CSCP CERTIFIED SUPPLY CHAIN PROFESSIONAL

MODULE 8: OPTIMIZATION, SUSTAINABILITY, AND TECHNOLOGY

SECTION A: OPTIMIZING SUPPLY CHAIN STRATEGY AND TACTICS

APICS

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Section A Introduction

Section A Key Processes:

- Optimize supply chain strategy.
  - Evaluate existing supply chain strategy.
  - Redesign strategy for optimization.
- Evaluate the existing network and optimize the supply chain network and processes.

Section A Topics:

- Business and Supply Chain Strategy
- Supply Chain Strategic Value and Optimization

Alignment of Strategies

A plan for how a company will function in its environment

A plan for choosing how to compete

A plan for how the supply chain will function in its environment to meet strategies and business goals

Processes to Develop or Design the Supply Chain

Develop: Align

Align with business strategy

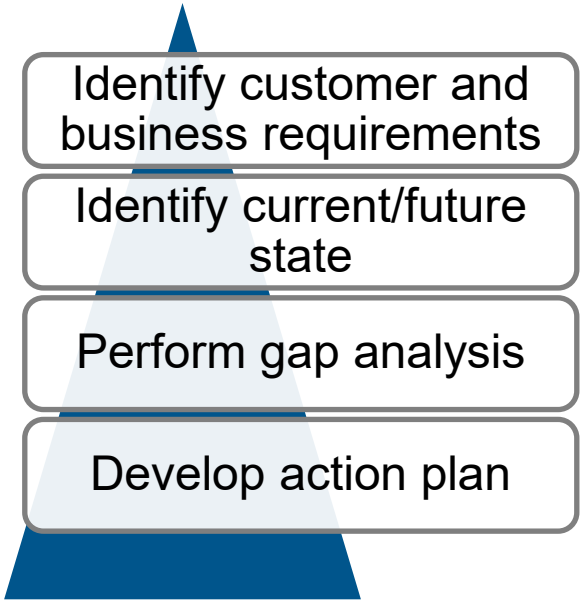
- Business plan, financials
- External scanning
- Current capacity, resilience, etc.

Develop: Strategize

Create supply chain strategy

- Define customer service
- Set revenue model
- Do mapping
- Align in-house vs contracted
- Document and get approval

Design or Redesign



Common Business Strategies

	Low Cost (Cheaper)	⟷	Differentiation (Better)
Broad	**Low Cost** • Compete: **cost** • Low price • No frills		**Broad Differentiation** • Compete: **customer experience** and **quality** • Attributes and variety appeal to many
↕	**Best Cost** • Compete: **cost** and **quality** • Best value at low price		
Focused (Segment-specific)	**Focused Low Cost** • Compete: **cost** and **responsiveness** • Well defined niche market		**Focused Differentiation** • Compete: **Innovation** and **niche marketing** • Unique strategies for niche market

Low-Cost and Differentiation Strategies

Low-Cost Advantage

- High operational efficiency
- Standardized products
- Tight inventory control
- Target costing
- Global strategy and economies of scale
- Mass marketing

Product or Service Differentiation

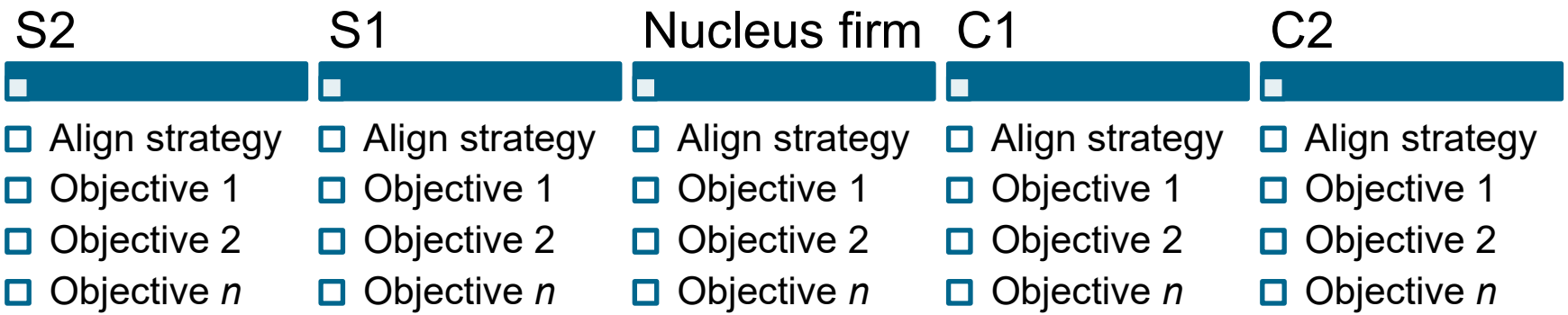
- Competitive analysis
- Nonprice basis distinction
  - Availability
  - Durability
  - Quality
  - Reliability
  - Diversity of product line
  - Special features
- Postponement

Focus Advantage Strategies

Mass vs. Niche Marketing	Responsiveness	Innovation
▪ Mass marketing: same message to all market (enters consciousness). ▪ Niche marketing tailors message to 1+ segments.	▪ Safety stocks or close warehouses ▪ Agility (ramp production up or down fast)	▪ R&D, time-to-market, and time-to-volume.

Business Strategy: Customer Focus and Alignment

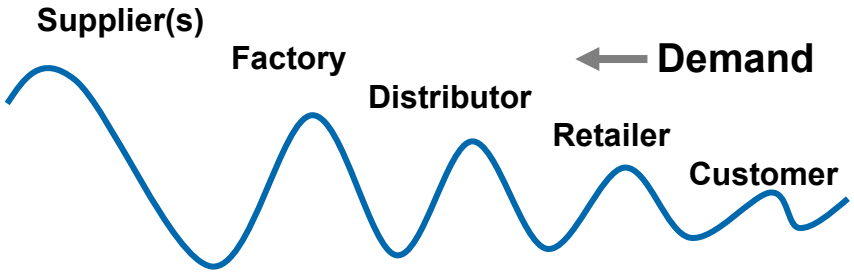
- Commitments and cooperation to synchronize objectives
- Supply chain strategy
  - Right product/service, price, time, and place
  - Align with organizational strategy
  - End-customer focus



Strategies: Forecast vs. Demand-Driven Enterprise

Forecast-Driven Enterprise

- Problem: Bullwhip effect
  - Demand variability increases at each stage due to each tier's demand forecast inaccuracies.

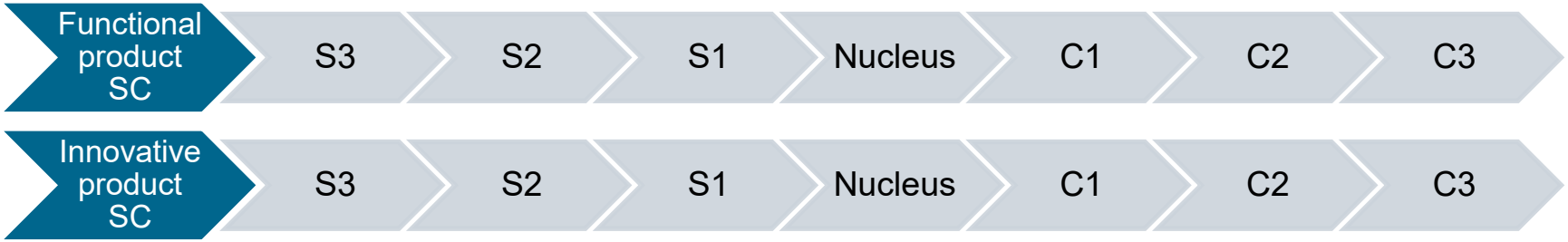


Demand-Driven Enterprise

- Solution: Real data, not forecasts.
  - Partner trust and collaboration.
  - Share real demand data along supply chain.
  - "Agile" response to order flow variability.
  - Pull! Don't push.

