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CERTIFIED SUPPLY CHAIN PROFESSIONAL

MODULE 8: OPTIMIZATION, SUSTAINABILITY, AND TECHNOLOGY

Section A: Optimizing Supply Chain Strategy and Tactics

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Section A Introduction

**Section A Key Processes:**

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

Section A Topics:

- Topic 1: Business and Supply Chain Strategy
- Topic 2: Supply Chain Strategic Value and Optimization

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Alignment of Strategies

| A plan for choosing how to compete	A plan for how a company will function in its environment	A plan for how the supply chain will function in its environment to meet business goals and strategies

Business strategy → **Organizational strategy** → **Supply chain strategy**

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Processes to Develop or Design the Supply Chain

Develop

- Align with business strategy
  - Business plan, financials
  - External scanning
  - Current capacity, resilience, etc.
- Create supply chain strategy
  - Define customer service
  - Set revenue model
  - Do mapping
  - Align in-house vs contracted
  - Document and get approval

Design or Redesign

- Identify customer and business requirements
- Identify current/future state
- Perform gap analysis
- Develop action plan

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

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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

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Focus Advantage Strategies

Mass vs. Niche Marketing

- Safety stocks or close warehouses
- Agility (ramp production up or down fast)

Responsiveness

- Mass marketing: same message to all market (enters consciousness).
- Niche marketing tailors message to 1+ segments.

Innovation

- R&D, time-to-market, and time-to-volume.

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Organizational Strategy: Customer Focus and Alignment

Commitments and cooperation to synchronize objectives
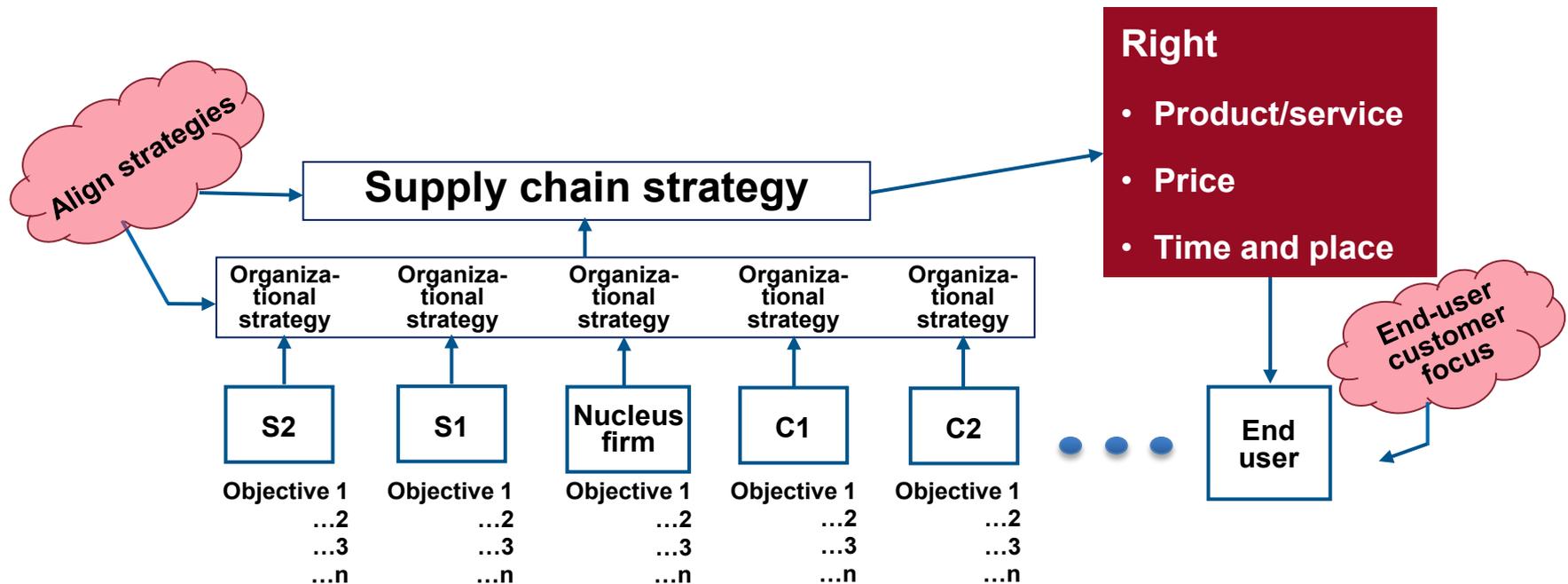
Strategies: Forecast vs. Demand-Driven Enterprise

Forecast-Driven Enterprise

- Problem: Bullwhip effect
- End user demand variability increases at each stage due to each firm's demand forecast inaccuracies.

Supplier(s)

Factory

Distributor

Retailer

Customer
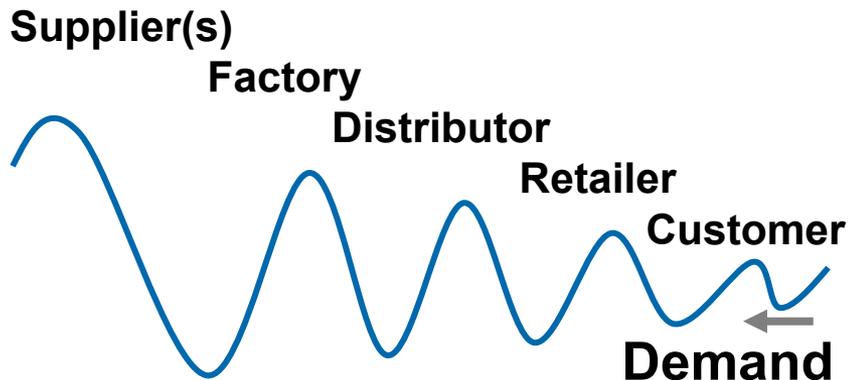
Demand

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.

Organizational Strategy: 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**
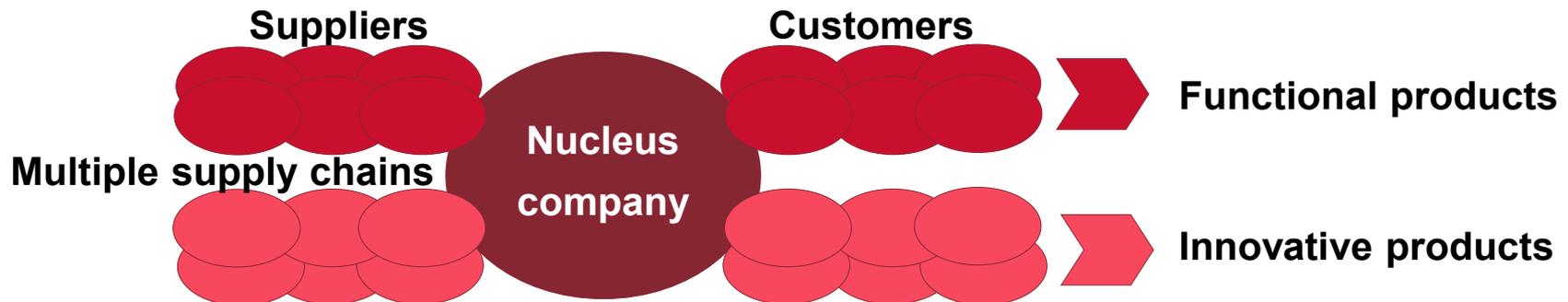
Business Plan

