Chapter 3

Process technology

TPK4180 Manufacturing Strategy

Erlend Alfnes, NTNU, 7.2.2013

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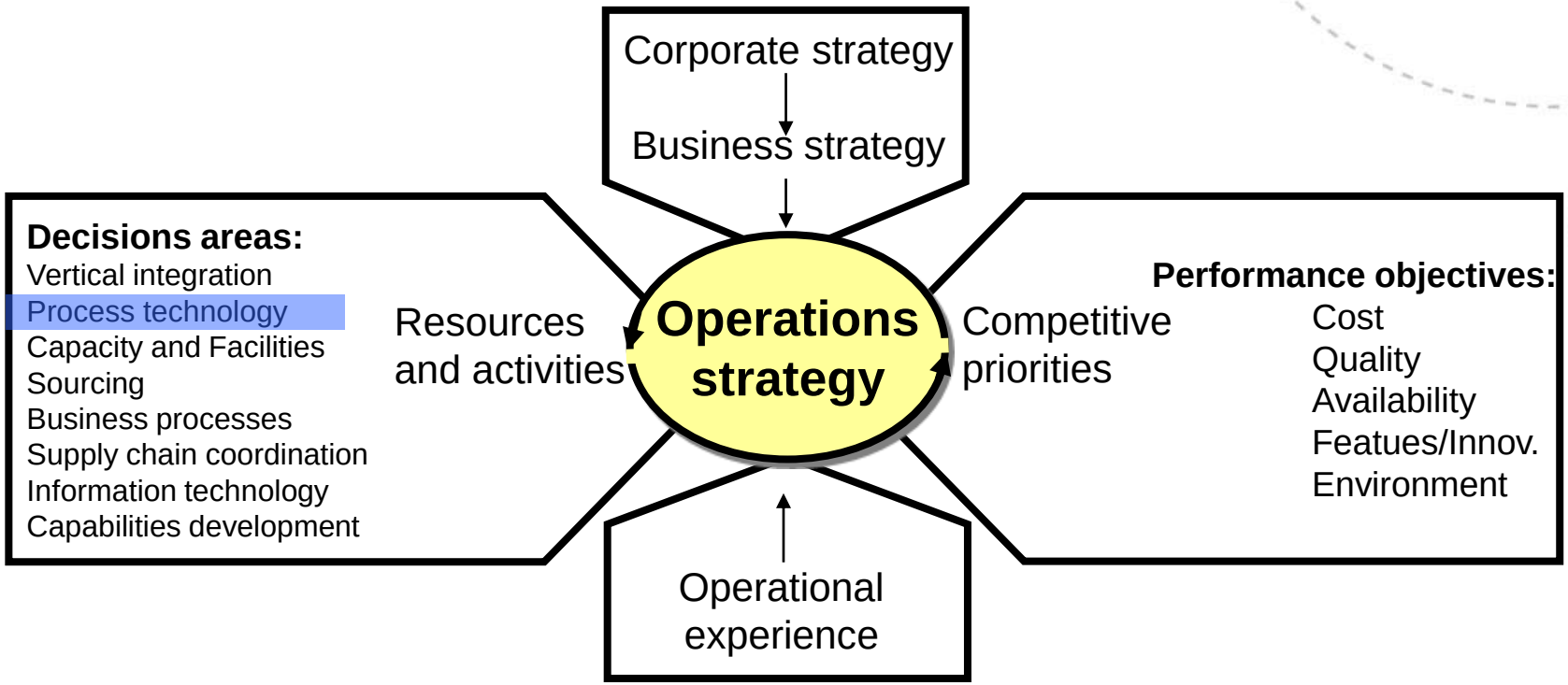
Manufacturing strategy framework



Agenda

1. Tools for overall strategy development
2. Tools for analysing process technology
3. Process technology strategy decisions

Manufacturing strategy development

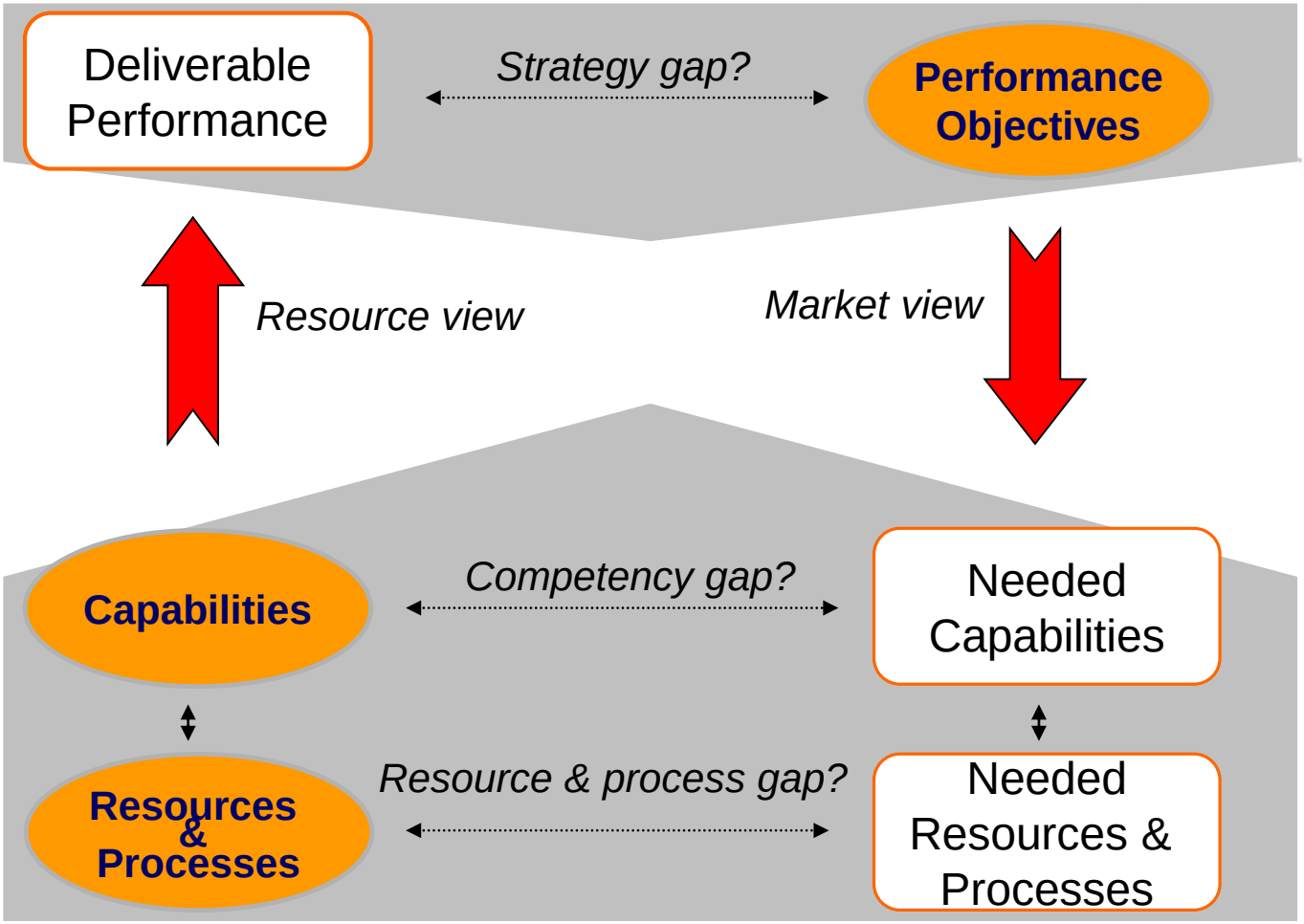
1 What businesses are we in?
(Five forces, opportunities and threats, order winners and qualifiers)

