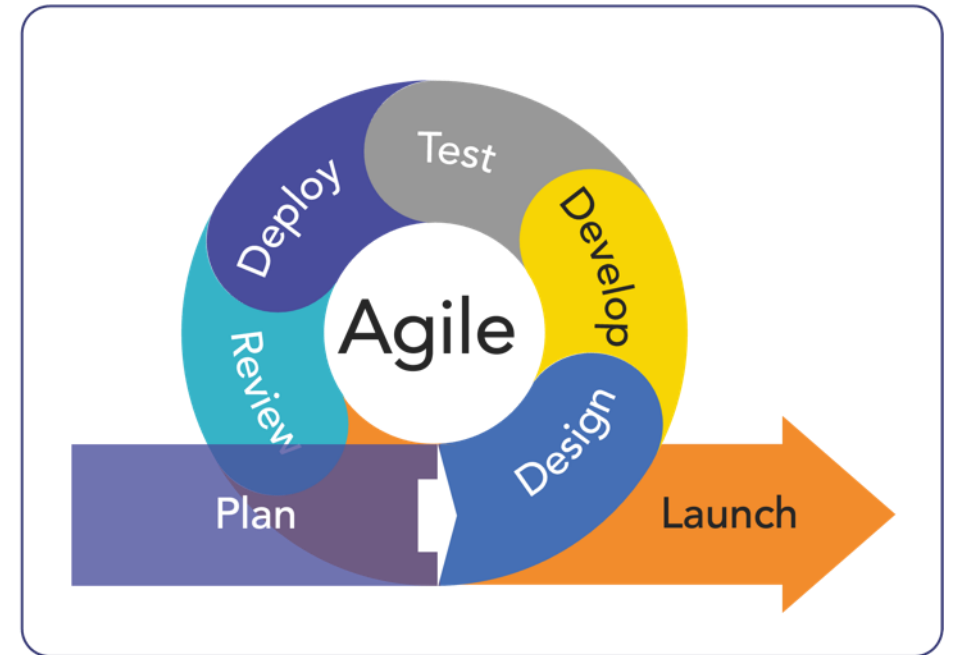
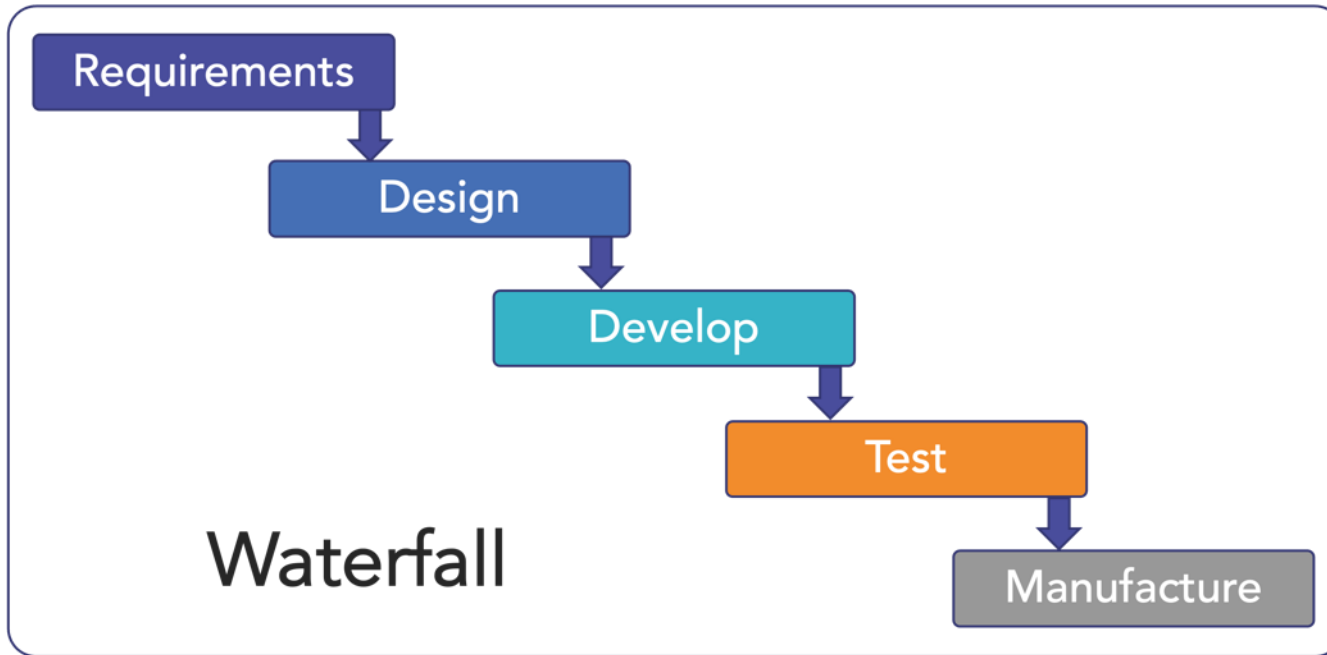
We've simplified it to 10 Best Practices