Business and Supply Chain Strategy

Strategy: Multiple Supply Chains, Product-Type-Driven



Functional product SCs

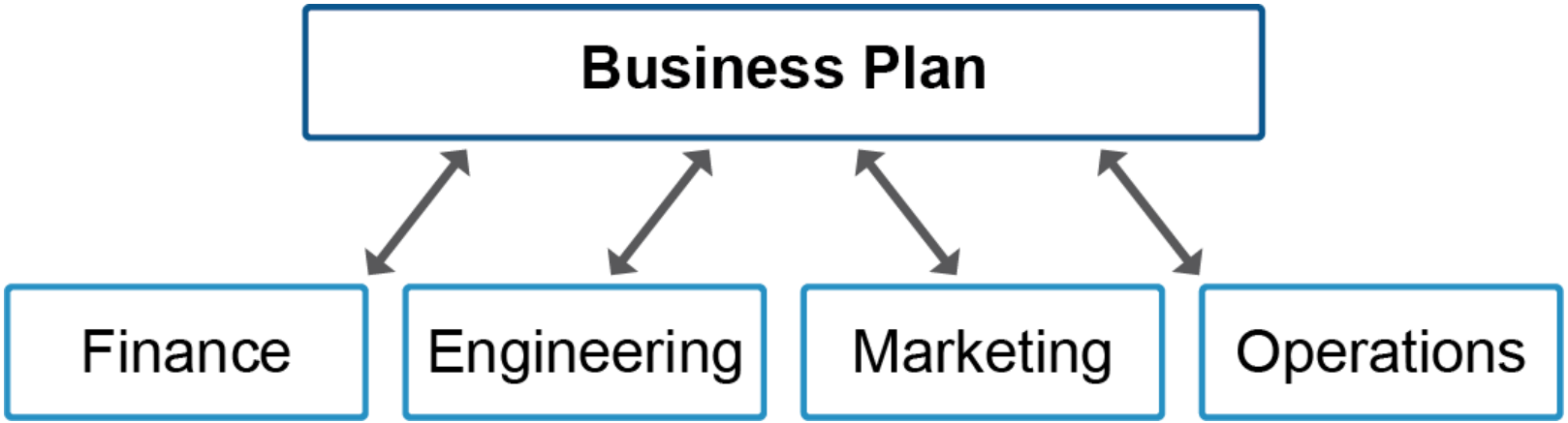
- High average utilization rate
- Minimal inventory with high turns
- Short lead time
- Choose suppliers for cost, quality
- Products with maximum performance, minimal cost
- Predictability and low cost

Innovative product SCs

- Buffer capacity and safety stock
- Aggressive reduction of lead times
- Choose suppliers for speed, flexibility, quality (not cost)
- Modular design with postponement of differentiation
- Market responsiveness

Business Plan

Statement of long-range strategy and revenue, cost, and profit objectives with budgets and projected financial statements



Fundamental Elements and Value Proposition

Value added: quality and utility vs. price

Relative to the competition

Customer's perspective

Non-value added

Porter's five fundamental elements

- Customer service
- Sales channels
- Value system
- Operating model
- Asset footprint

Core Competencies

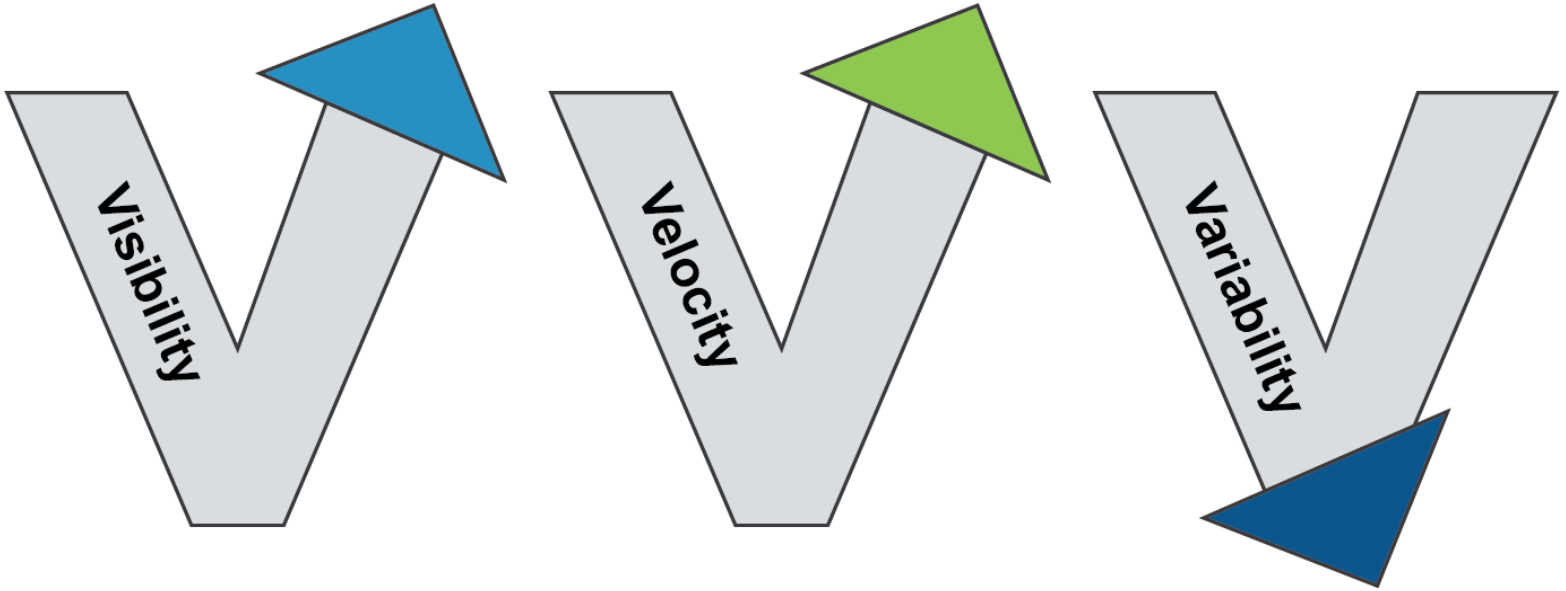
- Best at?
  - Decision making (plan, orchestrate)
  - Execution (source, transform, order, fulfill, return)
- Relative to competition
- Because
  - Economies of scale
  - Geography/culture
  - Technology
  - Resources