Statement of **long-range strategy and revenue, cost, and profit objectives** with budgets and projected financial statements
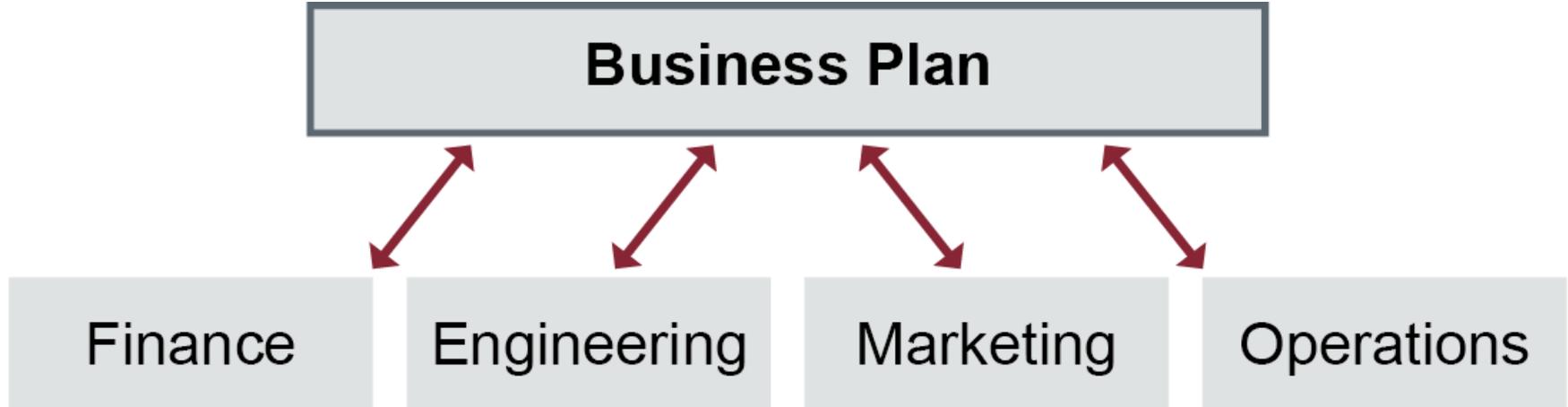
Fundamental Elements and Value Proposition

Value added

Customer service

Quality

Utility vs. price

Non-value added

Customer's perspective

Relative to the competition

SOLD

Porter's five fundamental elements:

Customer service

Sales channels

Value system

Operating model

Asset footprint

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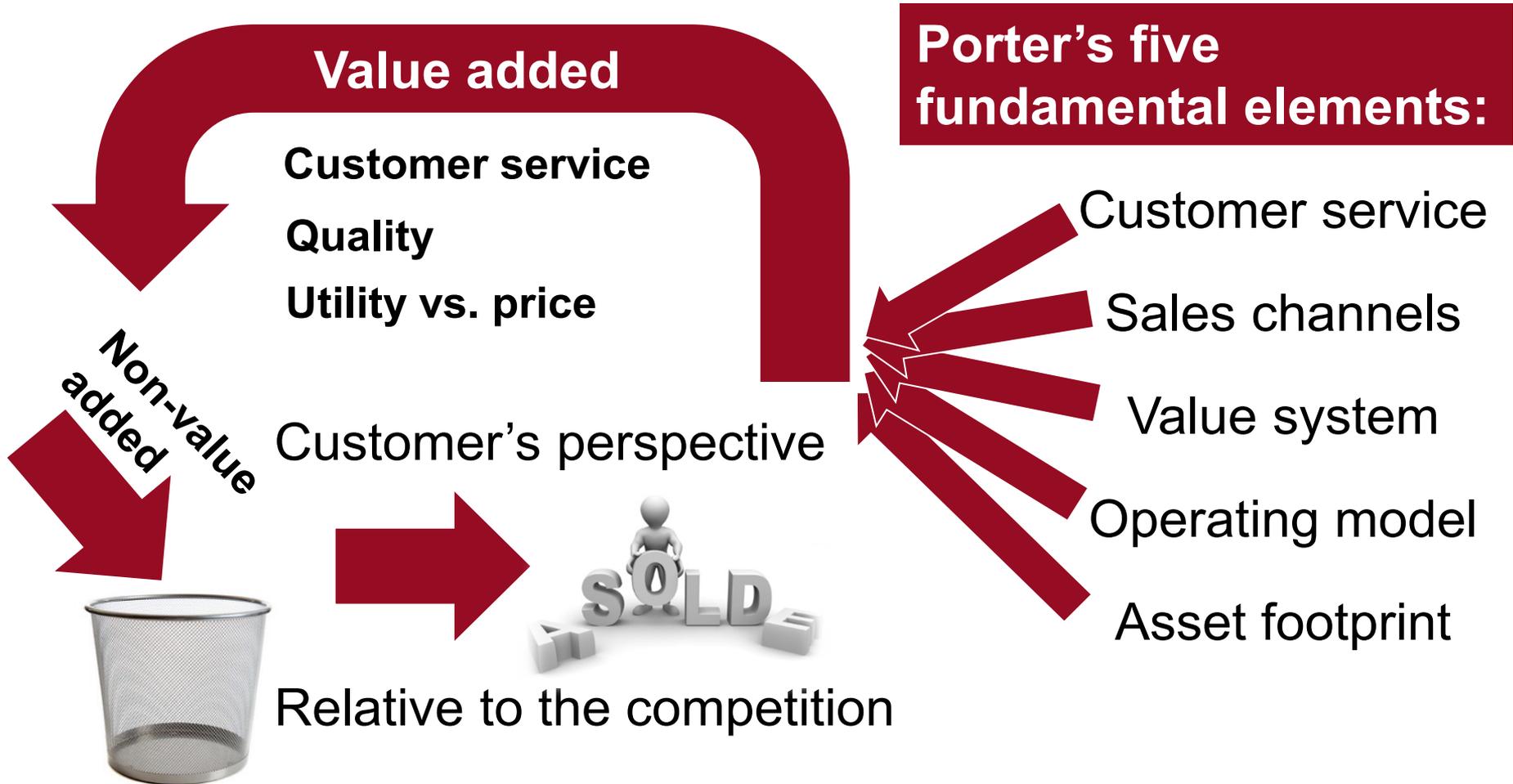
Core Competencies

- Best at?
  - Decision making (plan, enable)
  - Execution (source, make, deliver, return)
- Relative to competition
- Because
  - Economies of scale
  - Geography/culture
  - Technology
  - Resources
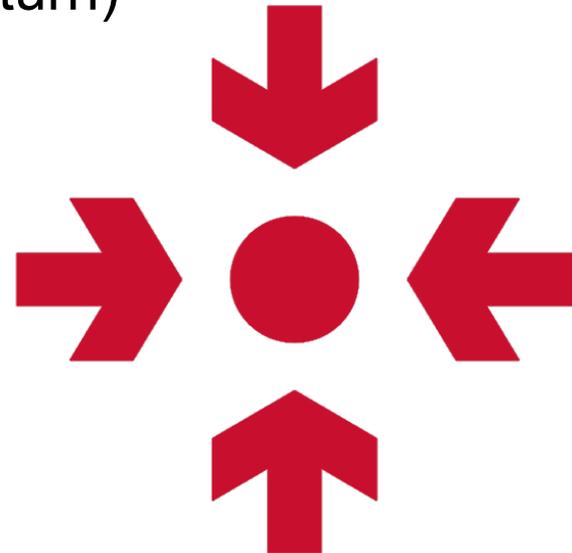
Cost Structure and Revenue Model