B Baseline Knowledge

Agile Hardware vs. Agile Software

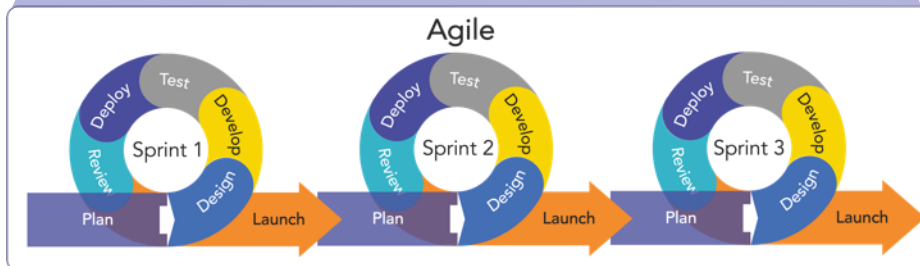
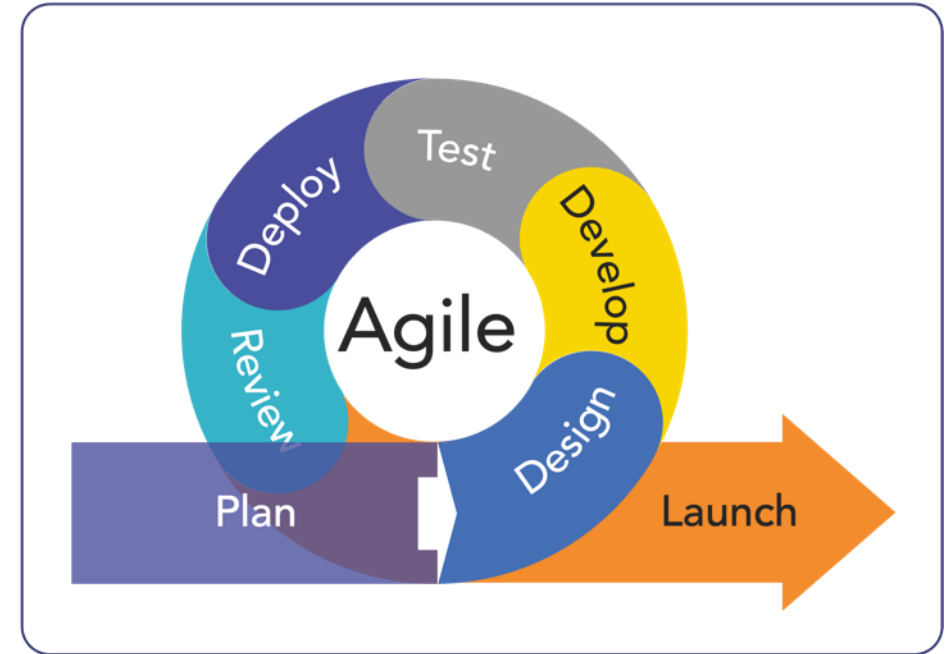
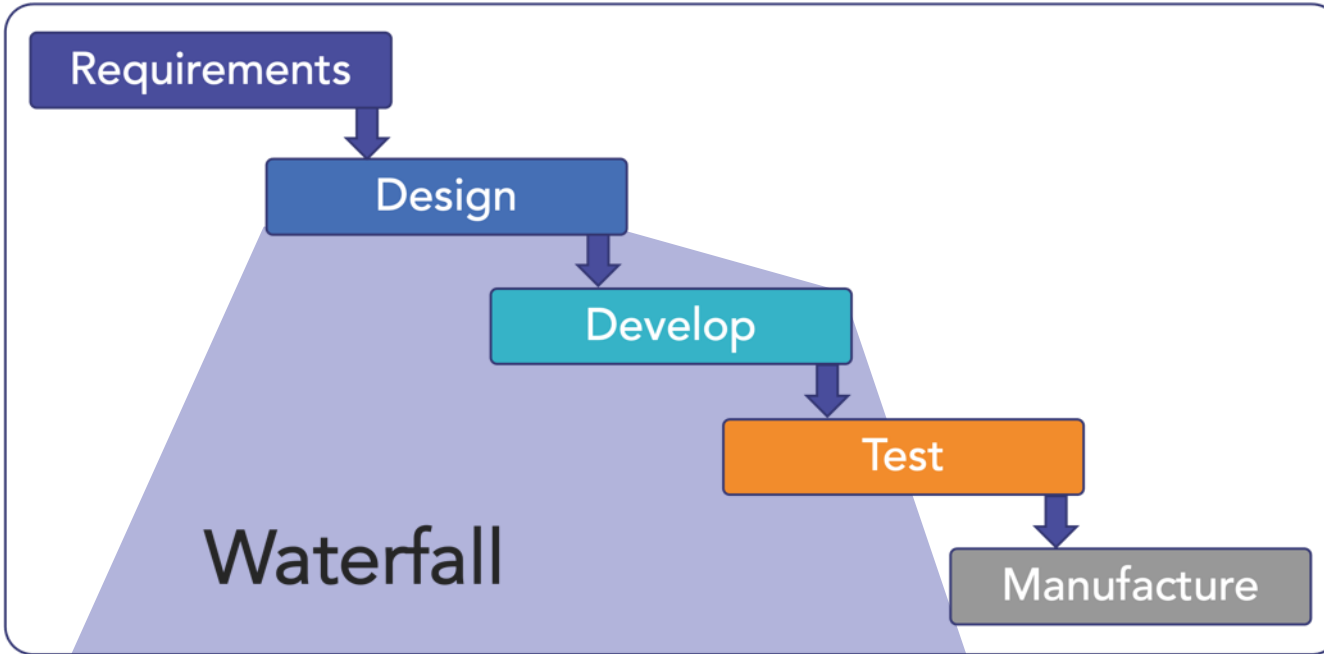
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Agile Hardware vs. Agile Software