Cost Structure and Revenue Model

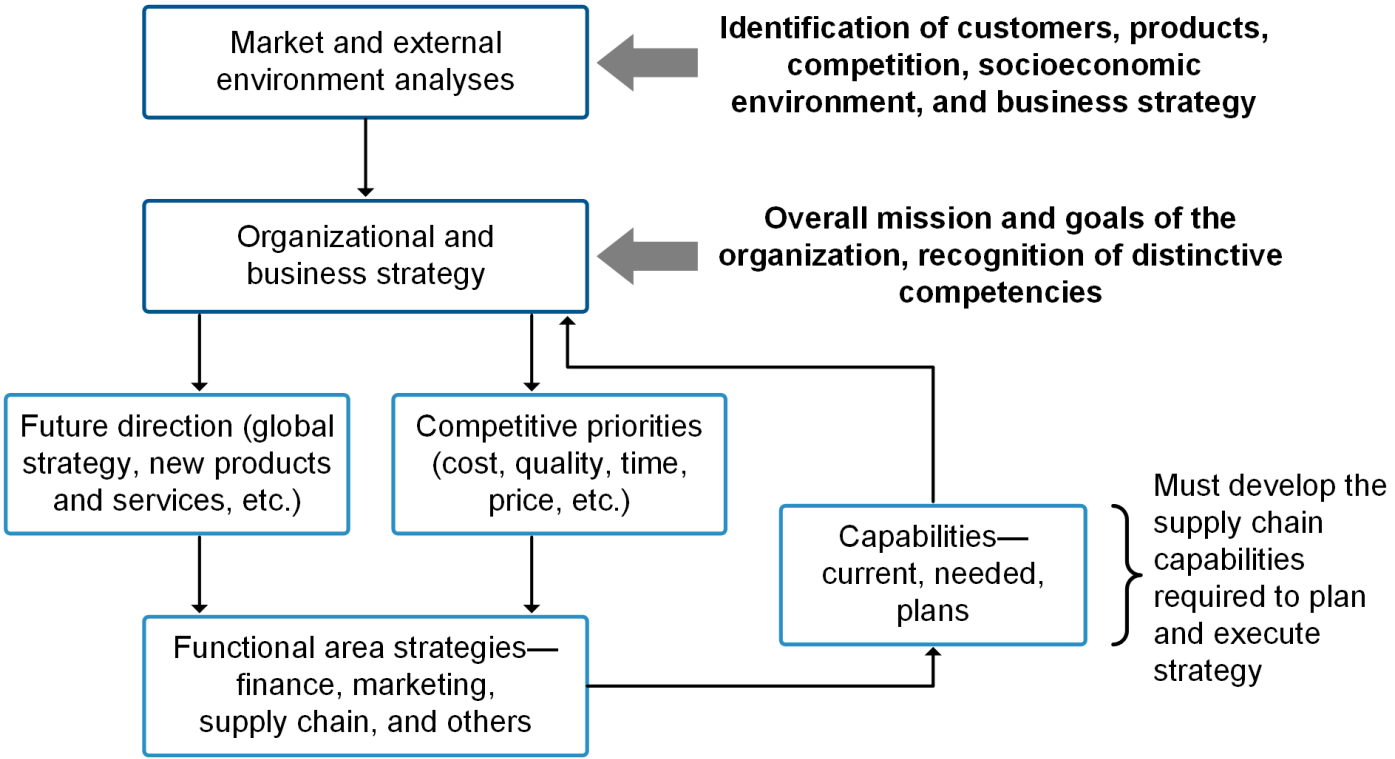
- Global, regional, or country-specific asset footprint
- Revenue model (how to make a profit)
  - Sales channels by supply chain
  - Prioritizing customers
- Cost structure differs by operating model:

Model	Production Cost	Inventory Carrying/ Planning Cost	Best For
Make-to-stock	**Low**	**High**	**Standardized, high demand**
Assemble-to-order	**Mid**	**Low**	**Some variety, moderate demand**
Make-to-order	**High**	**Low**	**Variety, sporadic**
Engineer-to-order	**Delayed until sale**	**Delayed until sale**	**Highly custom**

The Three Vs



Aligning Organizational, Business, and SC Strategies



Value Chain and Mapping

Value chain

Functions in a company that add value to goods or services

Value stream

Processes that create, produce, and deliver a product or service

Value stream mapping

Map as is and to be value streams to improve process, cutting non-value-added steps

Balancing Varied Stakeholder Values

Companies in SC	Profit, market share, image
End customers	Product and service quality, affordability, availability
Investors	Return on investment, quality of communications
Lenders	Interest, long-term stability, return of principal
Communities/ environment	Tax base, environment, jobs
Governments	Laws, regulation, overall impact
Employees	Job security, compensation, opportunity, working conditions

Financial Value

- Cut costs to yield net gains at the bottom line.
- “It takes money to make money” (e.g., upgrades).
- Equitably distribute gains (all stakeholders).

Customer Value

Resources are invested in creating the value of greatest importance to the market.

- Quality
- Affordability
- Availability
- Service
- Sustainability

Social Value

Deliver socially desirable goods.	**Avoid negative side effects.**	**Integrate sustainability in supply chain.**

Existing Network and Process Evaluation

Organizational design

- Framework

Processes

- From logistics, procurement silos to business process excellence, networking, and visibility

Systems and technology

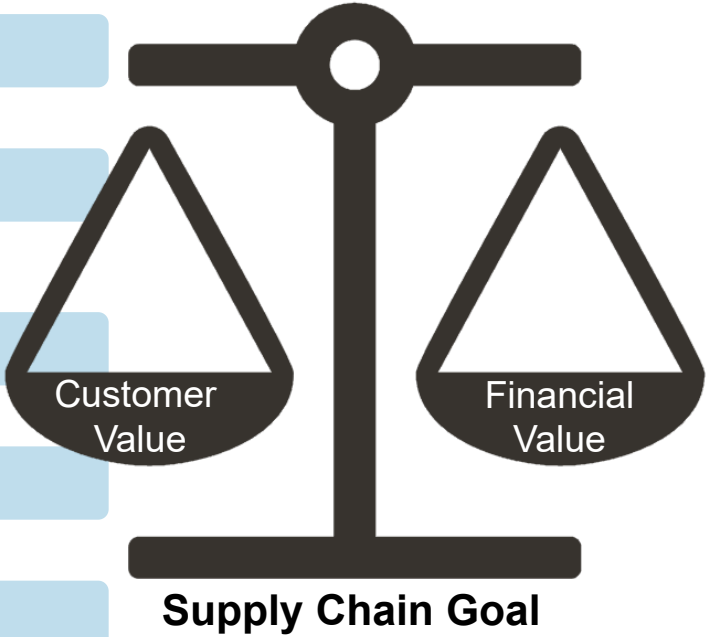
- Automation, transaction support (ERP), visibility (trust?)

Human resources

- Holistic knowledge, go-between with executive champion

Metrics

- Performance benchmarking and checklists



Excellence in Customer Service

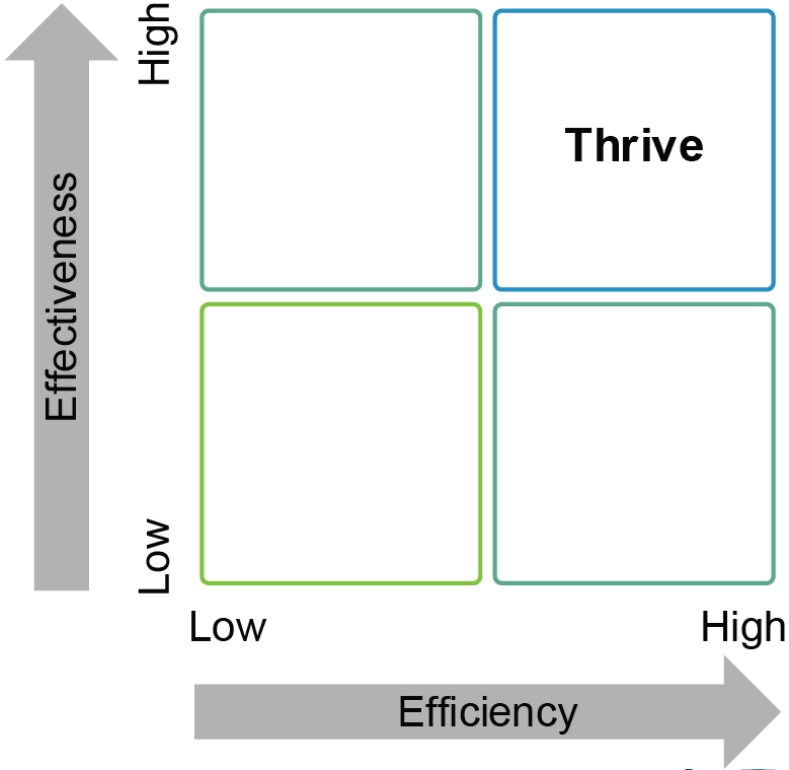
Fundamental attributes:

- Availability
- Operational performance
- Customer satisfaction

Supply Chain Strategic Value and Optimization

Effective and Efficient Use of Systemwide Resources

- Effectiveness:
  - Right product and right amount to right customer at right time.
- Efficiency:
  - Actual compared to standard output.
  - How well performing relative to standards.



Supply Chain Strategic Value and Optimization

Efficiently and Effectively Leveraging Partner Strengths

Strong partnerships:

- Add value to products
- Improve market access
- Build financial strength
- Add technological strength
- Strengthen operations
- Enhance strategic growth
- Improve organizational skills
- Build trust.

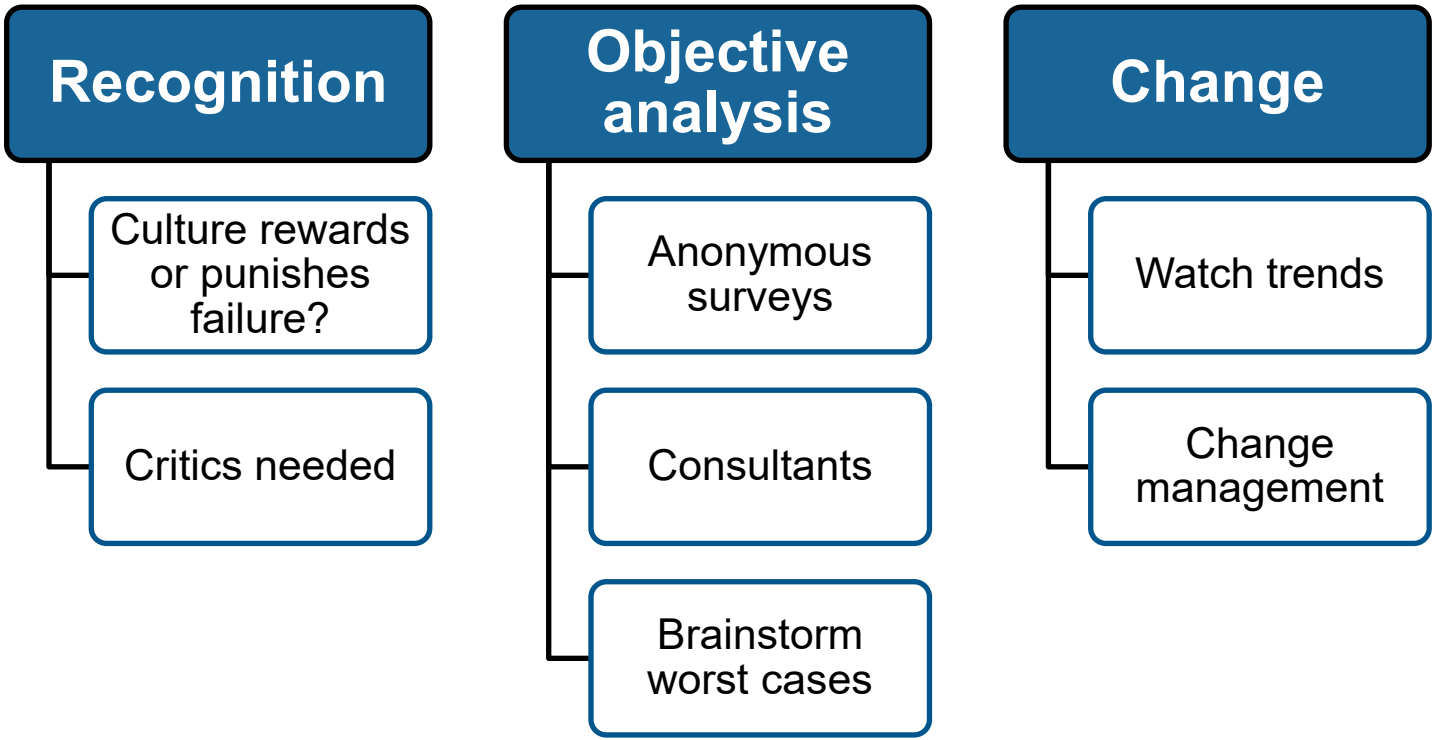
Cost Structure, Revenue Model, and Tax Strategy

- Align organizational and SC cost structures.
  - Low cost → Efficient (economies of scale, lowest cost make vs. buy choices, not as responsive).
  - Innovative → Responsive (transformative technology, scalable capacity, not as efficient).
- Spend management.
  - Control outflow of funds to increase profit.
- Align organizational and SC revenue models.
  - Shift view from cost center to value-added service.
- Leverage tax benefits of country, region, or city, especially if new area has other benefits (e.g., better efficiency).

Reasons Misalignments or Gaps Occur

- Change in market conditions
  - SC must be prepared to adapt quickly.
- Change in business direction
  - New products may require complete recasting of SC.
- Disruptive technology
- Anticipated change in market
  - Innovative SC can respond in advance.
- Business combination or merger
- Product life cycle change

Resolving Misalignments or Gaps



Aligning with Complexity and Partners

- Only as complex as it needs to be
  - Need multiple supply chains?
  - Variety only if actually in demand
- Align with supply chain partners
  - Determine who is channel master
  - Buyer's or seller's market?

Network Modeling and Operations Research

Models are as complex as needed, not more.

Inputs

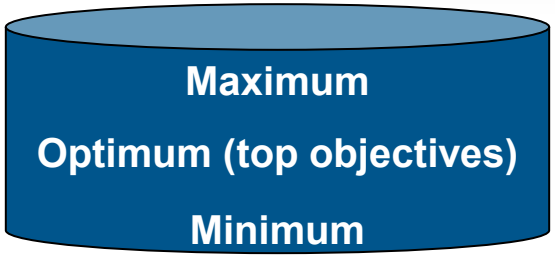
	A	B	C
2	Inputs Tab		
3		Scenario Name	Base Case
4		Match Result	1
5			
6		Assumptions	
7	Purchase price	$400.0	U
8	Setup Expenses	$200.0	U
9	Discount Rate	10.00%	

Processes

	A	B	C	D	E	F
1	Workings Tab					
2	*Year*		Year 0	Year 1	Year 2	Year 3
3	Copper Price per MT		$ 8,000	$ 8,390	$ 8,799	$ 9,228
4	Revenue		$ 0.0	$ 188.8	$ 198.0	$ 207.6
5	Cash Expenses		$ 600.0	$ 75.5	$ 79.2	$ 83.1
6	Depreciation Expenses		$ 0.0	$ 21.6	$ 21.6	$ 21.6
7	Income before tax		$ (600.0)	$ 91.7	$ 97.2	$ 103.0