- 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

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

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The Three Vs
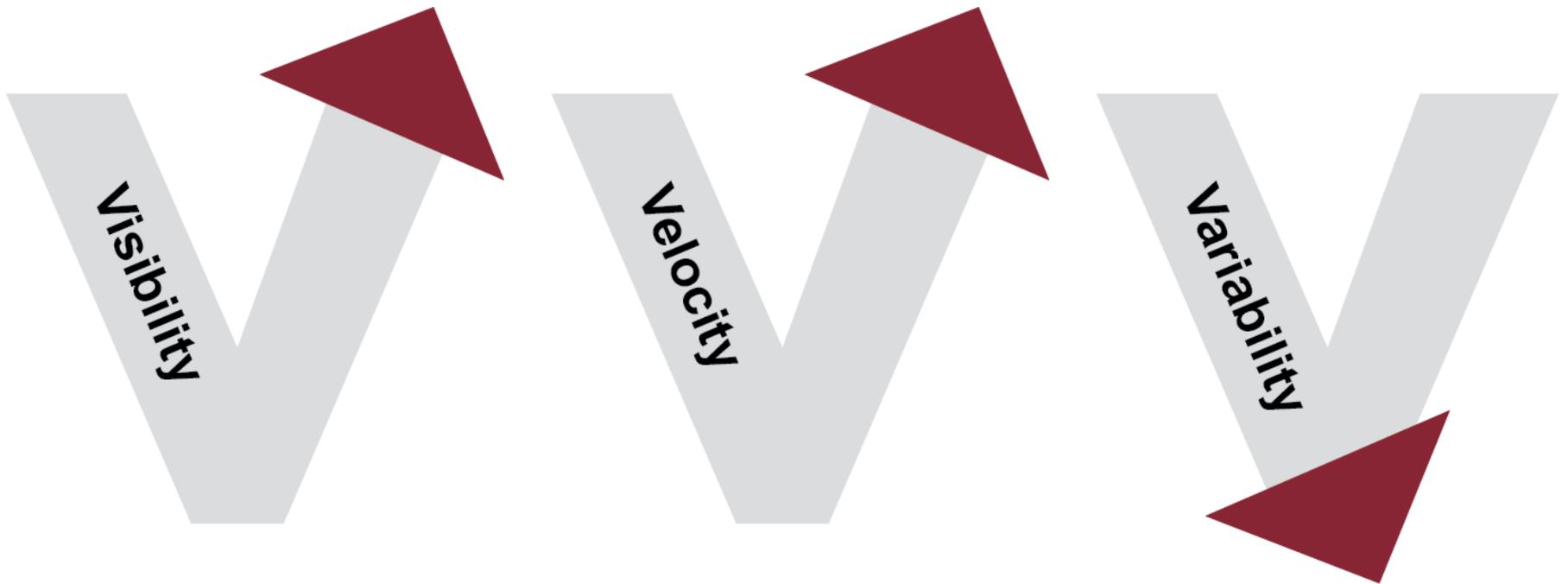
Aligning Organizational and SC Strategies

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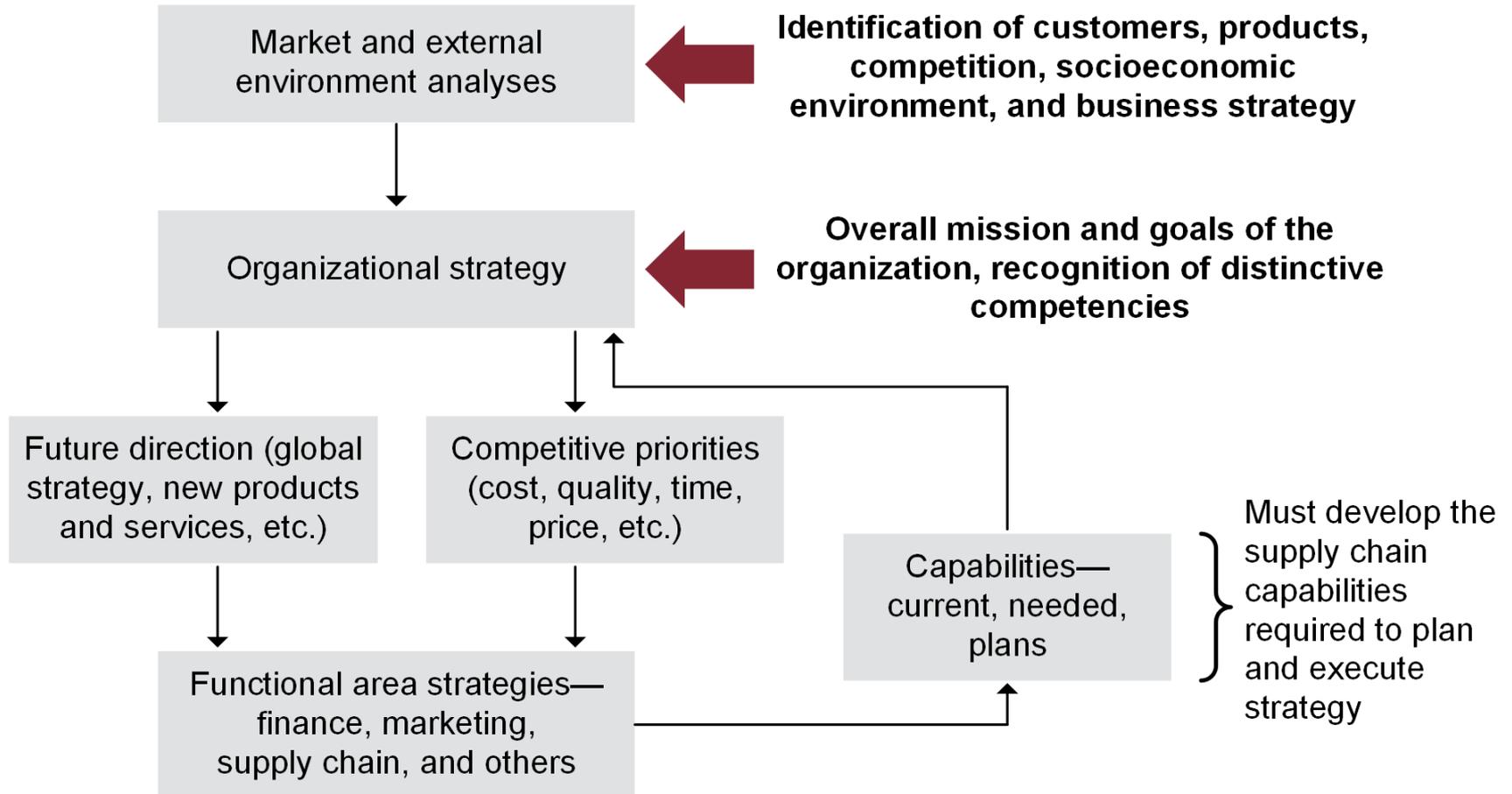
Value Chain and Mapping

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

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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

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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
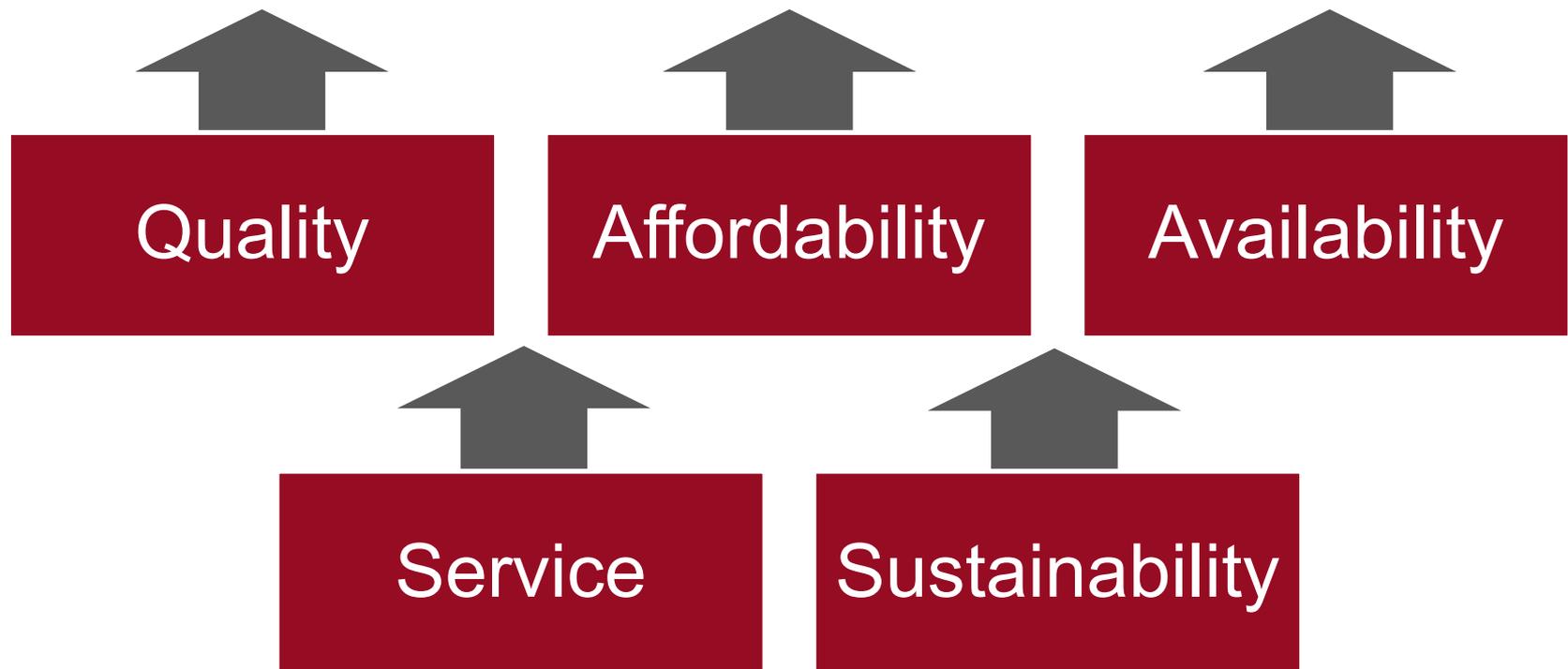
Sustainability