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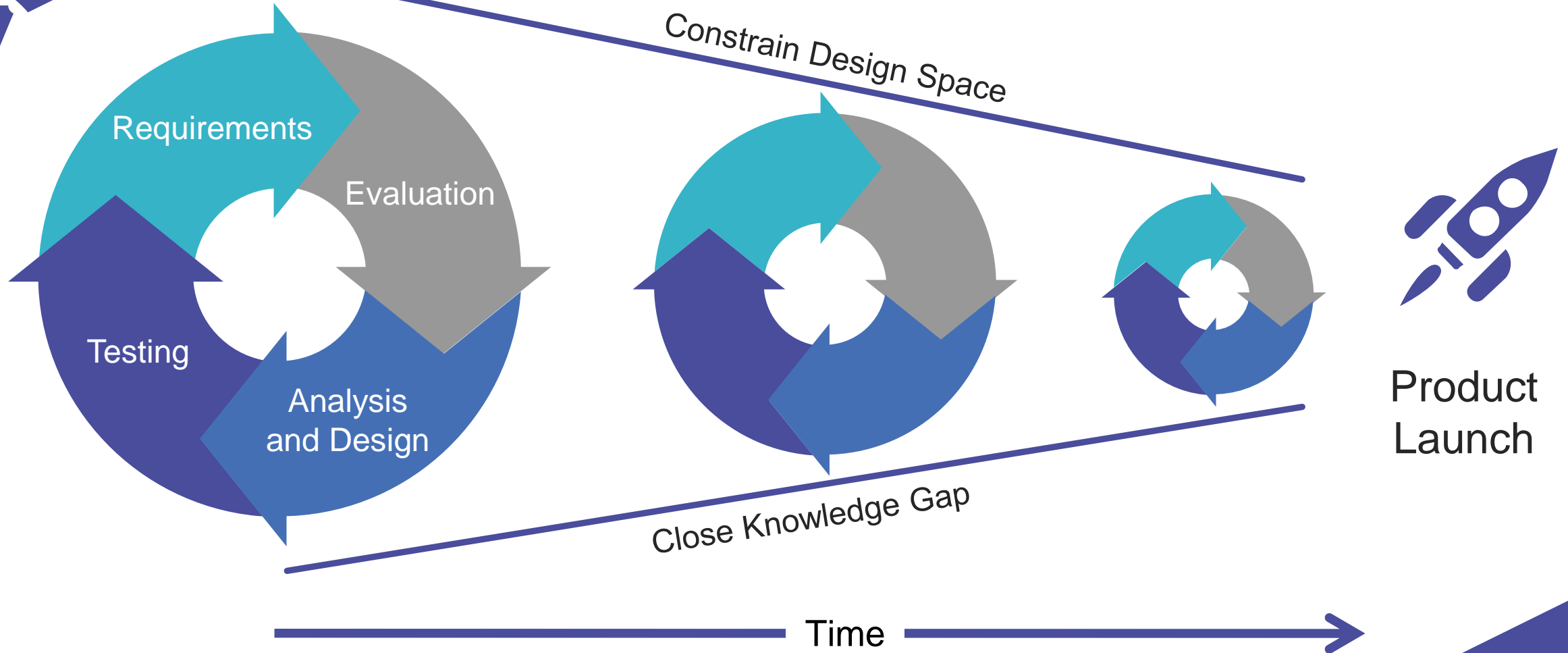