Outputs

	A	B	C	D	E
2	Outputs Tab				Select Scenario:
3					Base Case
4					
5	NPV			$380.2	US$ millions
6					
7	IRR			16.2%	



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SECTION B: SUSTAINABILITY

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Section B Introduction

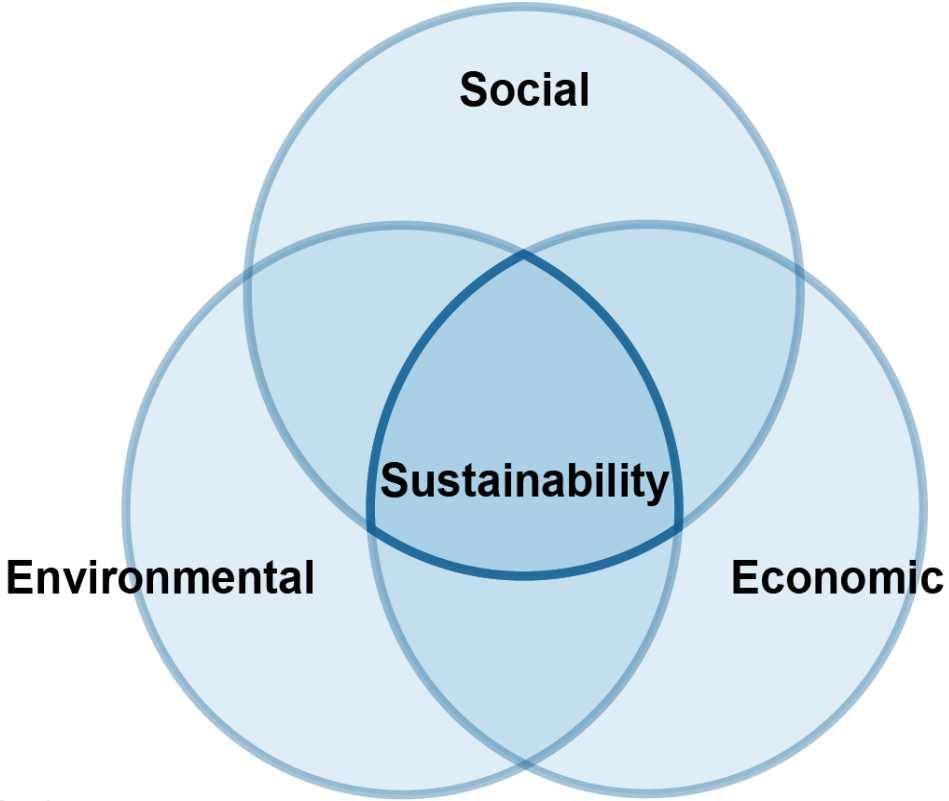
Section B Key Processes:

- Use triple bottom line (TBL).
- Follow United Nations (UN) Global Compact guidelines.
- Use Global Reporting Initiative (GRI) Standards.
- Develop sustainability metrics.
- Adhere to social, environmental, safety, and quality accreditations and certifications.

Section B Topics:

- Sustainable Supply Chains
- Sustainability Guidelines and Standards

The Triple Bottom Line



Balancing Short- and Long-Term Performance

Design goals and incentives so that short- and long-term economics are considered.

Short-Term Economics

- Weekly, monthly, quarterly
- Promotions to meet monthly sales goals
- Seasonal event stock buildup

Long-Term Economics

- Annually, 5+ year strategic horizon
- Incentives on profit margins
- Different supply chains for short vs. long cycle time items

Environmental Performance

Environmentally…

- Responsible business: Minimize impacts to society.
- Responsible manufacturing: Design product, facility, manufacturing, logistics, and supply to reduce waste.
- Sensitive engineering: Product and package design.

- Sustainable and safe products, services, packaging
- Responsible procurement, manufacturing, warehousing, transportation, and reverse logistics
- Public opinion and consumer choice
- Competitive advantage?

Social Performance

Corporate social responsibility (CSR) commitments for organization (may extend to supply chain partners):

- Needs and rights of employees, communities, and indigenous peoples
- Nondiscriminatory hiring and labor management
- Living wage by region
- Local worker and local business investments
- Charity to local causes

Sustainable Supply Chains and Compliance

Voluntary

- Reuse, recycling, recovery of industrial materials/end-of-life products.
- Material content reporting.
- Measured, cost-effective.
- Increased disclosure may increase scrutiny.

Mandatory

- EU Restriction of Hazardous Substances (RoHs).
- Noncompliance risks generally outweigh cost considerations.
- Could avoid doing business in country.

Organization-specific

- For example, U.S. Timberland “EcoMetrics” on shoes made:
  - Energy used
  - Global warming contribution
  - Material efficiency
  - Use of renewable energy

Government and Regulatory Compliance

Material content reporting	• Reuse, recycling, recovery
Dangerous/ hazardous goods	• Transportation risk; U.S. DOT codes • IMDG Code: Packaging, container traffic, stowage, segregation
EU efforts	• Disclosure, reuse; WEEE directive

Other Compliance Issues

Conflict Minerals

- Armed conflict regions
- U.S. Dodd-Frank Act
  - Tantalum, tin, gold, or tungsten
  - Democratic Republic of Congo and area
  - Disclose
  - Reasonable country of origin inquiry

Sustainability Risks from Packaging: Solutions

- Heat/chemical treatments for wood pallets (ISPM15)
- Reusing/repairing pallets
- Grinding up pallets
- Pallets or slip sheets from plastic or corrugated cardboard

Sustainability Guidelines and Standards

The UN Global Compact: Businesses should…

Human Rights

- Protect human rights
- Avoid human rights abuse

Labour

- Allow collective bargaining membership
- Prohibit forced and compulsory labour
- Not support or use child labour
- Not discriminate in employment or occupation

Environment

- Protect the environment
- Promote environmental responsibility
- Encourage environmentally friendly technology

Anti-Corruption

- Prohibit corruption like bribery or extortion.

OECD Guidelines for Multinational Enterprises

Goals:

- Ensure enterprises' operations align with government policies.
- Reinforce trust and confidence between enterprises and communities.
- Strengthen foreign investment climate and augment enterprises' sustainable development contributions.