2 Competitive strategy:
(Performance objectives, gap analysis, strengths and weaknesses)

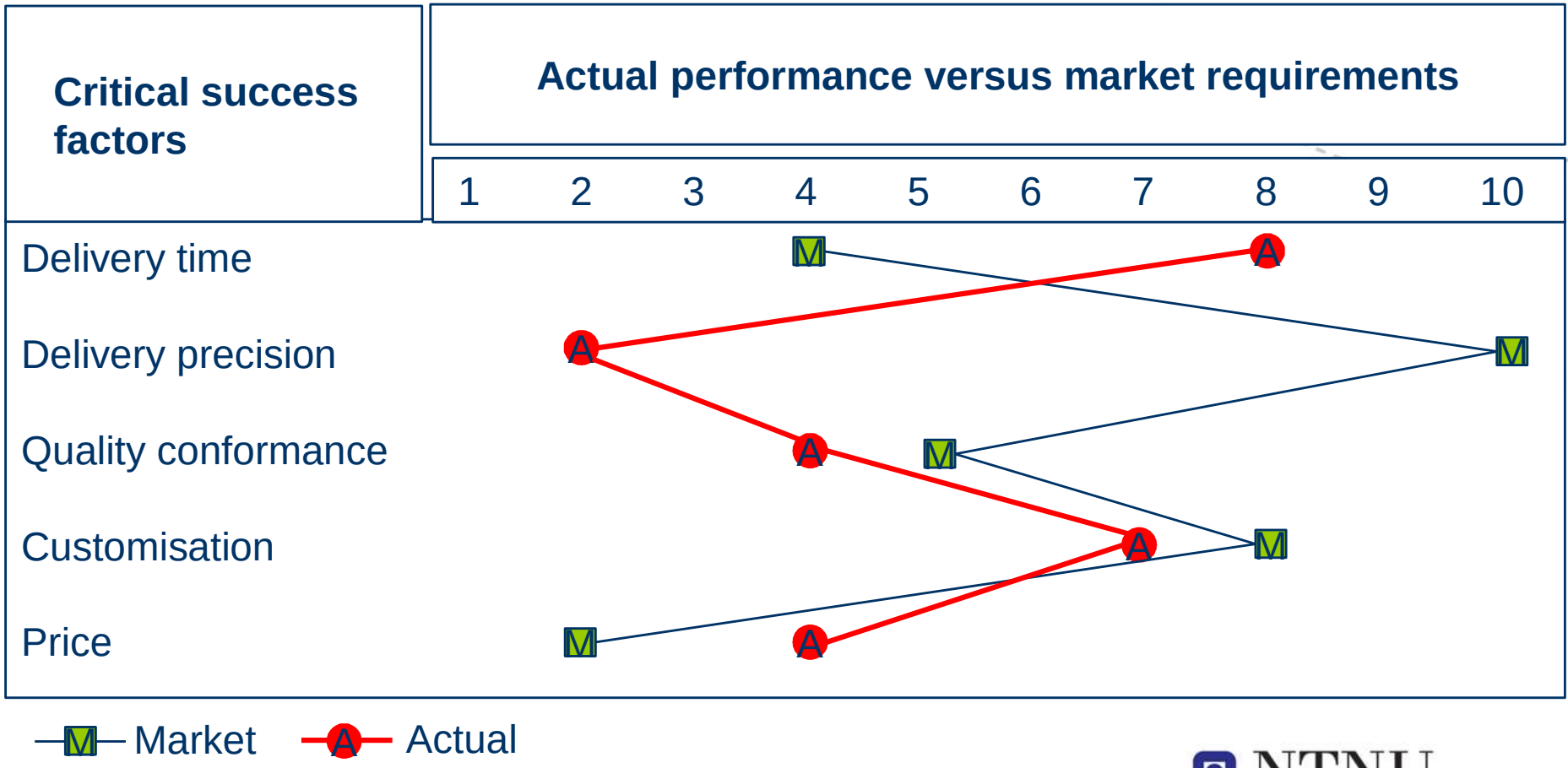
3 Existing manufacturing strategy:
(Decisions areas, four stage model, product process matrix, product profiling)

4 Revised manufacturing strategy: How will the decisions we make about manufacturing fit with performance objectives and with decisions made in other functional areas?

Tools: The Strategic Operational Audit



Tools: Gap analysis on Performance (1)



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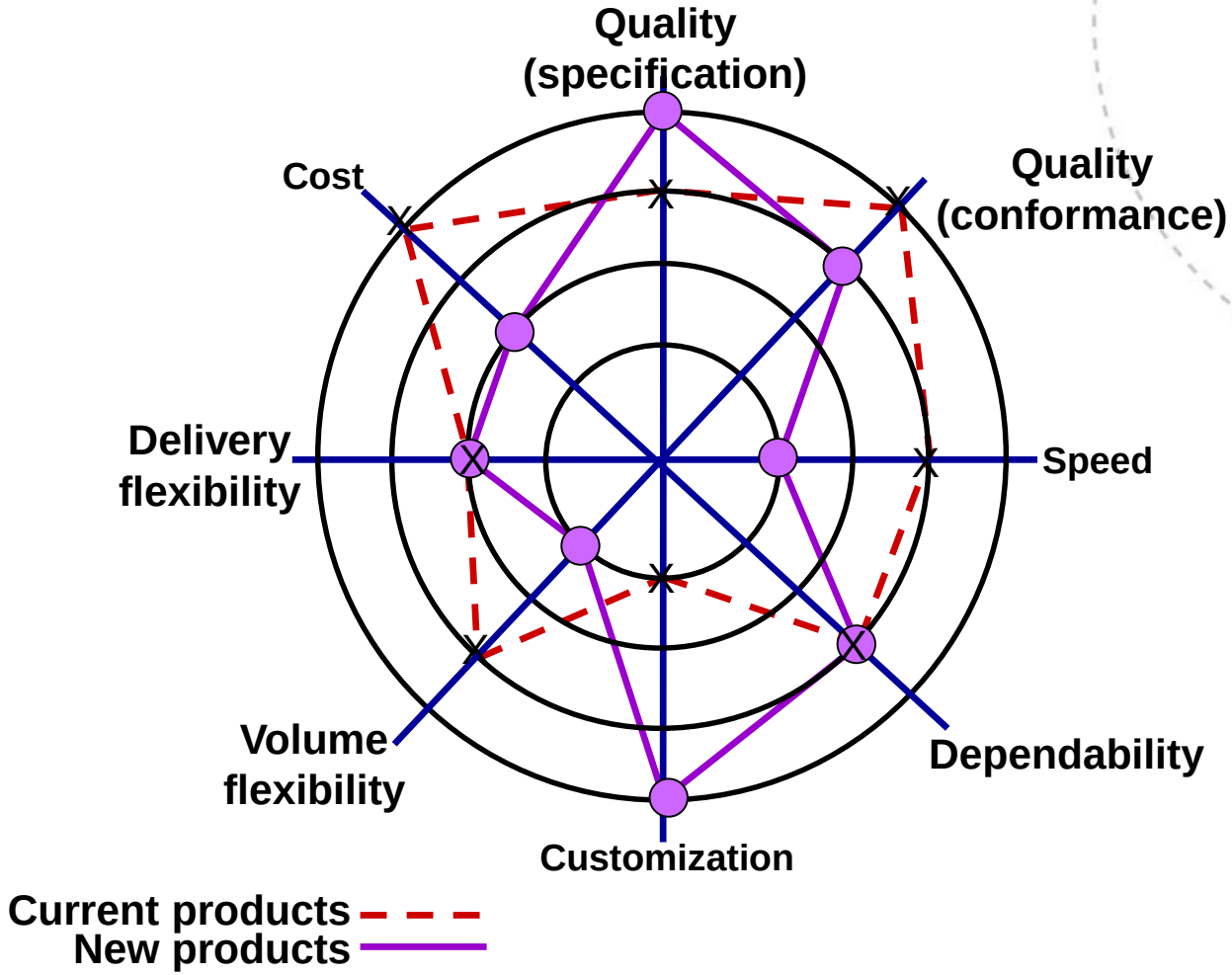

Tools: Gap analysis on performance (2)