Agile Hardware Development

Use Agile Hardware Methodology

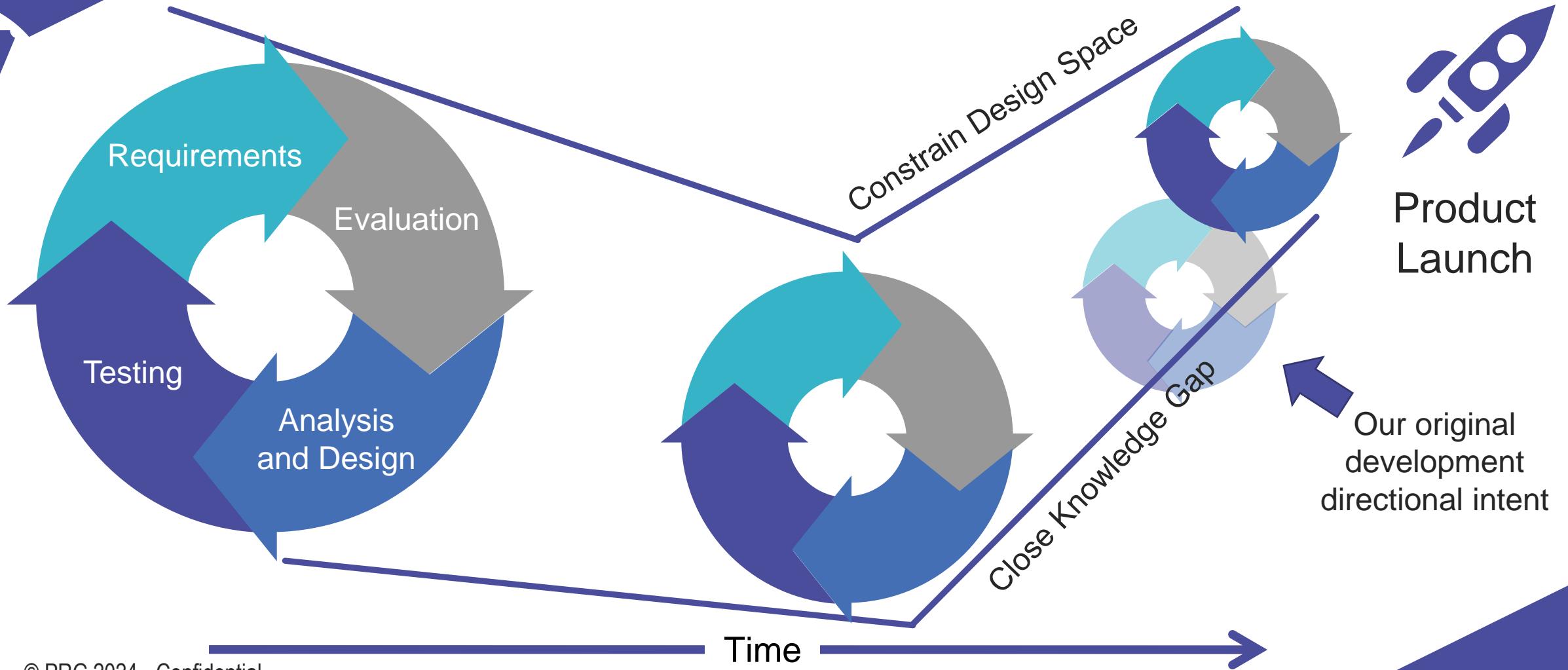
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Agile Hardware Development