GRI Reporting Framework and Standards

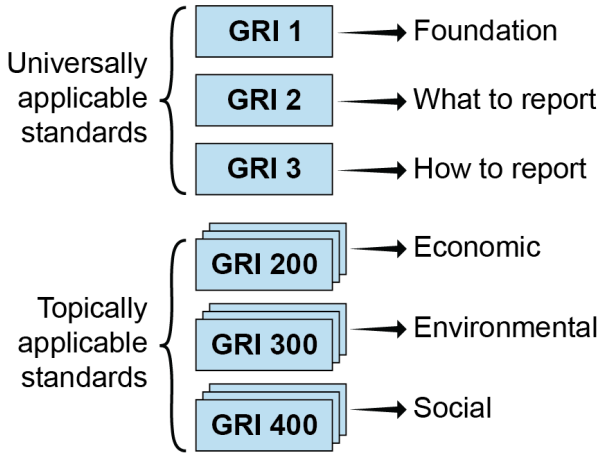
Principles for defining report content:

- Stakeholder inclusiveness
- Sustainability context
- Materiality
- Completeness

Report quality principles:

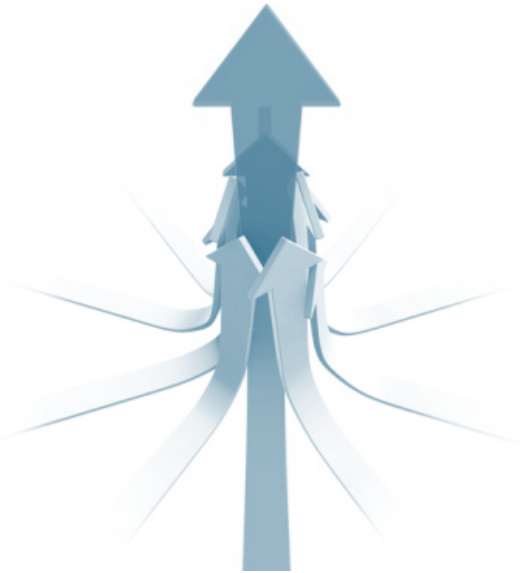
- Accuracy
- Balance
- Clarity
- Comparability
- Reliability
- Timeliness

GRI standards areas



Sustainability Guidelines and Standards

The ISO (International Organization for Standardization)

Features	Standardize for operations excellence	Benefits
▪ Generic management system standards ▪ Voluntary ▪ Market-driven ▪ Consensus-driven ▪ Expected in RFPs/ITTs ▪ Registration ▪ 3-year renewal		▪ Improved efficiency, productivity, bottom line ▪ Fair trade ▪ Reduced environmental impacts ▪ Legislation ▪ Best practices

ISO 9000 Series Standards

ISO 9000 Series Standards

- Quality management
- Quality system elements
- Not industry specific
- Most popular ISO standards
- ISO 9000: Definitions
- ISO 9001: Requirements
- ISO 9004: Continuous improvement

ISO 9001

- Framework for quality processes
- Consistently provide products that meet customer and regulatory requirements
- Enhance customer satisfaction
- Top management commitment to quality
- Process-centered approach
- Continual improvement

ISO 14000 Series Standards (Environmental)

Environmental Management System	ISO 14001	ISO 14004
▪ Identify and control impact of activities, products, and services. ▪ Enhance environmental performance regularly. ▪ Systematic objectives and measurement methods.	▪ Framework for strategic, holistic approach to environmental policy, plans, and actions ▪ Generic EMS requirements	▪ Specific guidelines of EMS ▪ Implementation guide ▪ Assurance and proof

Sustainability Guidelines and Standards

ISO 26000:2010—Guidance for Social Responsibility

- Recognize social responsibility within company's sphere of influence
- Identify and engage stakeholders
- Address the areas of guidance in the standard:
  - Organizational governance
  - Human rights
  - Labor practices
  - Environment
  - Fair operating practices
  - Consumer issues
  - Community involvement/ development

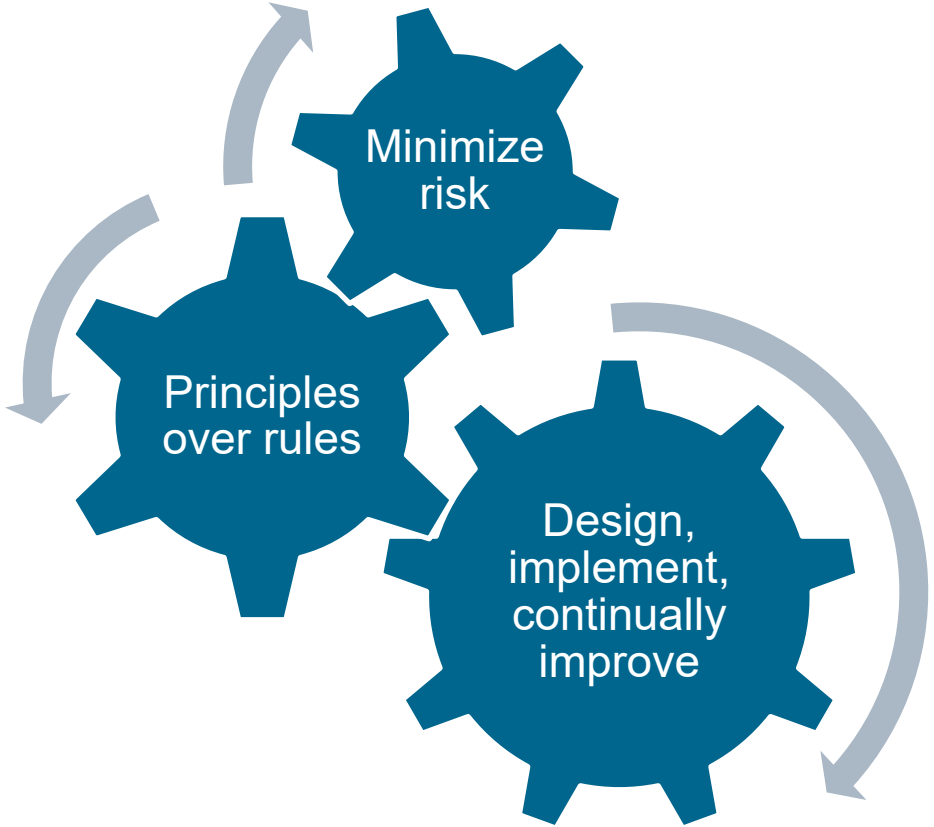
Sustainability Guidelines and Standards

SA8000 (Certify each location separately.)

- Neither support nor use child labor or forced labor.
- Provide safe and healthy workplace.
- Respect union formation.
- Don’t discriminate.
- Avoid harsh discipline.
- Comply with working hour laws and agreements.
- Pay a living wage and overtime.
- Show SA8000 support.

Sustainability Guidelines and Standards

ANSI Z.10 for Occupational Health and Safety



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SECTION C: TECHNOLOGY TRENDS

APICS

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Section C Introduction

Section C Key Processes:

- Consider emerging trends (e.g., blockchain).
  - Understand various emerging trends.
  - Assess the impact on current practices.
  - Incorporate changes as needed.

Section C Topics:

- Emerging Technology Trends
- Technology Assessment and Implementation

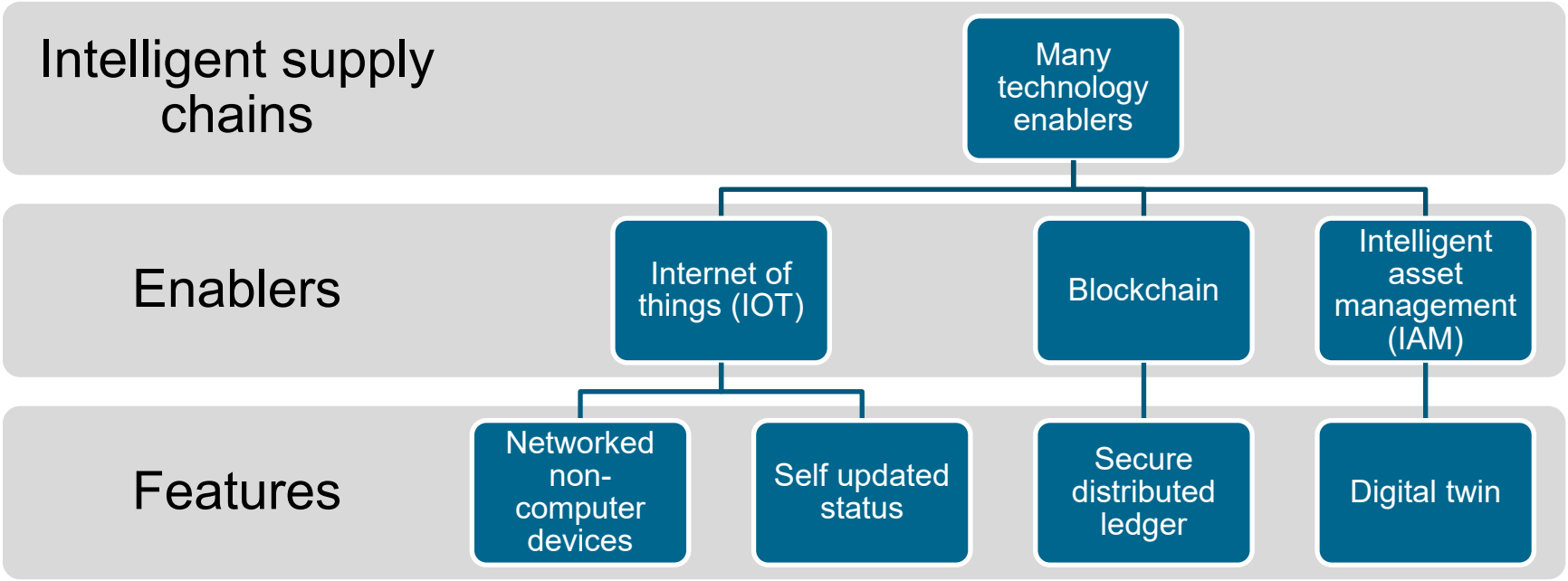
Emerging Technologies

Technology	Key Points
Cloud computing	Floating allocation for efficiency, automated vendor software updates, and easy partner implementations.
AI, machine learning, and data analytics	Artificial intelligence is self-improving software. Machine learning mimics human decision making. Data analytics generates insights from data.
Sensors and telematics	Sensors provide remote sensing. Telematics provide remote control. They enable visibility and automation.
Control towers	Centralized visibility and control in real time using dashboards with AI, machine learning, and analytic capabilities. Find gaps in current systems first.
Quantum computing	Quantum physics and nanoscale superconductors enable mapping all permutations of an optimization problem simultaneously. Lease for optimization.

Emerging Technologies (continued)

Technology	Key Points
3D printing	Adding a material one layer at a time to make 3D object (e.g., replacement part or prototype).
Wearable technology	Hands free devices integrated into information systems such as for picking/put away. Augmented reality (AR) overlays instructions on top of normal vision.
Robotic process automation	Software “bots” that automate customer or system interactions, reducing load on customer service, etc.
Autonomous/automated guided vehicles	Self-driving cars have regulatory hurdles. AGVS are automated materials handling devices.
Drones	Autonomous or remote-controlled aircraft such as for inventory counts or pipeline inspection.

Intelligent Supply Chains and Enablers



Technology Road Map: Shipbuilder Example

Goals	Year 1	Year 2	Year 3
Business	Meet technology budget/schedule.	Meet utilization goals: blockchain for QR and RFID.	Break-even, messaging, and asset optimization.
Product (i.e., ships)	Meet deadlines despite changes.	Check asset availability before project changes.	Allow compressed schedules.
Process	Develop and train asset checkout.	Develop and train predictive maintenance.	Develop and train asset optimization.
Equipment	Install bar code readers and tag small assets with QR codes.	Upgrade heavy equipment with RFID and install sensors.	Adjust equipment and asset levels based on internal demand.
Software	Develop IAM and blockchain MVP.	RFID interface; predictive maintenance.	Analytics, IoT, and IAM updating.

Technology Audits and Implementation Reviews

- Current capabilities and how to address gaps
- Availability, security, confidentiality, and integrity
- Upper management audience
- Post-implementation reviews
  - Expected ROI?
  - Accountability if expectation is set that it will be done
- False vendor promises, poor integration, or features not getting used (poor training, change management)

Mitigating Typical IT Risks

- **Make incremental improvements.**
- **Clearly define business requirements.**
- **Perform due diligence on proposals.**
- **Control scope creep.**
- **Control excessive customization.**

Technologies and Alignment

- Process technology and IT strategies
- Strategic requirements
  - Alignment, e.g., for low-cost provider, strong cost-cutting ROI or no-frills technology
- Tactical requirements
  - Degree of automation, user friendliness, maintainability, throughput, and satisfaction of SC objectives (e.g., cold chain)
- Operational requirements
  - Detailed and specific: accuracy, precision, and other requirements, e.g., durable sensors for a harsh environments

Technology Selection Criteria

Competitive advantage

- Scarce
- Difficult to move
- Difficult to copy
- Difficult to substitute

Feasibility

- Cost-benefit analysis
- Implementation needs
- Learning curves
- Change management

Risks

- Project failure or lack of benefits
- Market shifts or new technology
- New regulations
- Unintended consequences

Requirements validation

- Quality
- Speed
- Dependability
- Flexibility
- Cost

Technology Selection and Cutover

Selection of Technology

- RFI for range of selections
- RFP/ITT once know needs
- Start wide and narrow down
- Keep all bidders in loop
- Bidder presentations: get proof it works with your data
- Accept or negotiate

Technology Cutover Plan

Go live	Migration, interface switching, testing, and go live are on tight schedule. A back out plan is needed.
Cutover period	Fully maintain old and new, allowing comparison of results, but adding labor cost and taking up space.
Rolling cutover	Phases such as for multiple sites. Small implementation teams use lessons learned.