Agenda

1. Tools for overall strategy development
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Process types

Repetitive flow

Connected line flow

Batch

Project

Continous flow

Continuous, automated, rigid line flow
Process segments tightly linked

Disconnected line flow
Jumbled flow but a dominant flow exists

Job Shop

Jumbled flow
Process segments loosely linked

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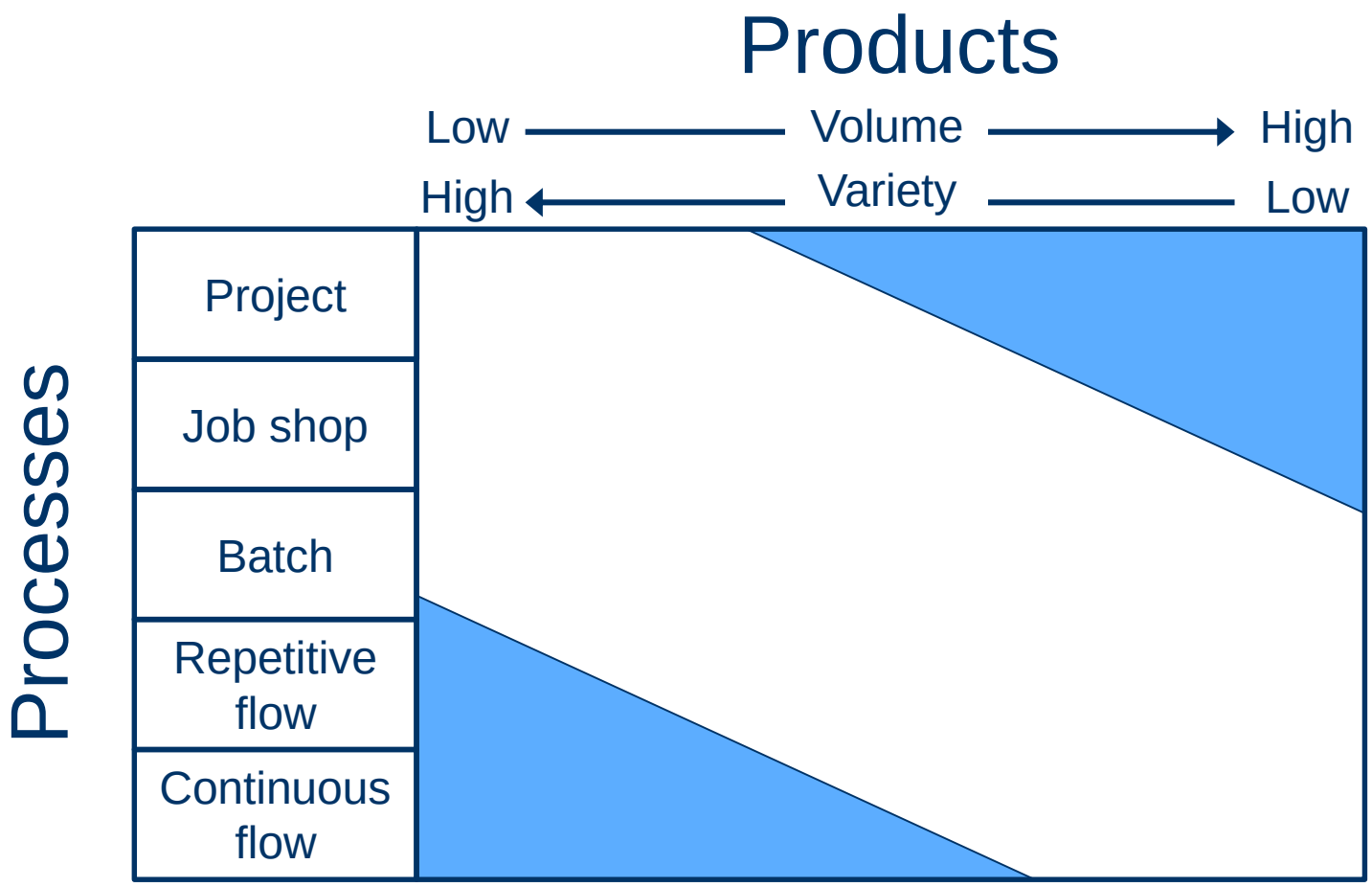
Layout types

- Fixed position or location layout
- Process or functional layout
- Cellular or combined layout
- Product layout



(Hayes and Wheelwright 1979)

Products

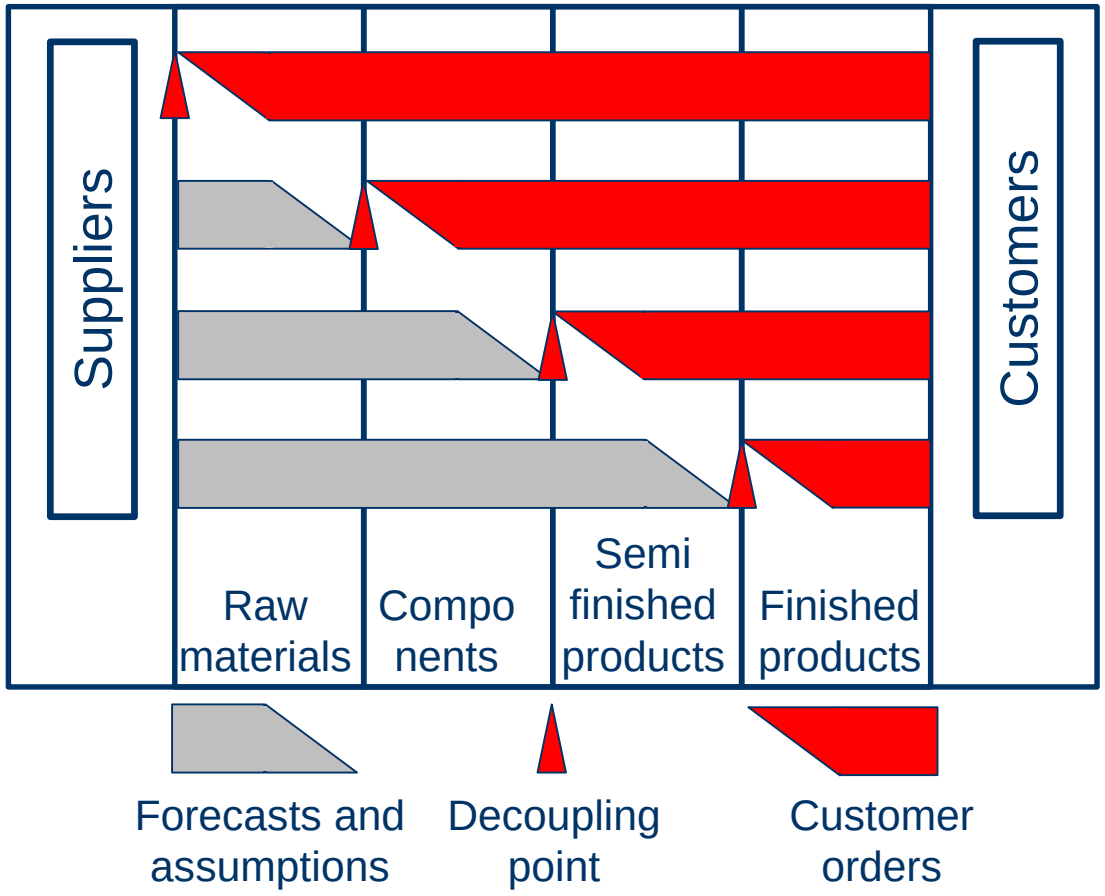
Low — Volume → High

High ← Variety — Low

Processes

Project
Job shop
Batch
Repetitive flow
Continuous flow

Interaction Strategies:

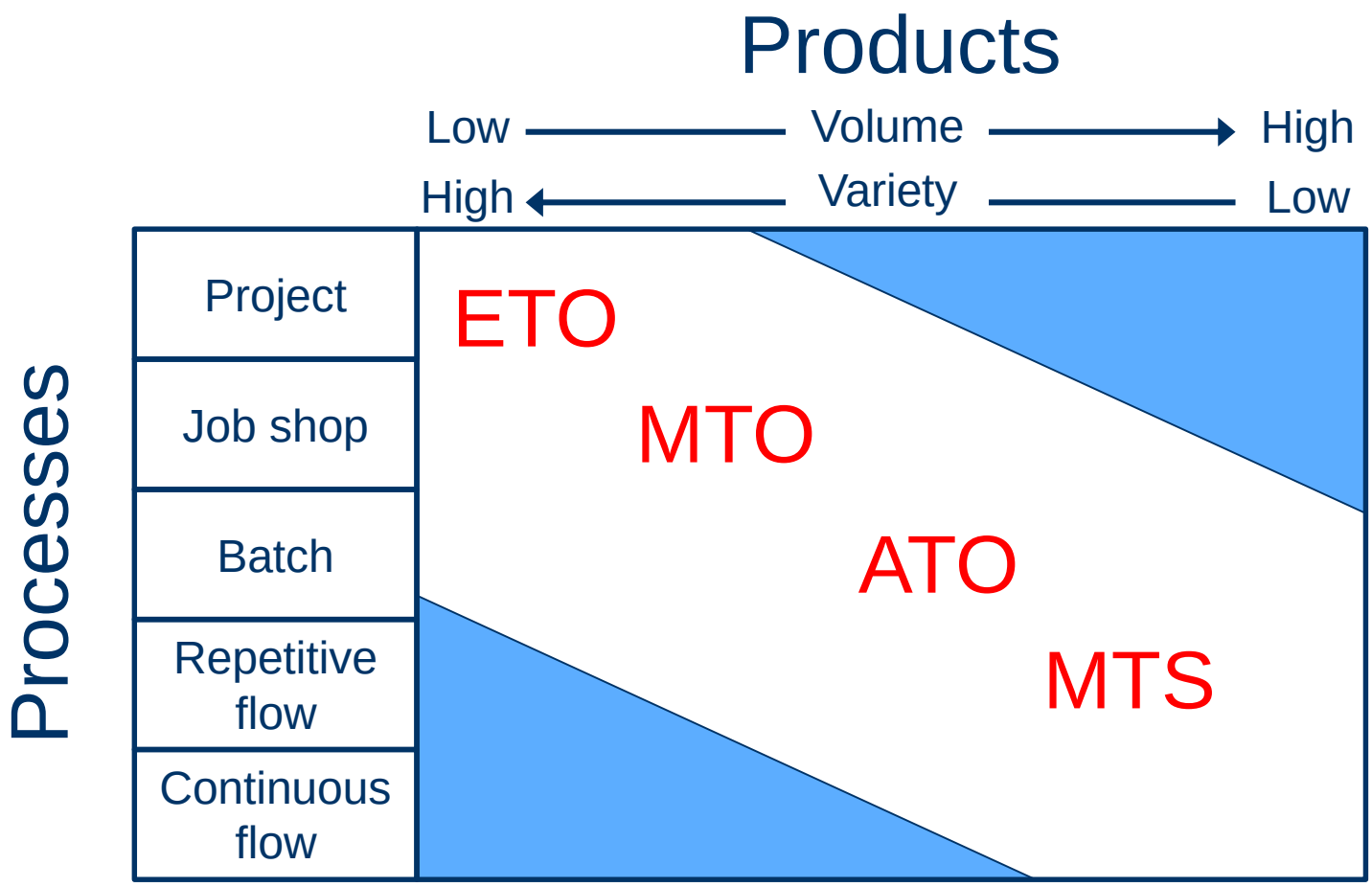


Engineer To Order

Make To Order

Assemble To Order

Make To Stock


Products
Low
Volume
High
High
Variety
Low
Processes
Project
Job shop
Batch
Repetitive flow
Continuous flow
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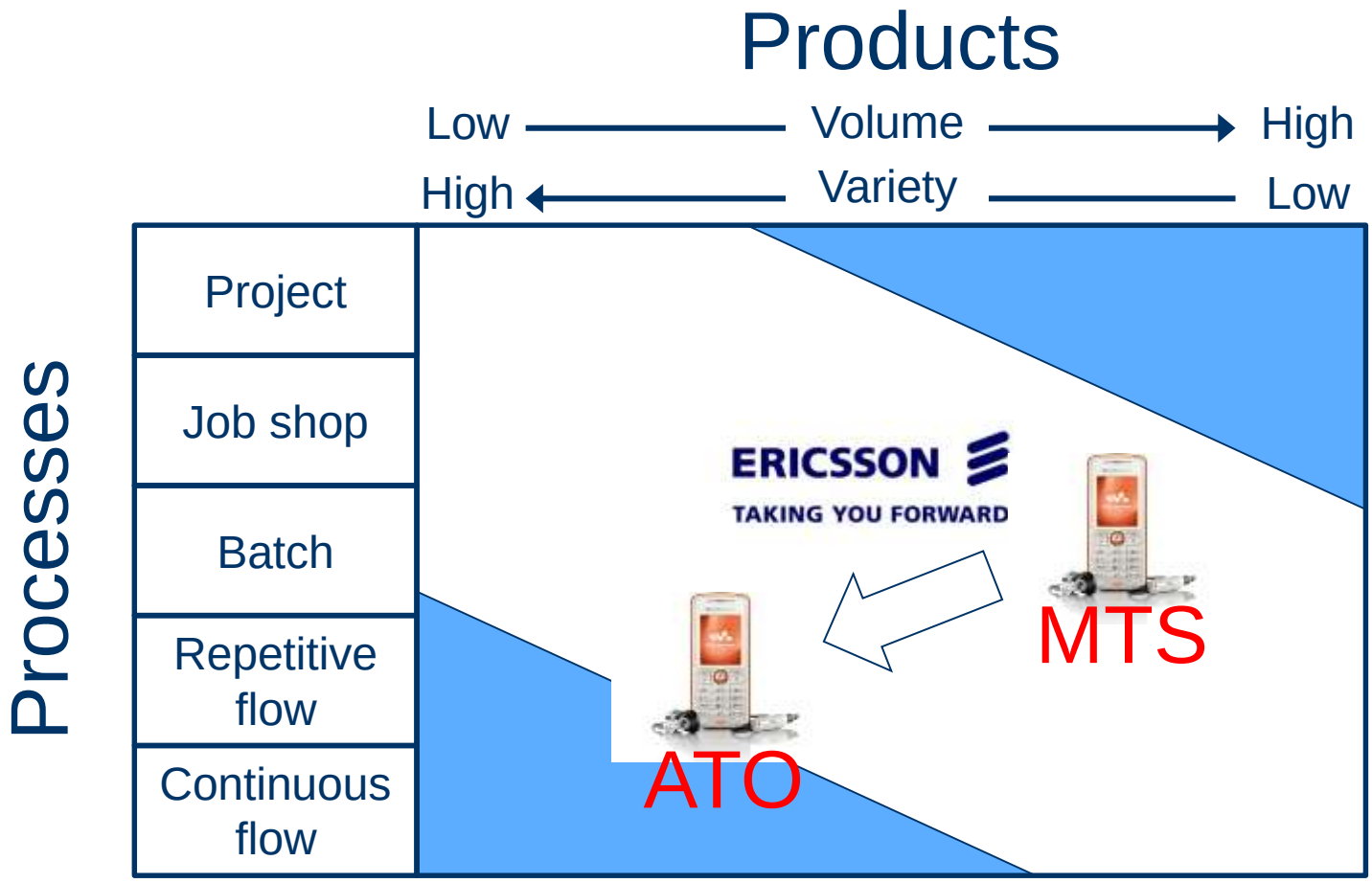
MTS