BUT: be prepared for direction changes

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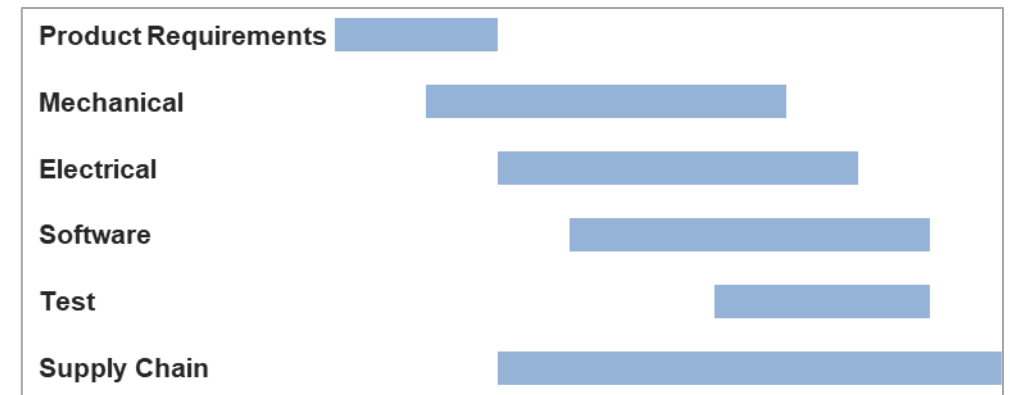
Agile Hardware Development

Utilize concurrent engineering

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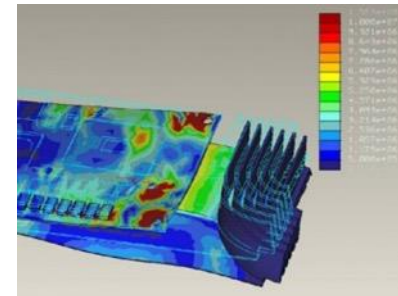
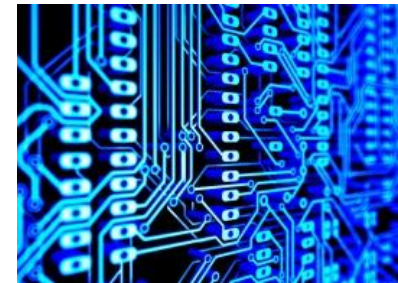
- Create a Cross Functional NPI Team and Schedule
 - Product Marketing / Sales
 - Engineering development
 - Operations
 - Customer Support
 - Finance
- Development Strategies
 - In-house
 - In-house + external consultants
 - Contract Manufacturing (CM)
 - Original Design and Manufacture (ODM)
 - Joint Development and Manufacturing (JDM)
 - Understand your core competencies