Operations versus Projects

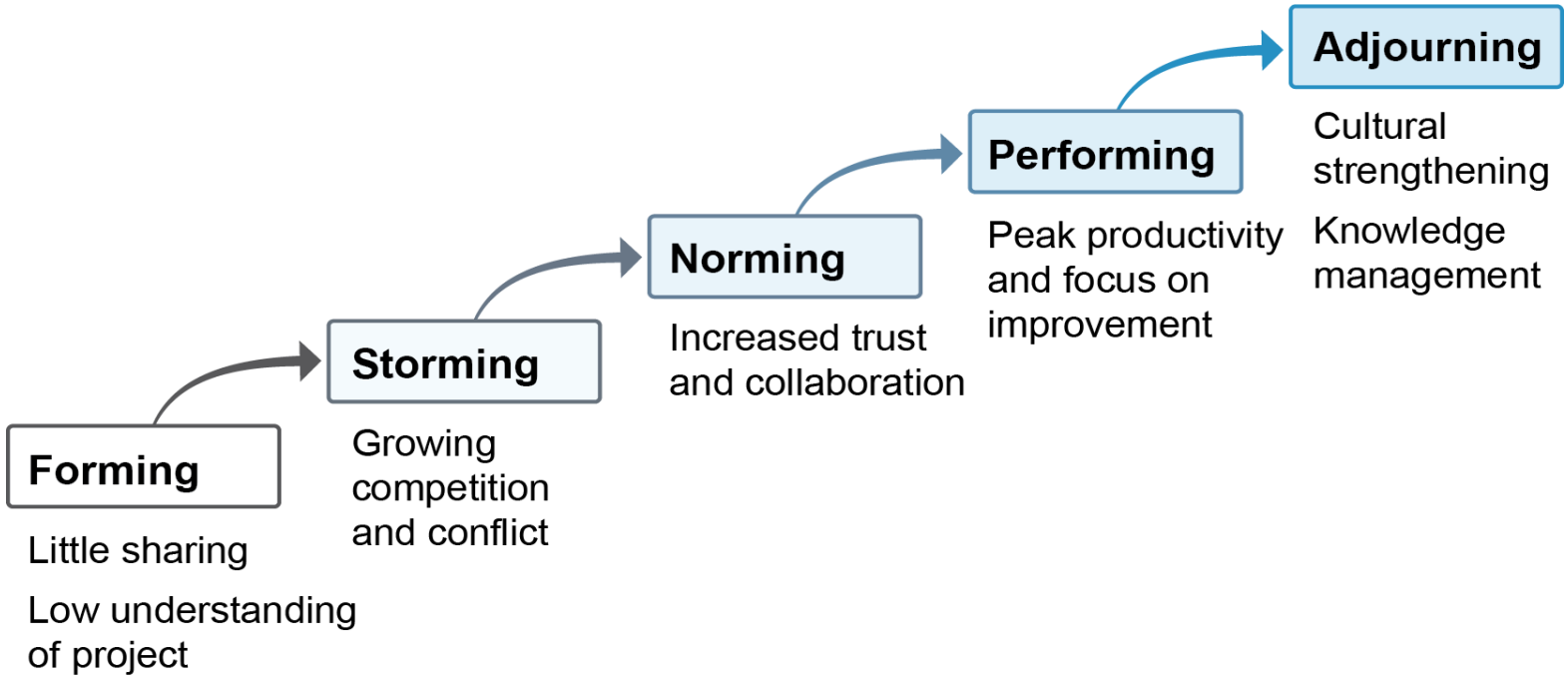
Distinguisher	Operations	Projects
Duration	Ongoing, indefinite, repetitive	Varies, but always temporary
Deliverables	Standardized • Producing inventory • Ongoing services • Weekly reports	Unique • Finished deliverable • Improved product, service, or result
Human resources	Permanent roles • Aligned to departments • Part-timers report to functional manager and project manager	Temporary teams • Lean and cross-functional • Need right skills to be involved
Manager	Functional manager	Project manager or scrum master
Funding	Organizational budget	Project budget authorized in signed formal charter.
Support	Organizational hierarchy	Executive as project champion

Project Teams: RACI Charts

Engine test	PM	Eng	Perf analytics	VP, Eng	VP, Acct
Run	I	R	I	A	I
Analyze results	I	C	R	A	I
Report	R	C	C	I	A
Follow up	R	C	I	I	A

R = Responsible for task completion, **A** = Accountable for outcome,
C = Consulted (provides input on the work), **I** = Informed of progress

Project Teams: Tuckman's Ladder



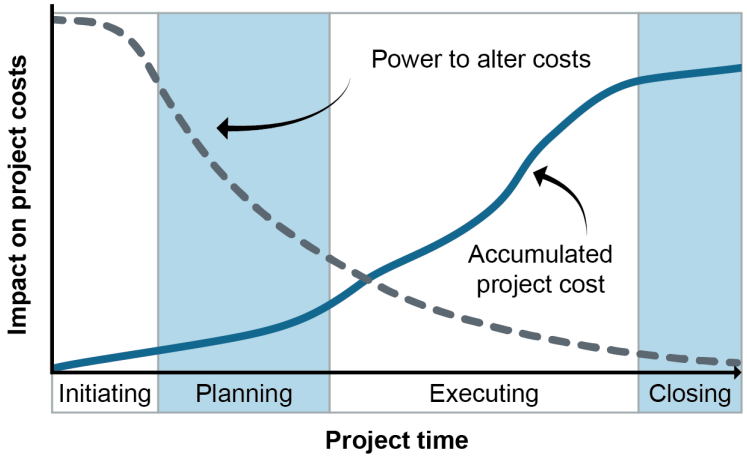
Pitfalls and Best Practices

Pitfalls	Best Practices
▪ Budget or schedule is significantly missed. ▪ Project results are ineffective. ▪ Deliverables have no valid purpose. ▪ Project sponsors or managers allow scope creep.	▪ Lead, coach, clearly delegate. ▪ Clarify roles for easy personnel transitions. ▪ Measure, control against plan. ▪ Meetings: substantive issues ▪ Control change: tradeoff analysis. ▪ Keep documents living and control version in use.

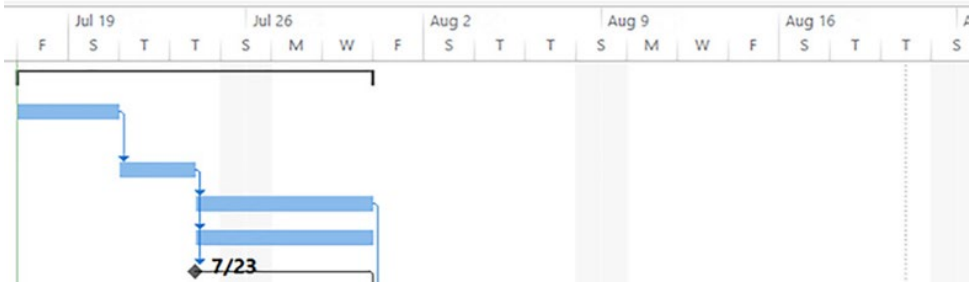
Source: *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, fifth edition, 2013.

Traditional Project Management

- Initiating, planning, execution, closing
- Monitoring and controlling
- Progressive elaboration
- Scope baseline
  - Project scope and WBS
- Project schedule
  - Concurrent versus sequential
  - Critical path
- Project budget
  - Bottom up, top down



Gantt chart



Course Corrections and Change Control

Course Corrections

- Project manager monitors and controls project against scope, schedule, and budget baselines.
- Fast tracking: concurrent tasks
- Crashing: more resources

Change Control

- Formal change control board approves changes and adds funds
- Otherwise, project manager rejects changes
- Scope creep
- Gold plating

Agile Project Management (E.g., Scrum)

Agile	Scrum Example
▪ Requirements change often – Prototype feedback ▪ Intense customer participation: product owner ▪ Plan for just next iteration ▪ Prioritize and reprioritize ▪ Minimum viable product (MVP) and releases	▪ Scrum: move as unit by letting members take lead ▪ Kanban board – Backlog, WIP, done ▪ Sprint or iteration ▪ Daily standup and retrospective ▪ Scrum master

Change Management Road Map

- Road map (master plan) plus project plans
- Interconnections create unintended consequences.
- Pilot projects
- Communicate before, during, and after

- Address:
  - Supply chain maturity
  - Executive champions
  - Balanced scorecard's process improvement, growth, and learning
  - Diplomacy with partners for information sharing

Change Process

- Identify need.
- Set vision of the future.
- Costs and benefits.
- Strengths and weaknesses.
- Build consensus.
- Build enthusiasm.

- Success criteria.
- Determine areas to change.
- Develop plans.
- Ongoing management plans.
- Get approval and funding.

- Rework organization structures.
- Rework workforce roles.

- Lead and manage.
- Monitor and control.

Maintaining Technologies

- Specific delegation
  - Internal or vendor maintains
- Maintenance policies and procedures
  - Testing protocols
  - Use restrictions, and tradeoffs (wear vs. throughput)
  - Maintenance priority plans
- Maintenance per schedule
  - Minimize conflicts with ongoing operations
  - Communicate with shop floor
  - Some replacement parts in stock, some ordered
    - Approval step
- Maintenance requirements reassessment