Products
Low
Volume
High
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Processes
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Job shop
Batch
Repetitive flow
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TAKING YOU FORWARD
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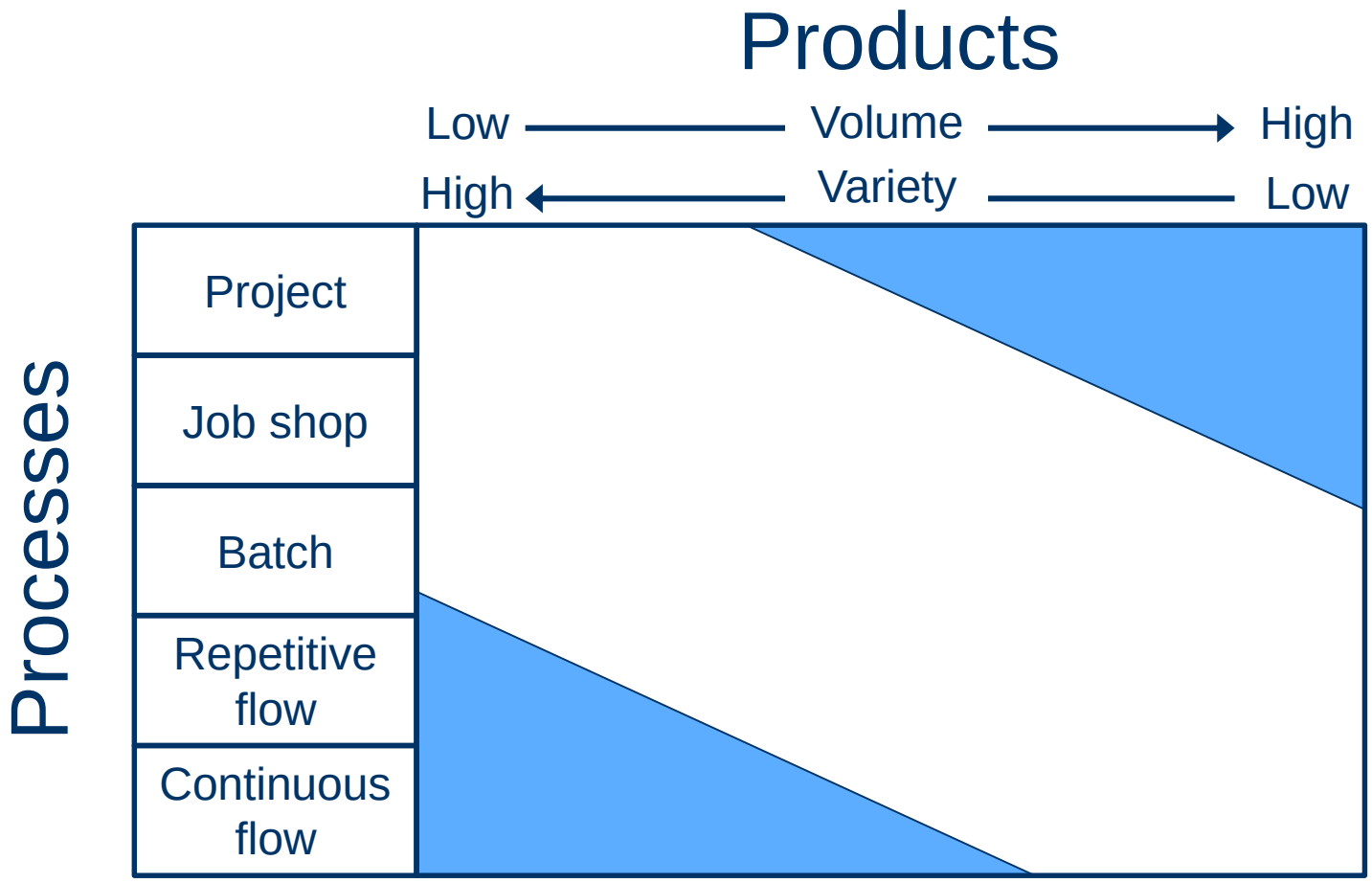
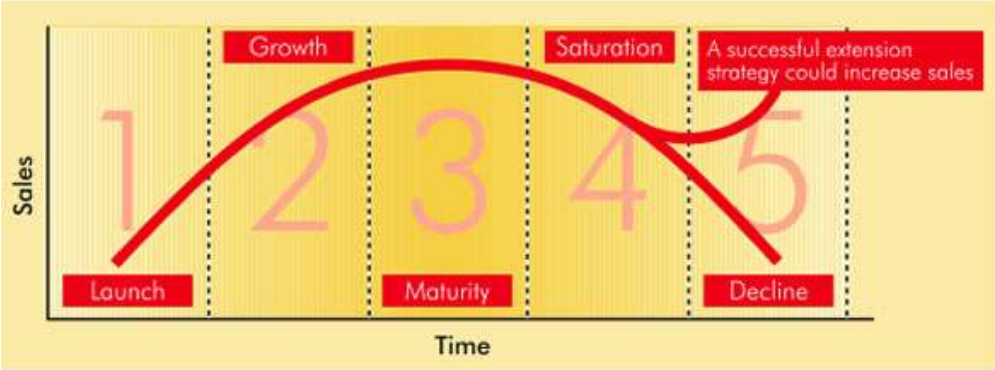
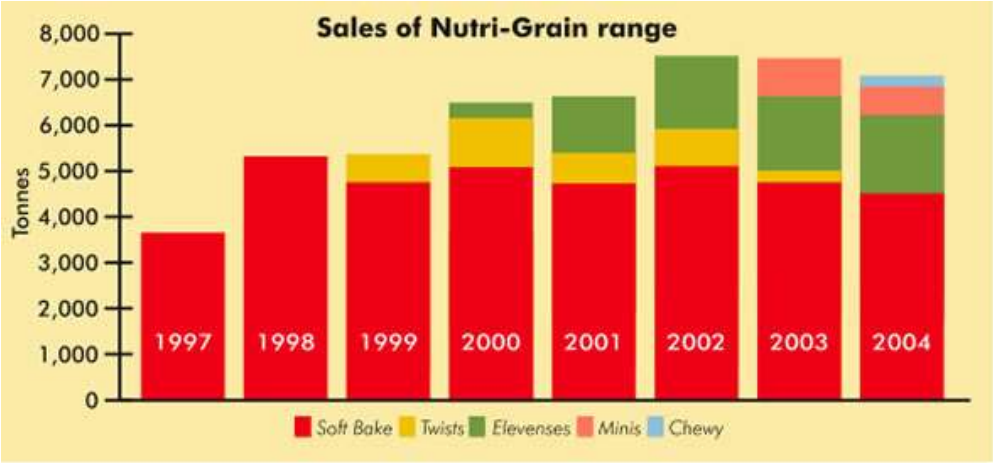


Task: ACC and DJC

(Hayes and Wheelwright 1979)