Social Value

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

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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

Customer Value

Financial Value

Supply Chain Goal

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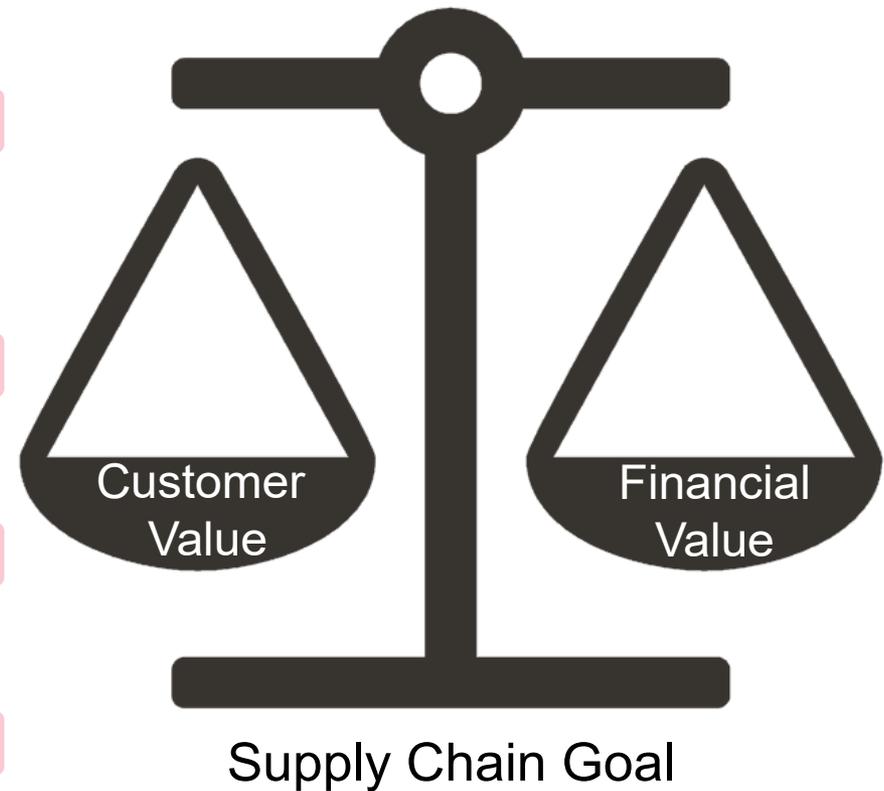
Excellence in Customer Service

Fundamental attributes:

- Availability

- Operational performance

- Customer satisfaction

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.
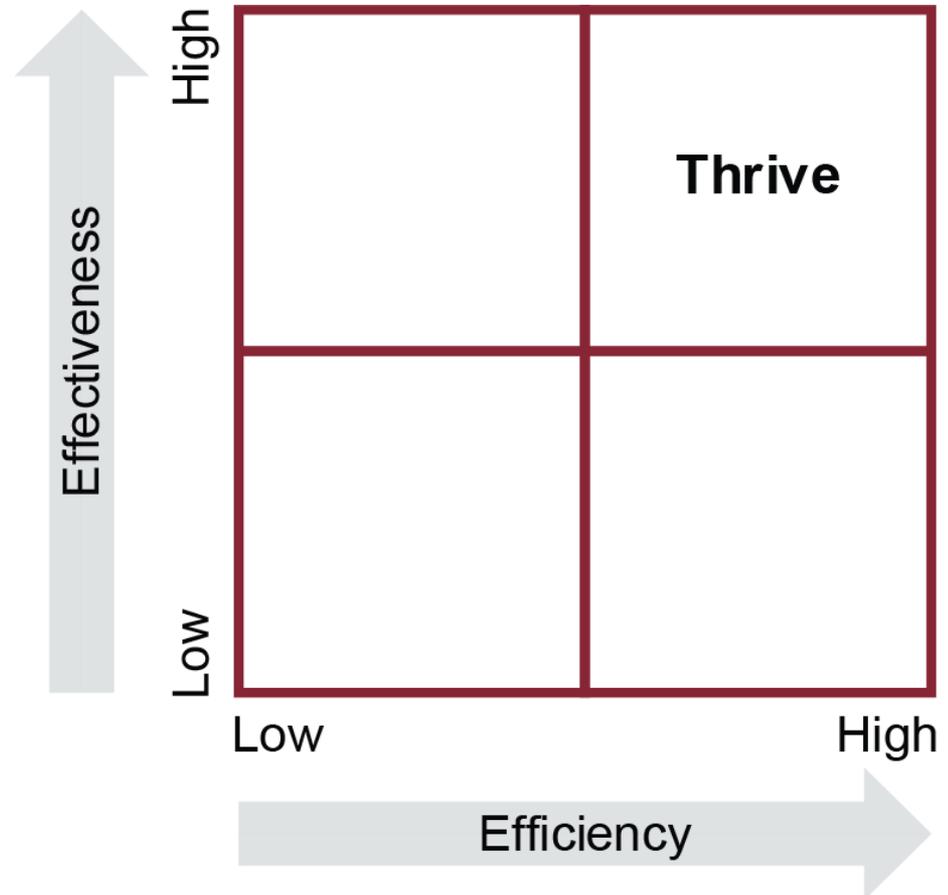
Efficiently and Effectively Leveraging Partner Strengths

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.

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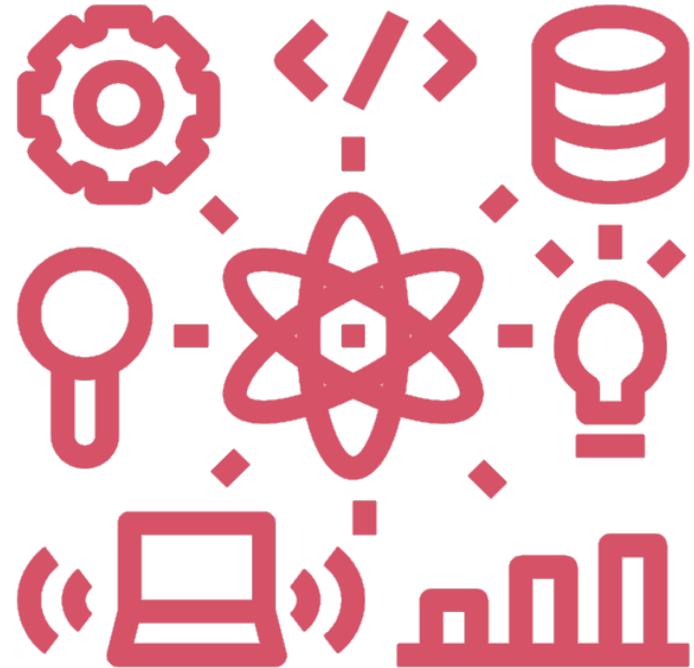
Cost Structure, Revenue Model, and Tax Strategy