Project Schedule



Leverage Simulation tools and Rapid Prototyping

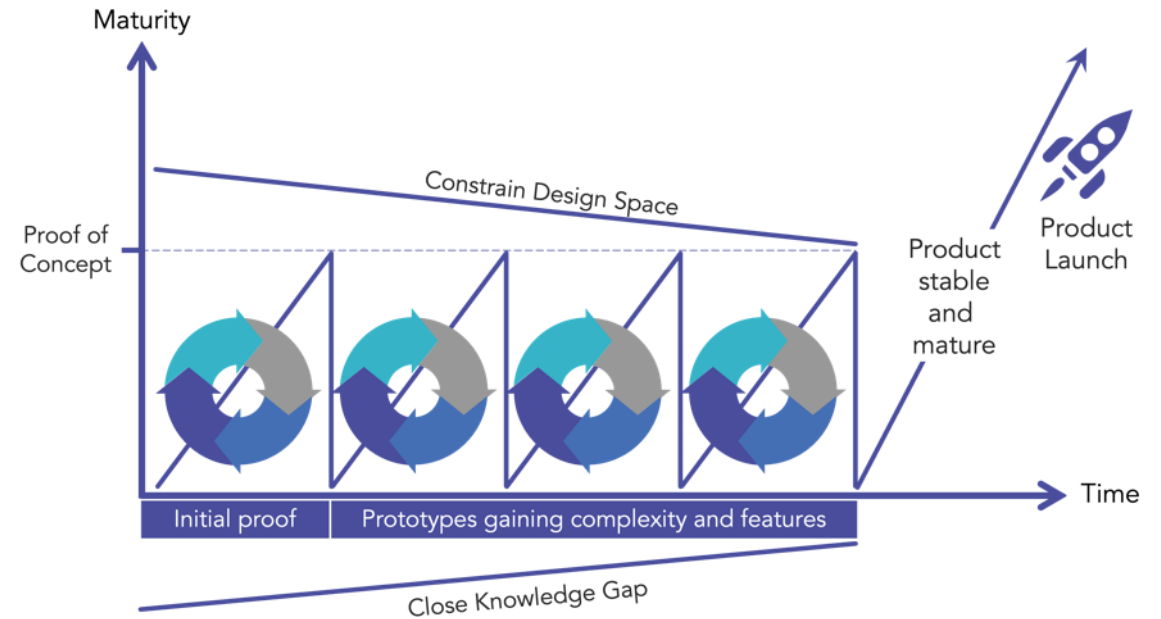
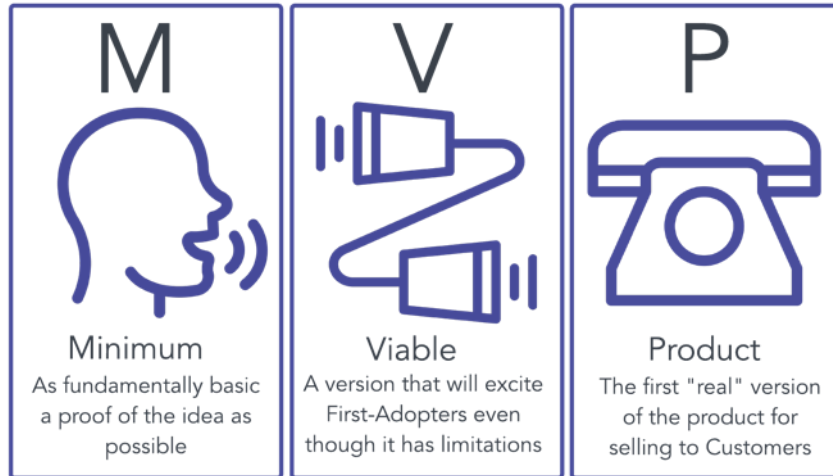
- Hardware simulation
 - Create digital models and exercise before making any hardware
 - Emulate complex custom components like ASICs in circuit before committing to silicon
- Additive manufacturing techniques
 - Shape analysis
 - Disposable tooling
 - Component fitting and Concept testing
 - Simulation and Air flow testing





Develop a Minimum Viable Product

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An MVP is about making hard choices:

- Is a feature absolutely necessary for the first product to ship? After all, every additional feature adds complexity to the design.
- Do the product features address the market need without extra “bells and whistles”?
- What are the additional features that are important, but not urgent that can be addressed after the initial market need has been validated using a strategic product roadmap?



Understand and Mitigate Risks Early

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Critical Product/Company Risks:

- Funding
- People
- Market
- Technology
- Development
- Regulatory
- Supply Chain & Manufacturing
- Distribution
- Sustainability



Apply Design for Excellence

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DfA – “Assembly”

DfC – “Cost”

DfM – “Manufacturability”

DfT – “Testability”

DfS – “Serviceability”

DfS – “Supply Chain”

DfX – many more

- Ability to scale to volume
- Better sourcing (cost, availability)
- Improve Product quality and reliability
- Cost impact (cash)

Design for Excellence (DFx)

Design for Manufacturability & Cost

- Create a part numbering system and product Bill of Materials (BOM)
- Eliminate or minimize fasteners
- Minimize parts & part numbers
- Consider total cost of each part/Reuse parts/2nd Source when possible
- Mistake proof (Poka Yoke)
- Modular design with logical subassemblies

Design for Testability

- Test capability built-in
- Ease of test and reduced test cost
- Comprehensive test improves quality & reliability, reduces warranty cost

Reliability, Validation and Test

(Start during Design phase!)