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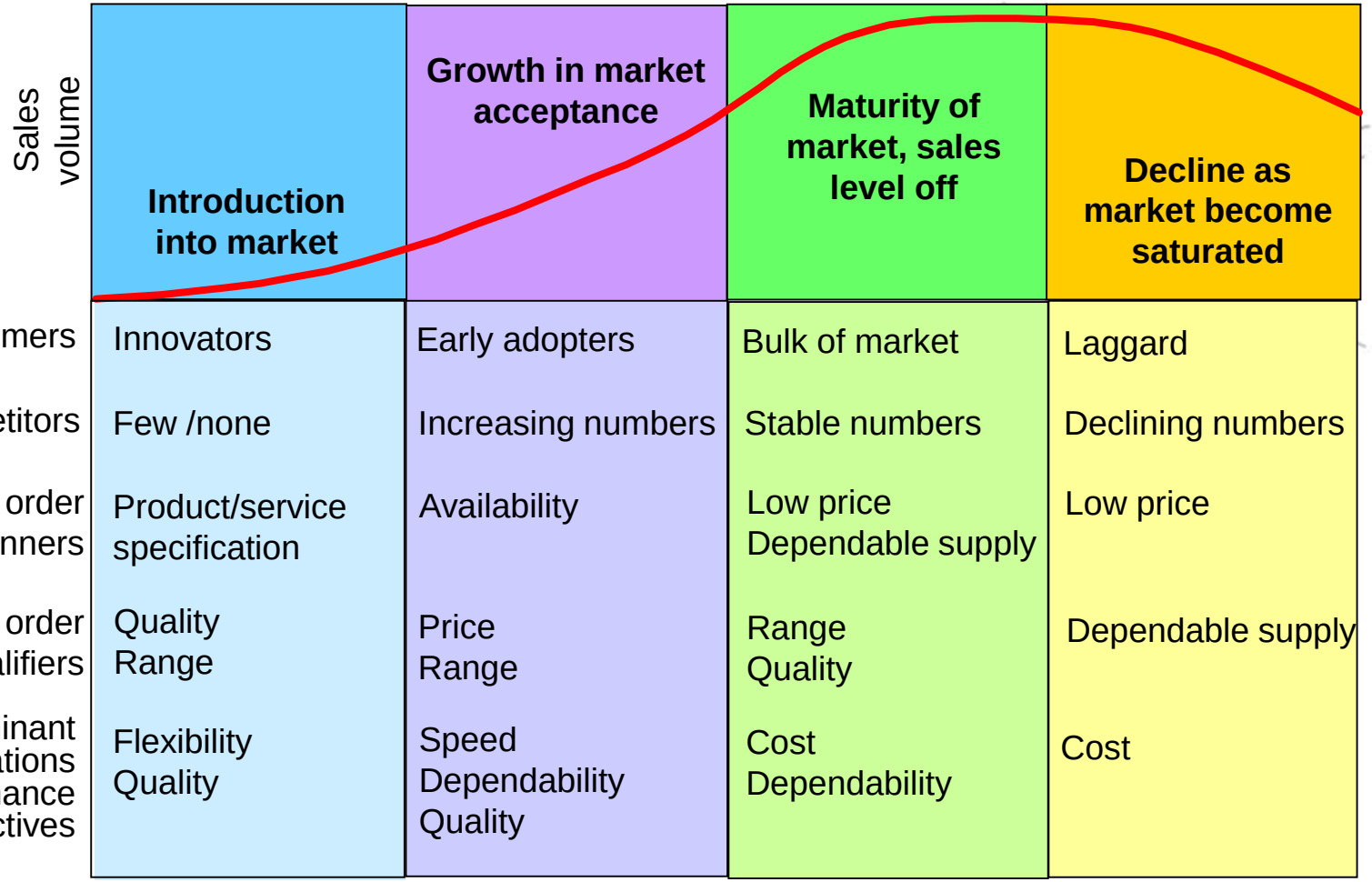
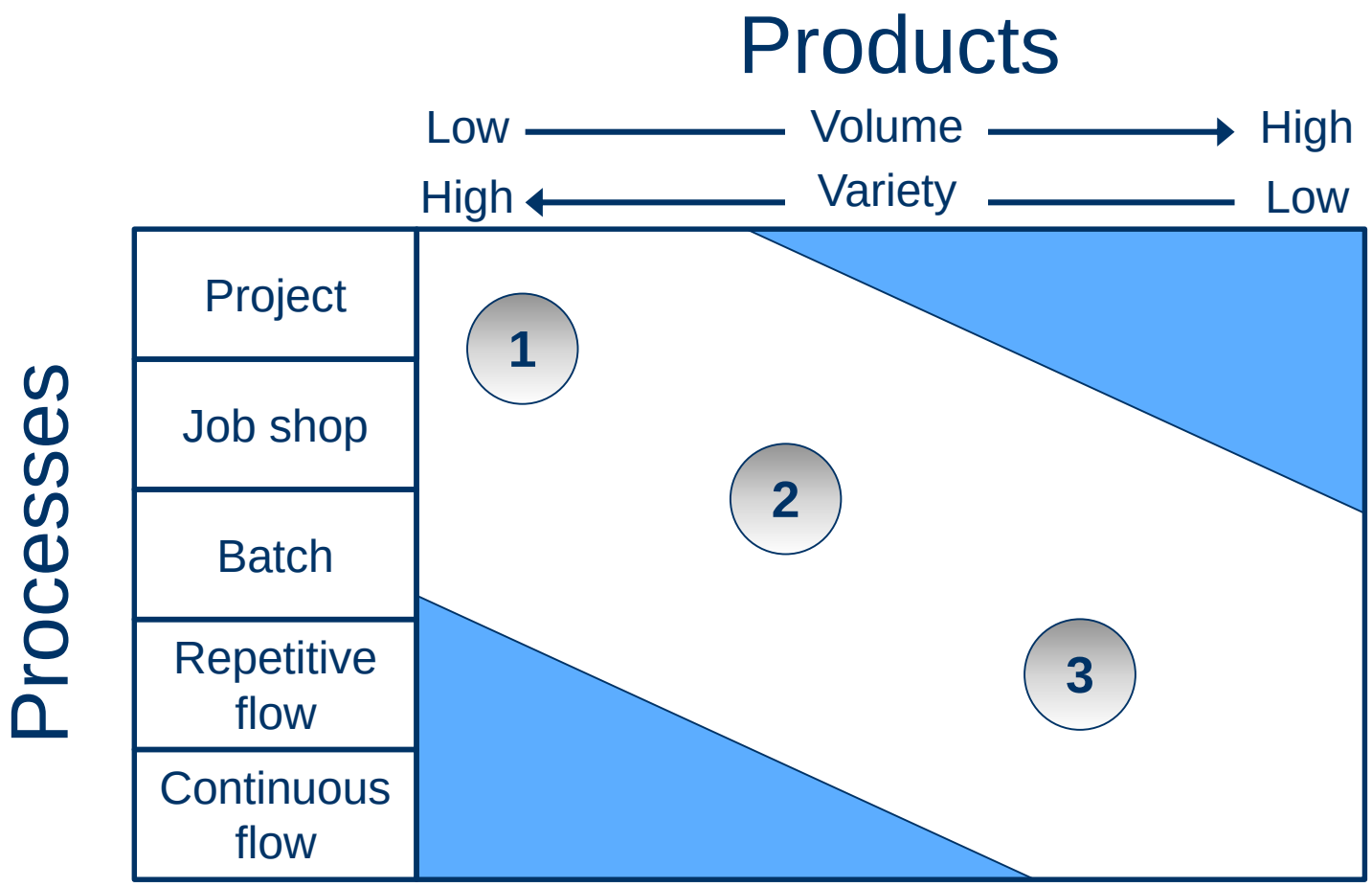
The effects of the product/service life cycle on operations performance objectives



	Introduction into market	Growth in market acceptance	Maturity of market, sales level off	Decline as market become saturated
Customers	Innovators	Early adopters	Bulk of market	Laggard
Competitors	Few /none	Increasing numbers	Stable numbers	Declining numbers
Likely order winners	Product/service specification	Availability	Low price Dependable supply	Low price
Likely order qualifiers	Quality Range	Price Range	Range Quality	Dependable supply
Dominant operations performance objectives	Flexibility Quality	Speed Dependability Quality	Cost Dependability	Cost



(Hayes and Wheelwright 1979)

Product profiling

Aspects		Typical characteristics of process choice: jobshop → batch → line	
Products and markets	Product type	Special	Standard
	Product range	Wide	Narrow
	Customer order size	Small	Large
	Level of product change required	High	Low
	Rate of new product introductions	High	Low
	Order winner	Delivery speed/ unique capability	Price
Operations	Process nature	General purpose	Dedicated
	Process flexibility	High	Low
	Operations volumes	Low	High
	Operations key strategic task	Meet specification/ delivery speed	Low cost operations
Investments	Level of investement	Low	High

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Agenda

1. Tools for overall strategy development
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3. Process technology strategy decisions

Process Technology Choices: Choosing an Appropriate Technology

- Labor intensive versus automated processes
- Flexible versus rigid processes
- Scalability
- Economic evaluation

$$NPV = -C_0 + \frac{FV_1}{(1+i)^1} + \frac{FV_2}{(1+i)^2} + \ldots + \frac{FV_n}{(1+i)^n}$$