- 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

Recognition
- Culture rewards or punishes failure?
- Critics needed

Objective analysis
- Anonymous surveys
- Consultants
- Brainstorm worst cases

Change
- Watch trends
- Change management

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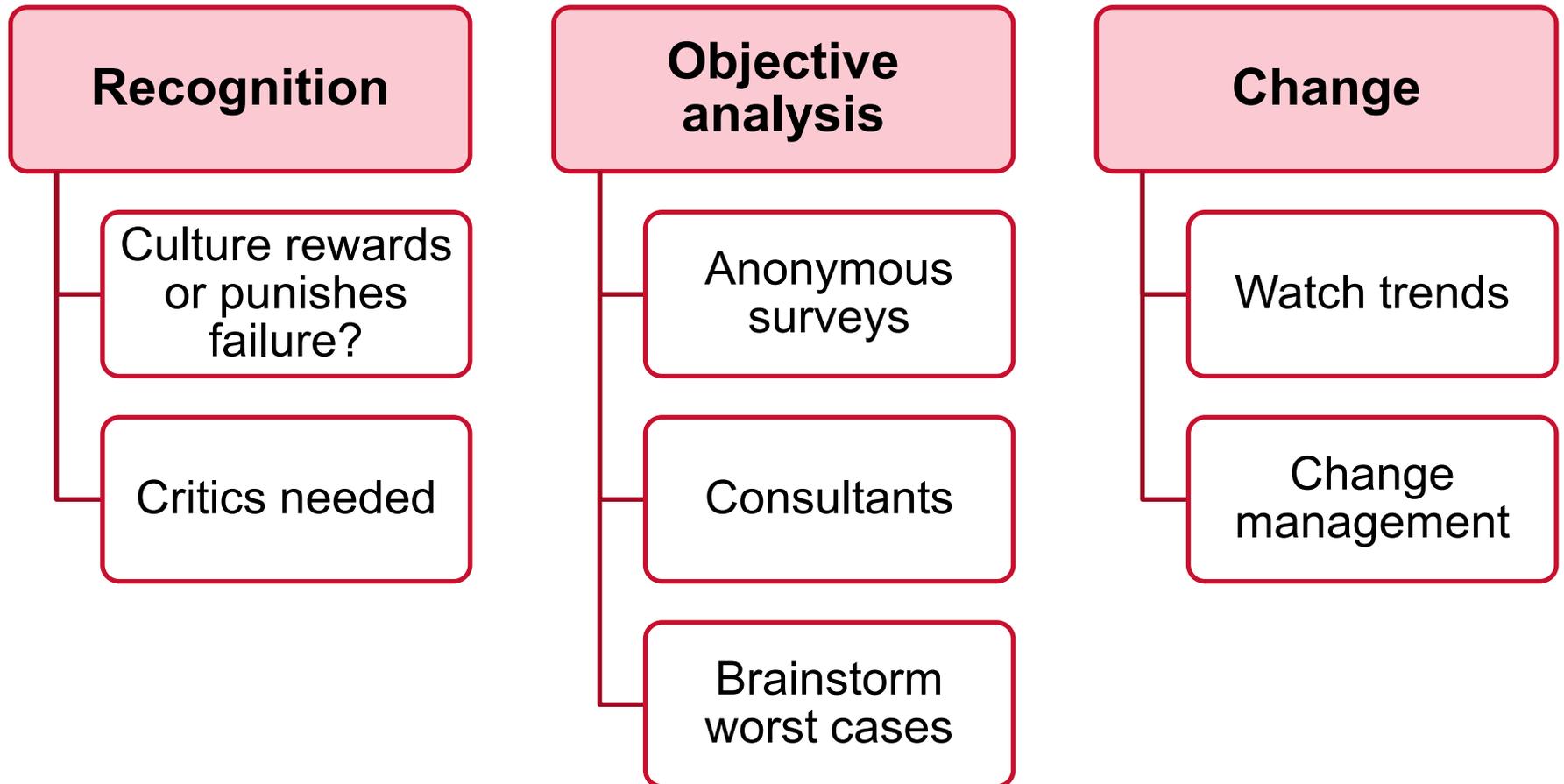
Aligning with Complexity and Partners

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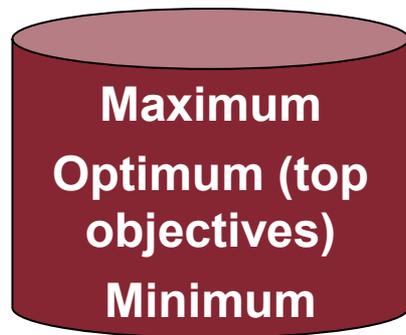
	A	B	C	D	E	F
1	**Workings Tab**					
2	*Year*		Year 0	Year 1	Year 2	Year 3
3	Copper Price per MT		$ 8,000	$ 8,390	$ 8,799	$ 9,228
4	Revenue		$ 0.0	$ 188.8	$ 198.0	$ 207.6
5	Cash Expenses		$ 600.0	$ 75.5	$ 79.2	$ 83.1
6	Depreciation Expenses		$ 0.0	$ 21.6	$ 21.6	$ 21.6
7	Income before tax		$ (600.0)	$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

Maximum
Optimum (top objectives)
Minimum

Outputs

				Select Scenario:	
2	**Outputs Tab**				
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:

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

Section B Topics:

- Topic 1: Sustainable Supply Chains
- Topic 2: Sustainability Guidelines and Standards

The Triple Bottom Line

Balancing Short- and Long-Term Performance

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

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

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?

Green SCOR Model

Reliability	Correct product to customer

• Reduces product discard waste and environmental impact of returns

Responsiveness	Speed of material movement

• Environmental impact of SC, including regulatory pollution control steps

Flexibility	Degree to which firm meets environmental demands

• Products and environmental impact of logistics

Costs	Cost of environmental compliance, cleanup, and energy use

Asset management	Consider governance, environment, social in investments

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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

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

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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

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The UN Global Compact

Businesses should:

▪ Protect human rights ▪ Avoid human rights abuse	**Human Rights**
▪ Allow collective bargaining membership ▪ Prohibit forced and compulsory labour ▪ Not support or use child labour ▪ Not discriminate in employment or occupation	**Labour**
▪ Protect the environment ▪ Promote environmental responsibility ▪ Encourage environmentally friendly technology	**Environment**
▪ Prohibit corruption like bribery or extortion.	**Anti-Corruption**