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- Product Reliability
 - Design for reliability
 - Calculate Mean Time Between Failures (MTBF)
 - Utilize Failure Modes and Effects Analysis (FMEA)
- Validation and Test
 - Layers of increasing test complexity ending up with customer validation
 - Highly Accelerated Life Testing (HALT/HASS)
 - Extend product life



Meet Regulatory Compliance

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- Agency Compliance
 - Safety (UL, CE)
 - Emissions (FCC, CE)
 - Product (FDA, ISO)
 - Military (MIL)
- Environmental Compliance
 - Hazardous Substances (RoHS)
 - Waste (WEEE)
 - Chemical Substances (REACH)



Deploy Scalable Business Systems

8

Develop a phased approach for business systems

- Design Phase
 - Start with Product Lifecycle Management (PLM)
- Prior to Production Launch
 - Add an Enterprise Resource Planning (ERP) system
- When customer relationships become important
 - Deploy a Customer Relationship Management (CRM) system
- Understand linkages and create an integrated systems strategy

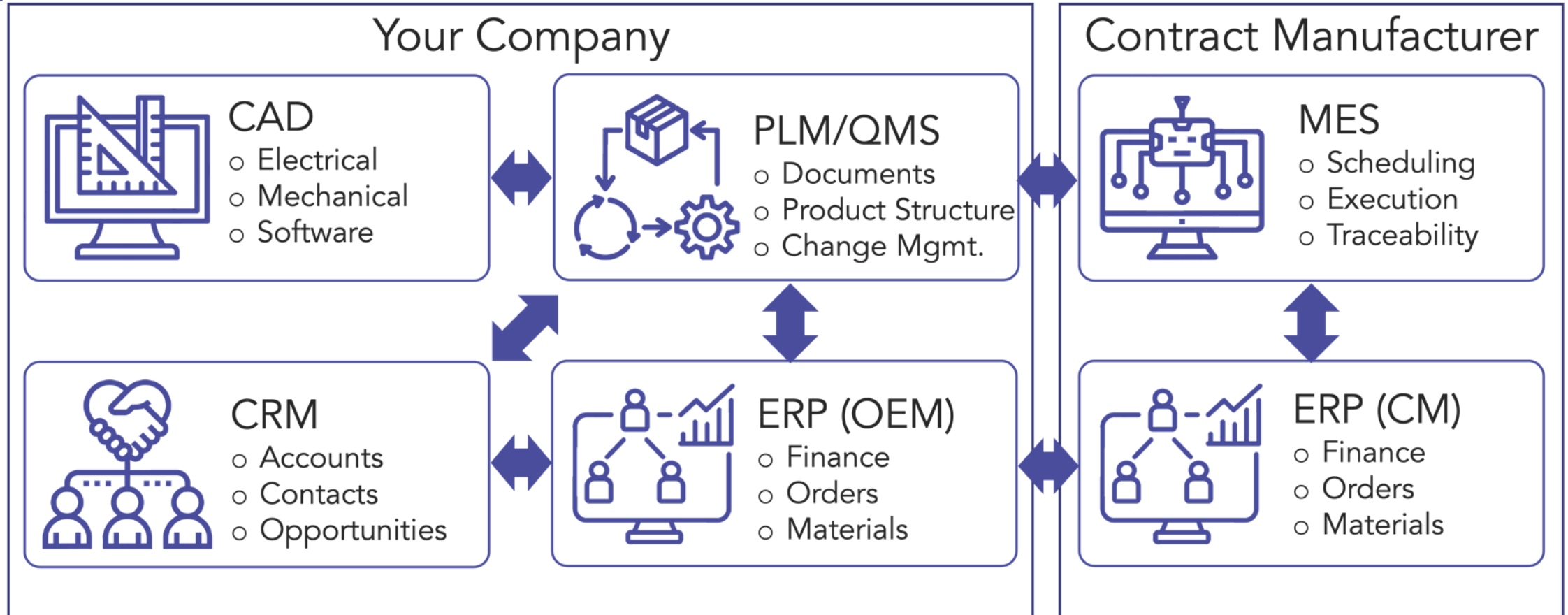




Deploy Scalable Business Systems

Create an integrated systems strategy

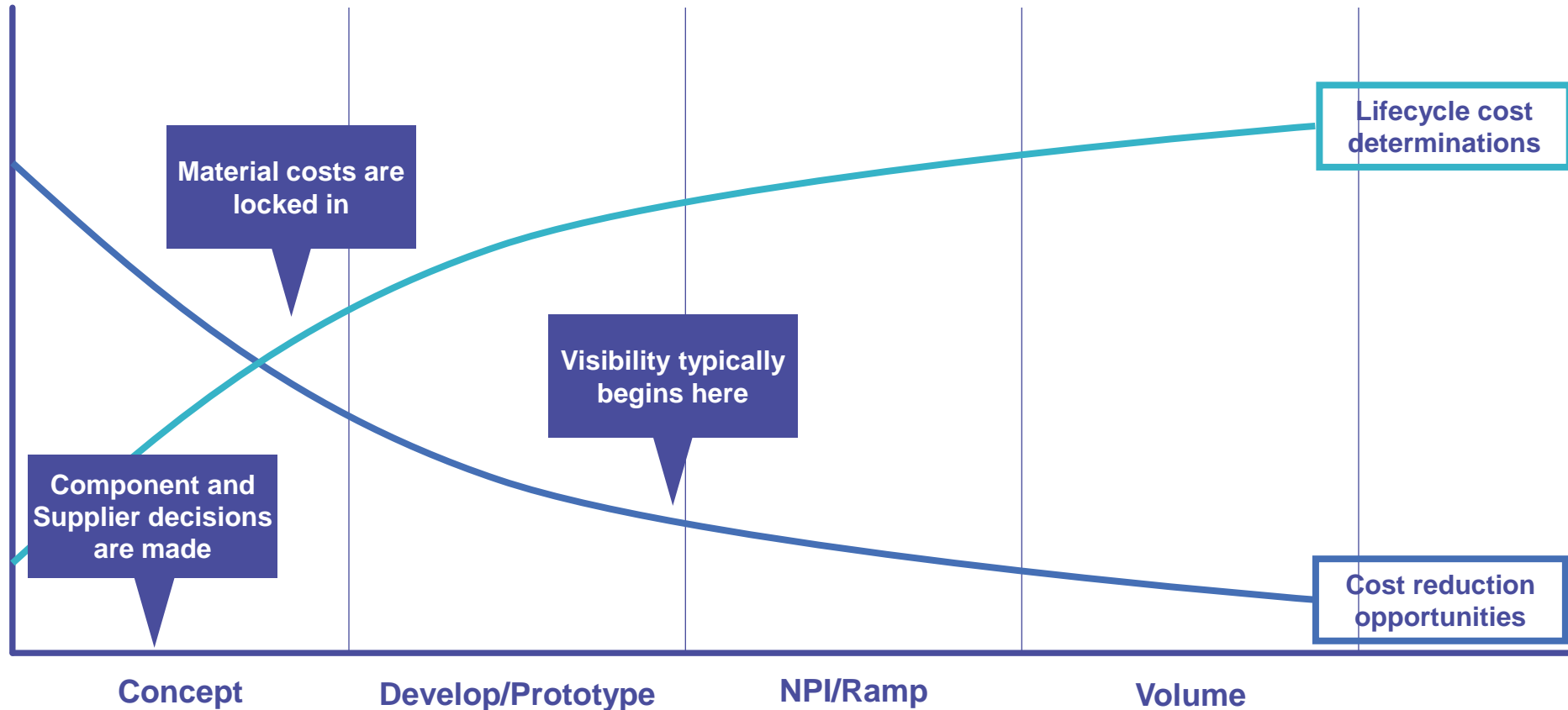
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Develop a Resilient Supply Chain

Locking in material costs



Only 12.5% of companies involve sourcing and suppliers before the prototype/pilot phase¹

Develop a Resilient Supply Chain

9

7 Tips for developing a resilient Supply Chain

1. Understand end user market location, capabilities, politics, and tariffs
2. Utilize standard and short lead time parts in design
3. Stabilize your product design prior to scaling into volume
4. Consider the following when selecting suppliers:
 - Good fit of product technology, culture, volumes, support and cost
 - Financial stability, size and ability to scale to your needs
5. Duplicate sources of supply where practical
6. Communicate clear and predictable production volumes
7. Hold regular supplier performance reviews



Verify Readiness for Volume Manufacturing

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Are you ready to scale?

1. Are all DfX requirements met?
2. Is prototype and production tooling complete?
3. Do you have a production test plan and fixtures?
4. Have you achieved regulatory certification?
5. Is the product documented & change management in-place?
6. Is all manufacturing documentation / training ready?
7. Do you have a volume sourcing strategy in-place?
8. Is the final packaging defined?
9. Are distribution, spares and servicing plans in-place?
10. Are lessons learned and updates incorporated?



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Thank You

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