Where C_0 = initial cost

FV_k = benefits – costs in period k

FV_n = salvage value in year n

i = interest rate

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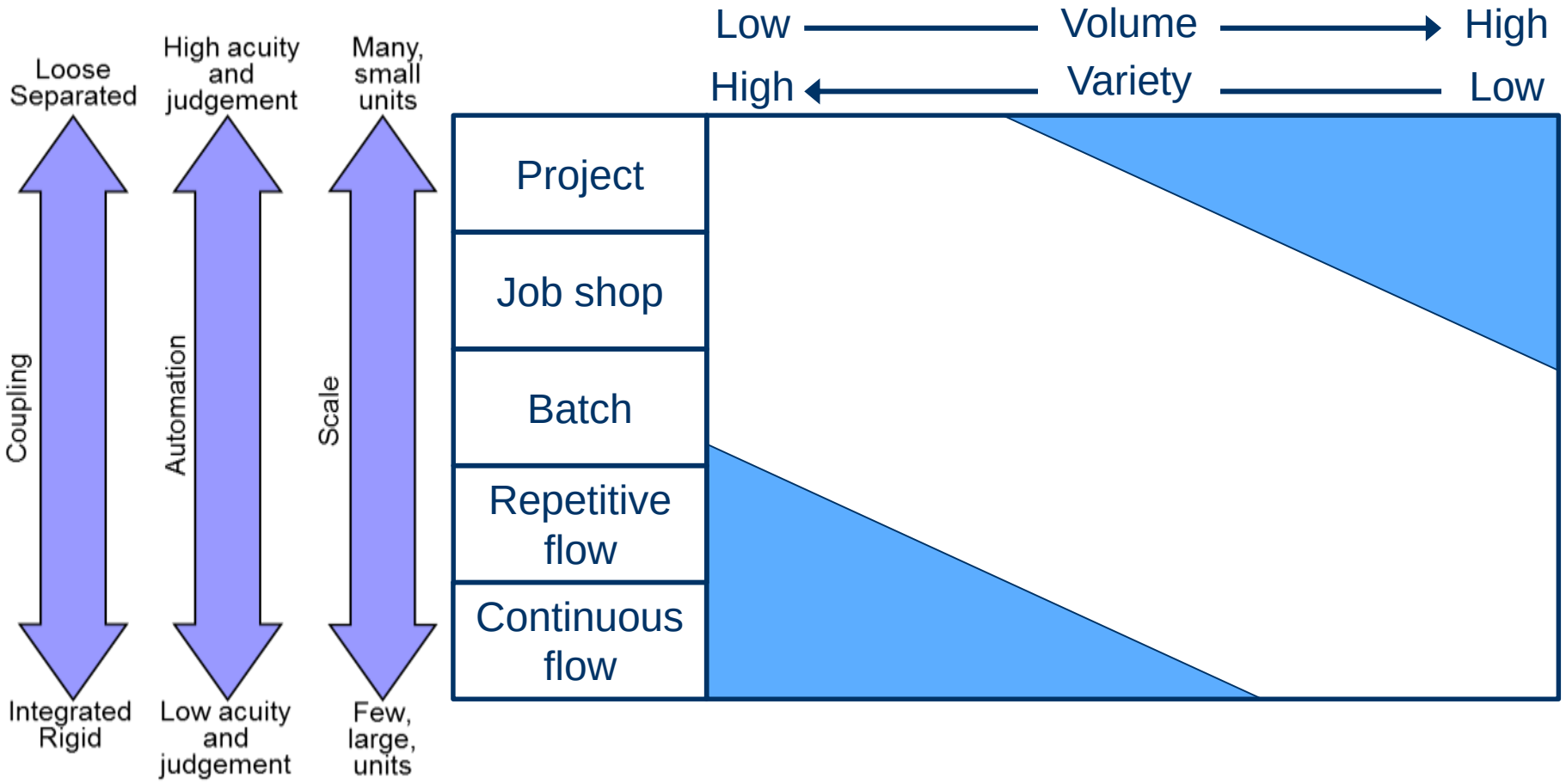
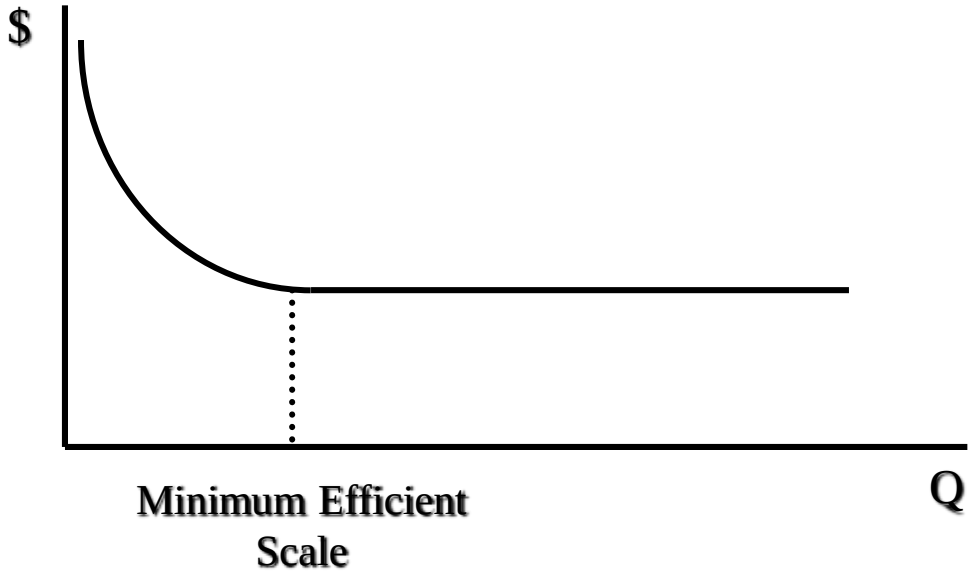
Products

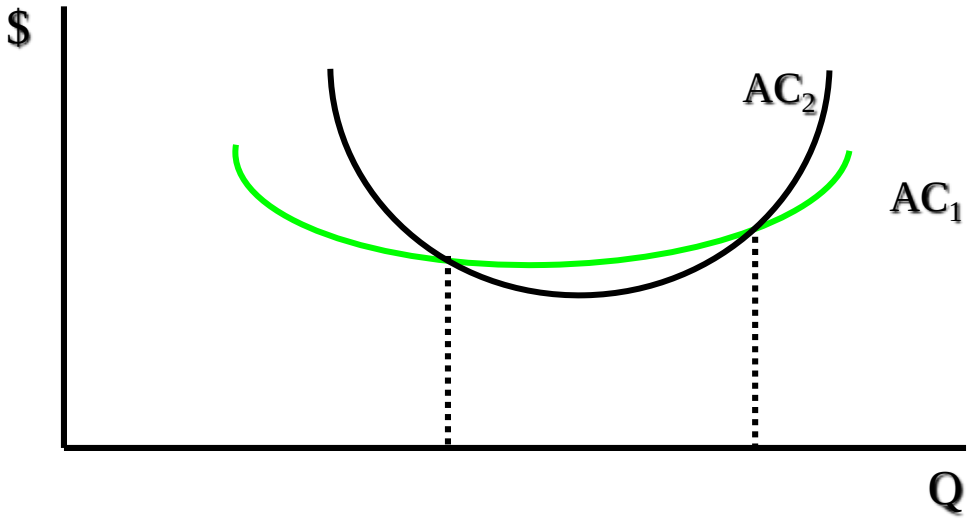


(Hayes and Wheelwright 1979)