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

Universally applicable standards

GRI 101	→ Foundation
GRI 102	→ What to report
GRI 103	→ How to report

Topically applicable standards

GRI 200	→ Economic
GRI 300	→ Environmental
GRI 400	→ Social
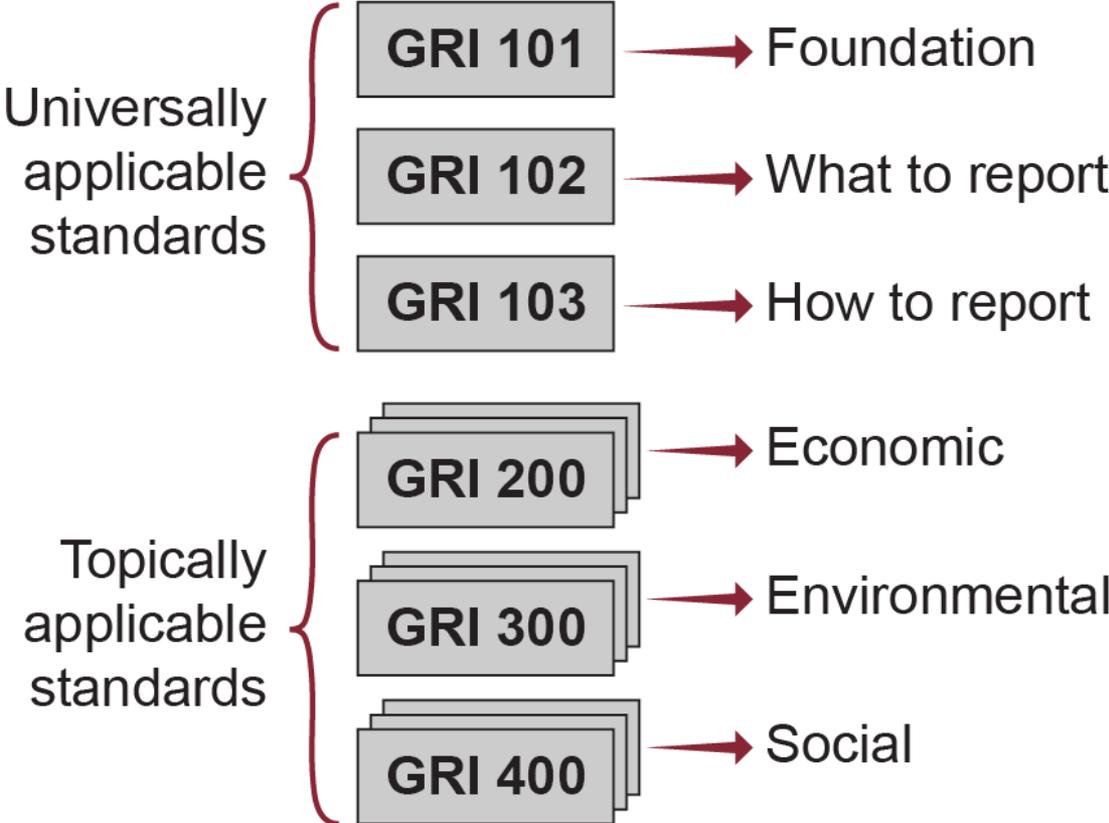
The ISO (International Organization for Standardization)

Benefits:

- Improved efficiency, productivity, bottom line
- Fair trade
- Reduced environmental impacts
- Legislation
- Best practices

Expected in RFPs/ITTs

Voluntary

3-year renewal

Market-driven

Consensus

Generic management system standards

Registration
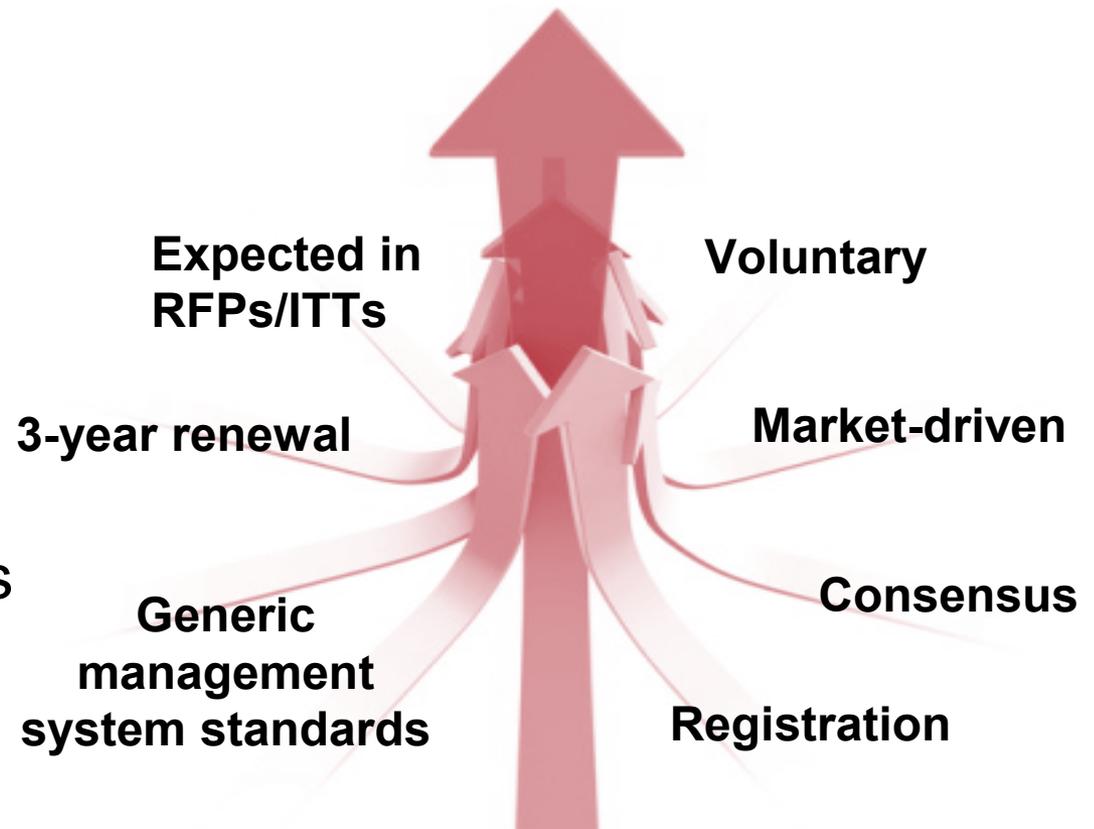
ISO 9000 Series Standards

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

- Series of environmental management standards
- Environmental management system (EMS)
  - Identify and control impact of activities, products, and services.
  - Enhance environmental performance regularly.
  - Systematic objectives and measurement methods.

ISO 14001:2015

- Framework for strategic, holistic approach to environmental policy, plans, and actions
- Generic EMS requirements

ISO 14004:2016

- Specific guidelines of EMS
- Implementation guide
- Assurance and proof

Topic 2: Sustainability Guidelines and Standards

ISO 26000:2010—Guidance for Social Responsibility

1. Recognize company's social responsibility within its sphere of influence

2. Identify and engage stakeholders

3. Address the areas of guidance in the standard:

   - Organizational governance

   - Human rights

   - Labor practices

   - Environment

   - Fair operating practices

   - Consumer issues

   - Community involvement/ development

Topic 2: 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.

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ANSI Z.10 for Occupational Health and Safety
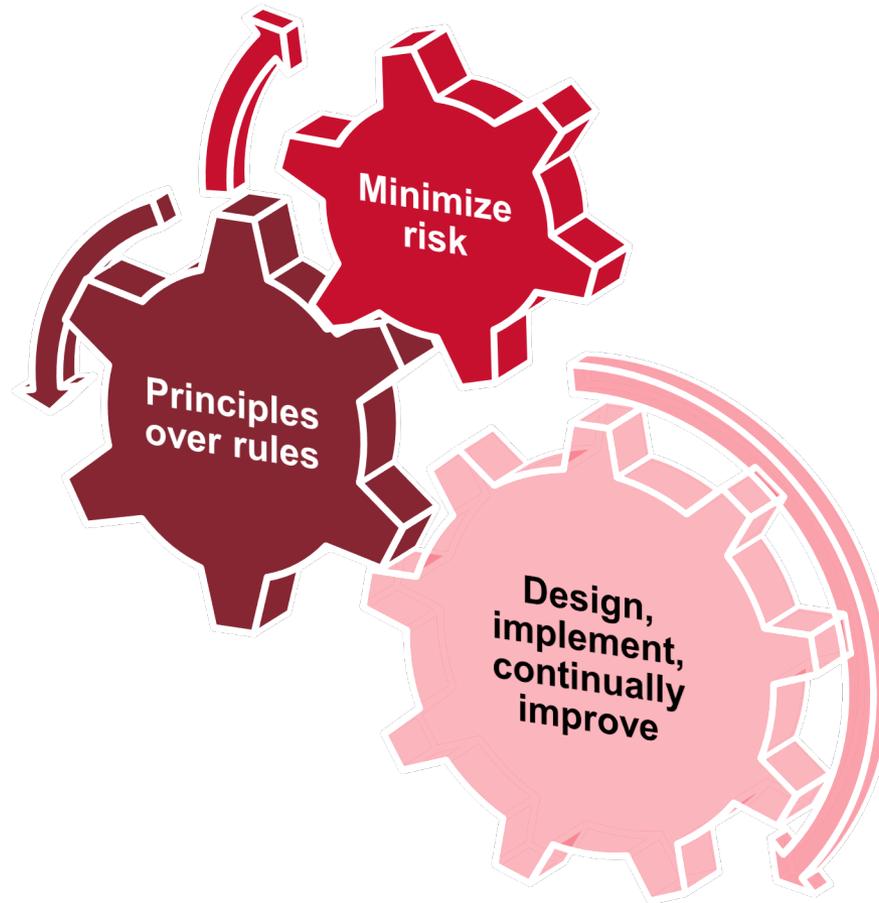
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SECTION C:
TECHNOLOGY TRENDS

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:

- Topic 1: Emerging Technology Trends
- Topic 2: 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.

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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.

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Intelligent Supply Chains and Enablers

Intelligent supply chains

Numerous technology enablers

Enablers

Internet of Things (IoT)

Blockchain

Intelligent asset management (IAM)

Features

Networked non-computer devices

Self updated status

Secure distributed ledger

Digital twin
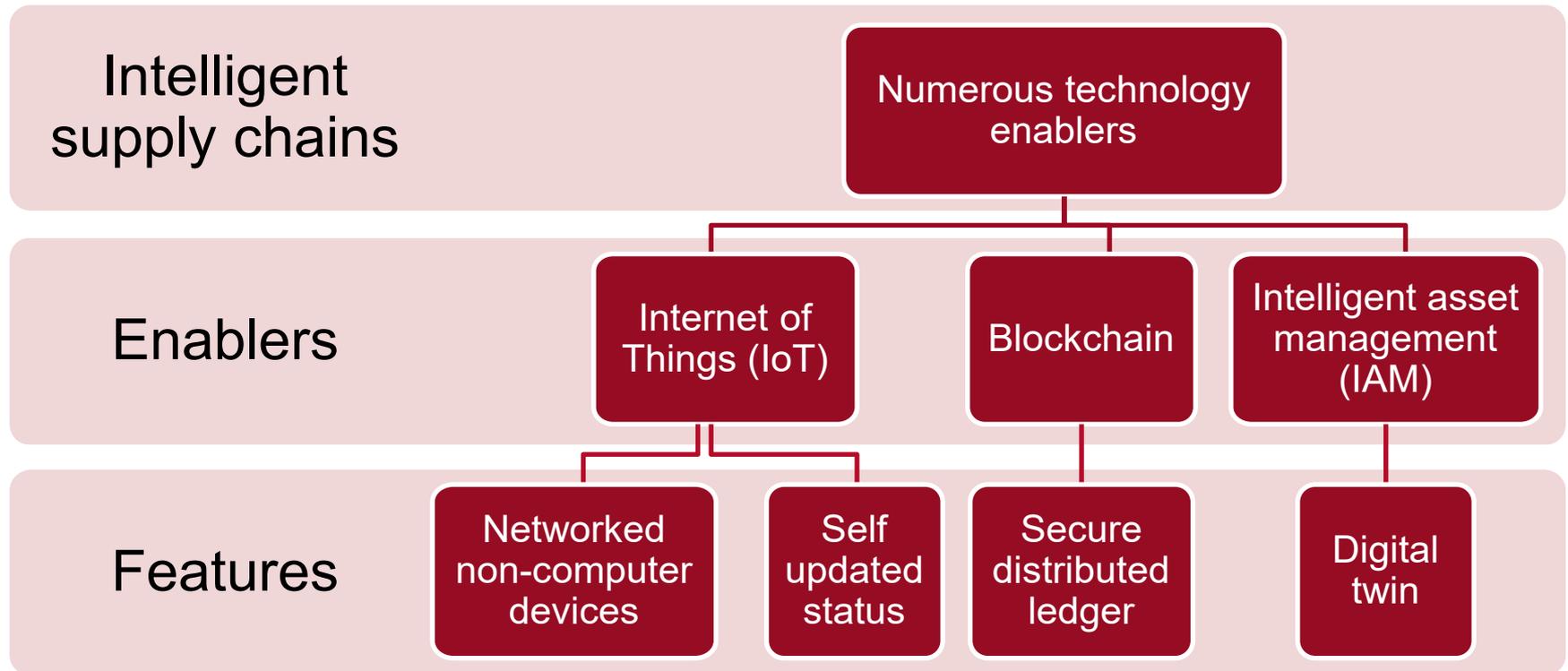
Technology Road Map: Shipbuilder Example

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.

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Topic 2: Technology Assessment and Implementation

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)

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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

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Technology Selection Criteria

- Competitive advantage
  - Scarce
  - Difficult to move
  - Difficult to copy
  - Difficult to substitute
- Risks
  - Project failure or lack of benefits
  - Market shifts or new technology
  - New regulations
  - Unintended consequences

- Feasibility
  - Cost-benefit analysis
  - Implementation needs
  - Learning curves
  - Change management
- Requirements validation
  - Quality
  - Speed
  - Dependability
  - Flexibility
  - Cost

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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.

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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

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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

Adjourning

Cultural strengthening

Knowledge management

Performing

Peak productivity and focus on improvement

Norming

Increased trust and collaboration

Storming

Growing competition and conflict

Forming

Little sharing

Low understanding of project
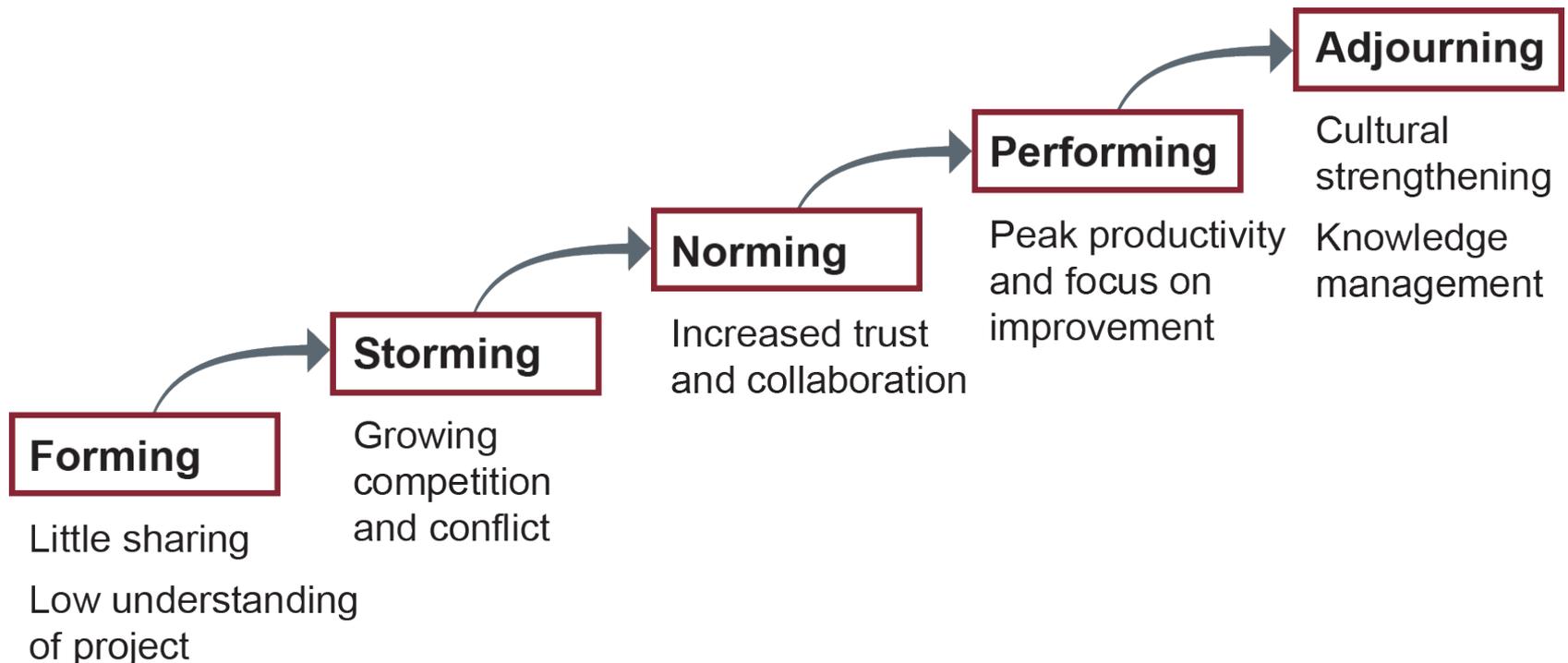
Topic 2: Technology Assessment and Implementation

Pitfalls and Best Practices

Pitfalls

- Budget or schedule is significantly missed.
- Project results are ineffective.
- Deliverables have no valid purpose.
- Project sponsors or managers allow scope creep.

Best Practices

- Lead, coach, and clearly delegate.
- Clarify roles for easy personnel transitions.
- Measure and control against the plan.
- Reserve meetings for substantive risks and issues.
- Control change using tradeoff analysis.
- Keep documents living and control version in use.

Traditional Project Management

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

Gantt chart
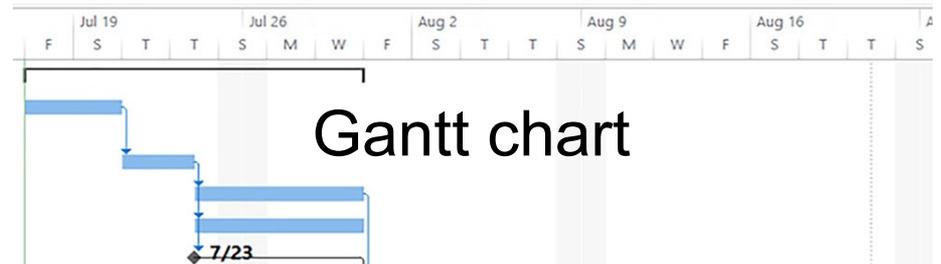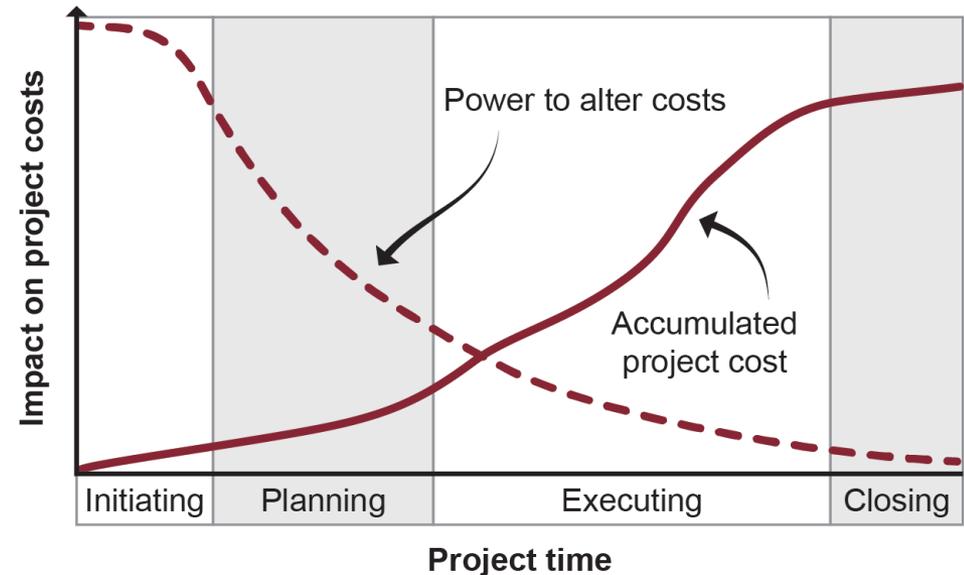
Course Corrections and Change Control

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

- 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 Example

- Scrum: move as unit by letting members take lead
- Kanban board
  - Backlog, WIP, done
- Sprint or iteration
- Daily standup and retrospective
- Scrum master

APICS

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

APICS

Change Process

Step 1: Prepare	Step 2: Plan	Step 3: Execute	Step 4: Monitor
• 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.

APICS
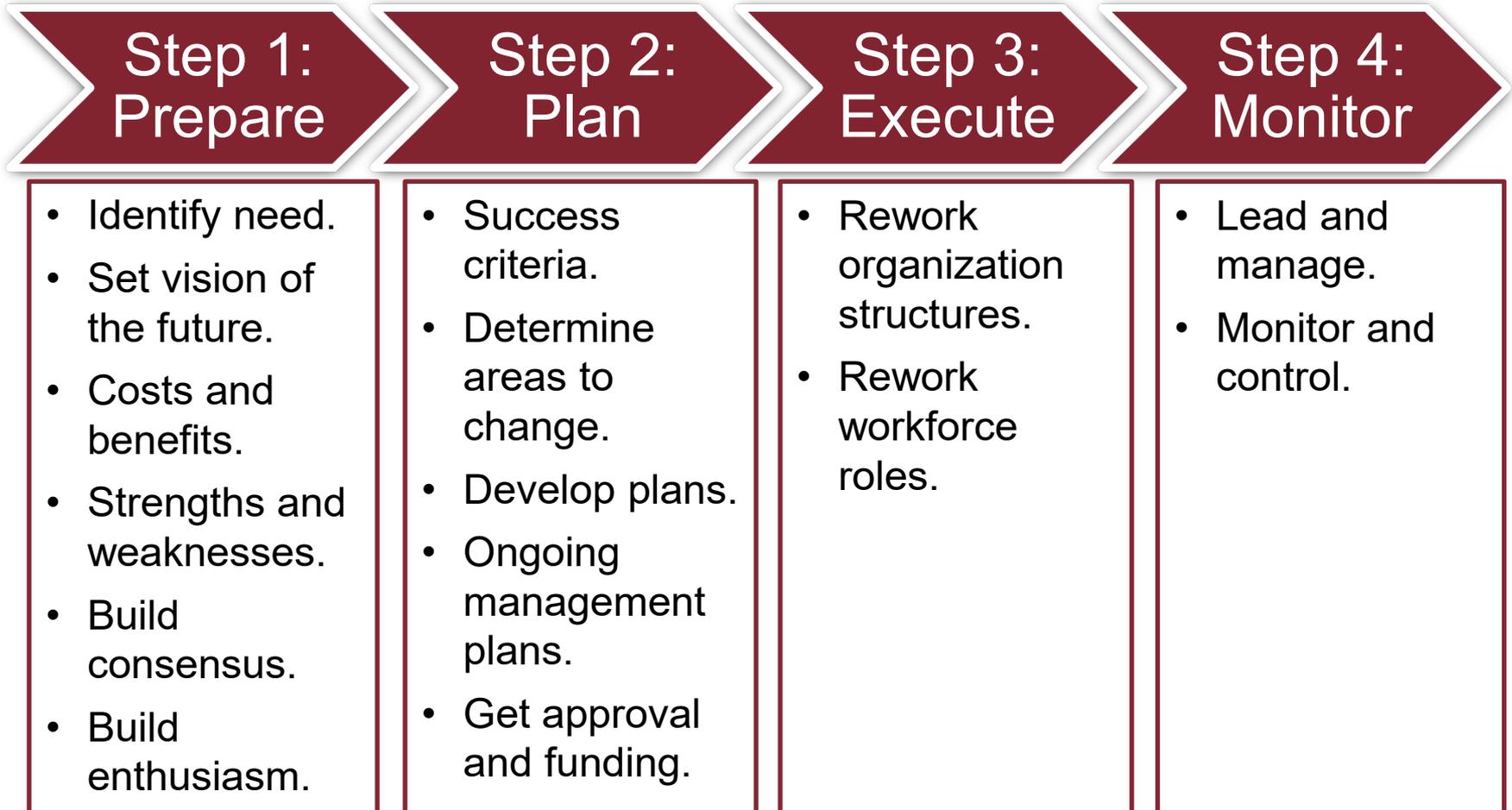
Maintaining Technologies

- Specific delegation
  - Internal or vendor maintenance
- Maintenance policies and procedures
  - Testing protocols
  - Usage restrictions
  - Assess usage 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

ÁPICS