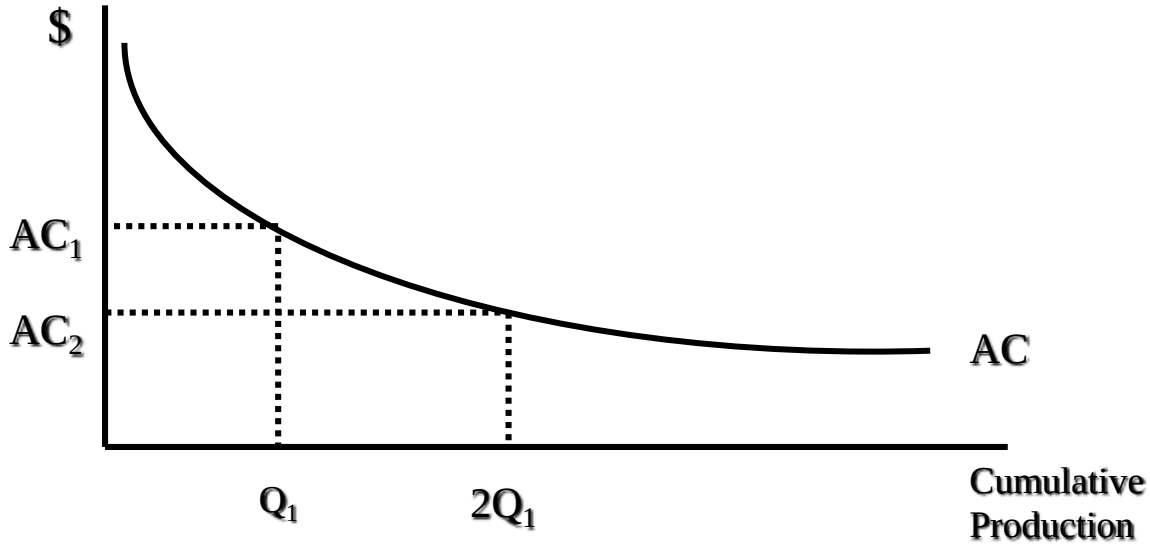
Scale curves



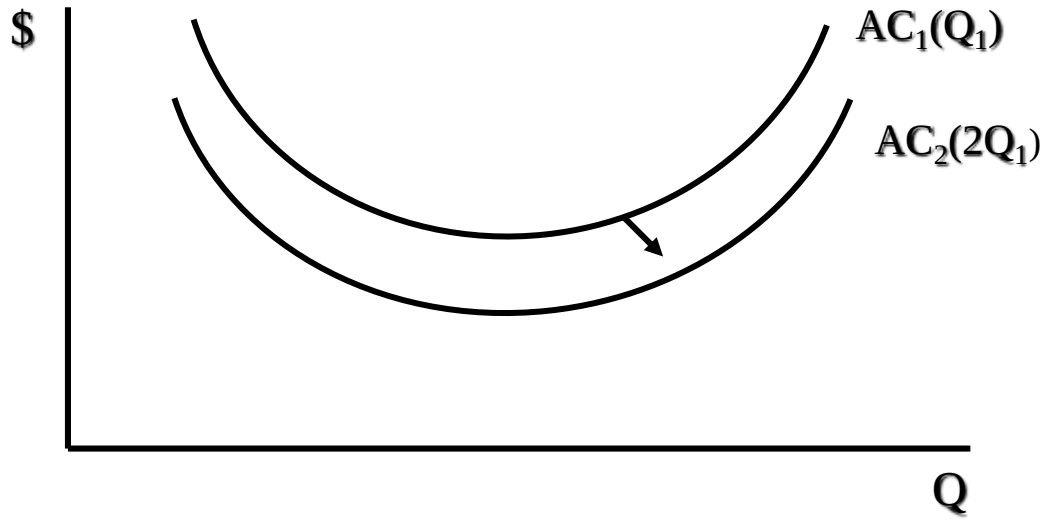
Process technologies and scale curves



Learning curves

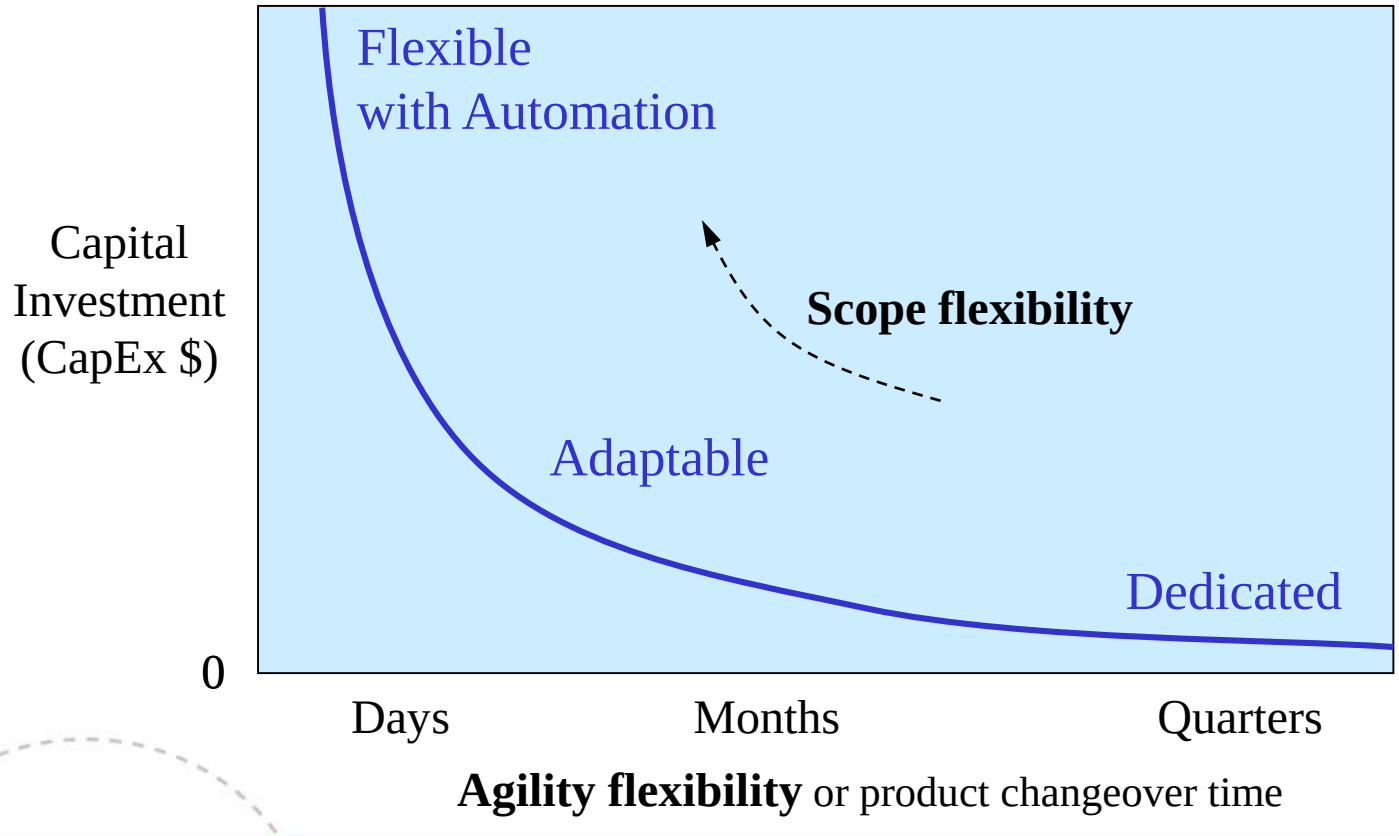


The effect of learning

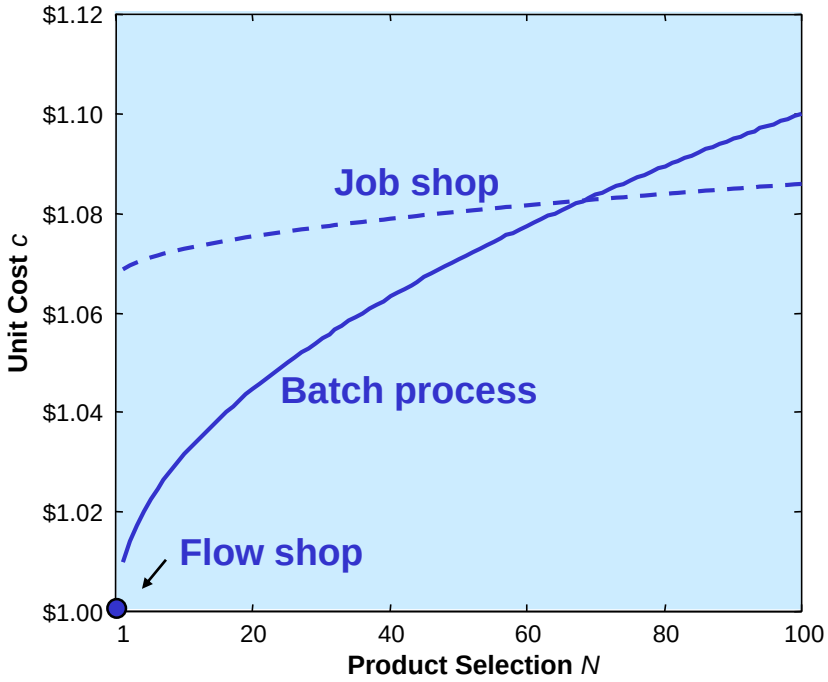


Flexible versus dedicated/rigid

- "Flexibility with automation can be very expensive (and take a long time to build/validate)"

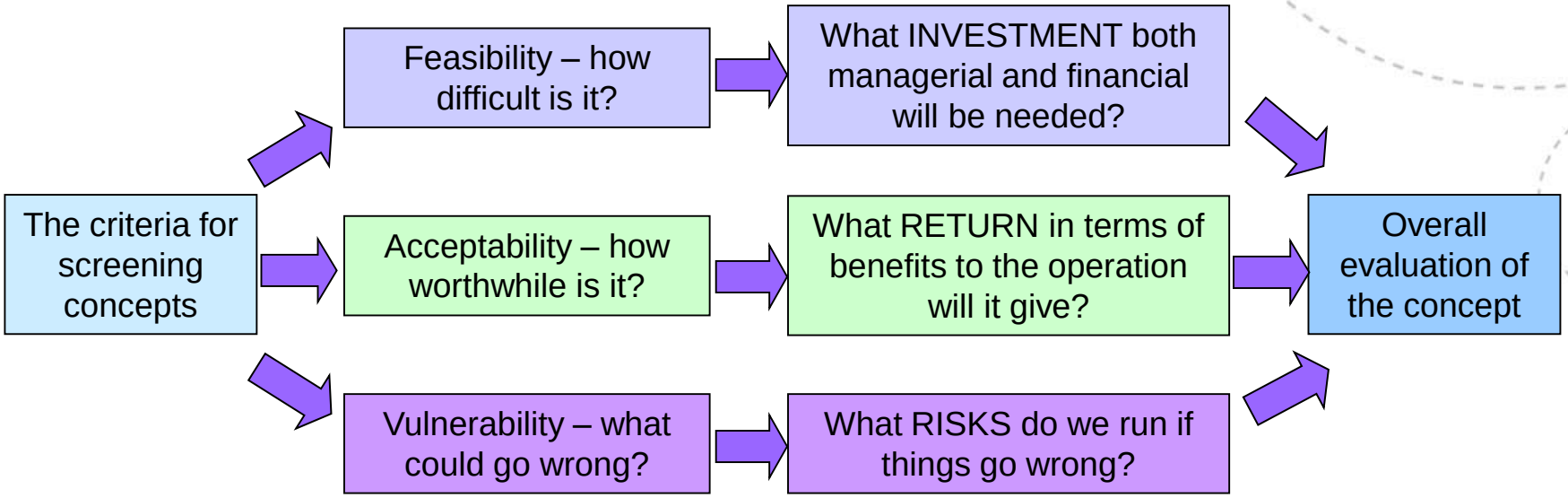


Product mix and trade-off: Wilbur Chocolate

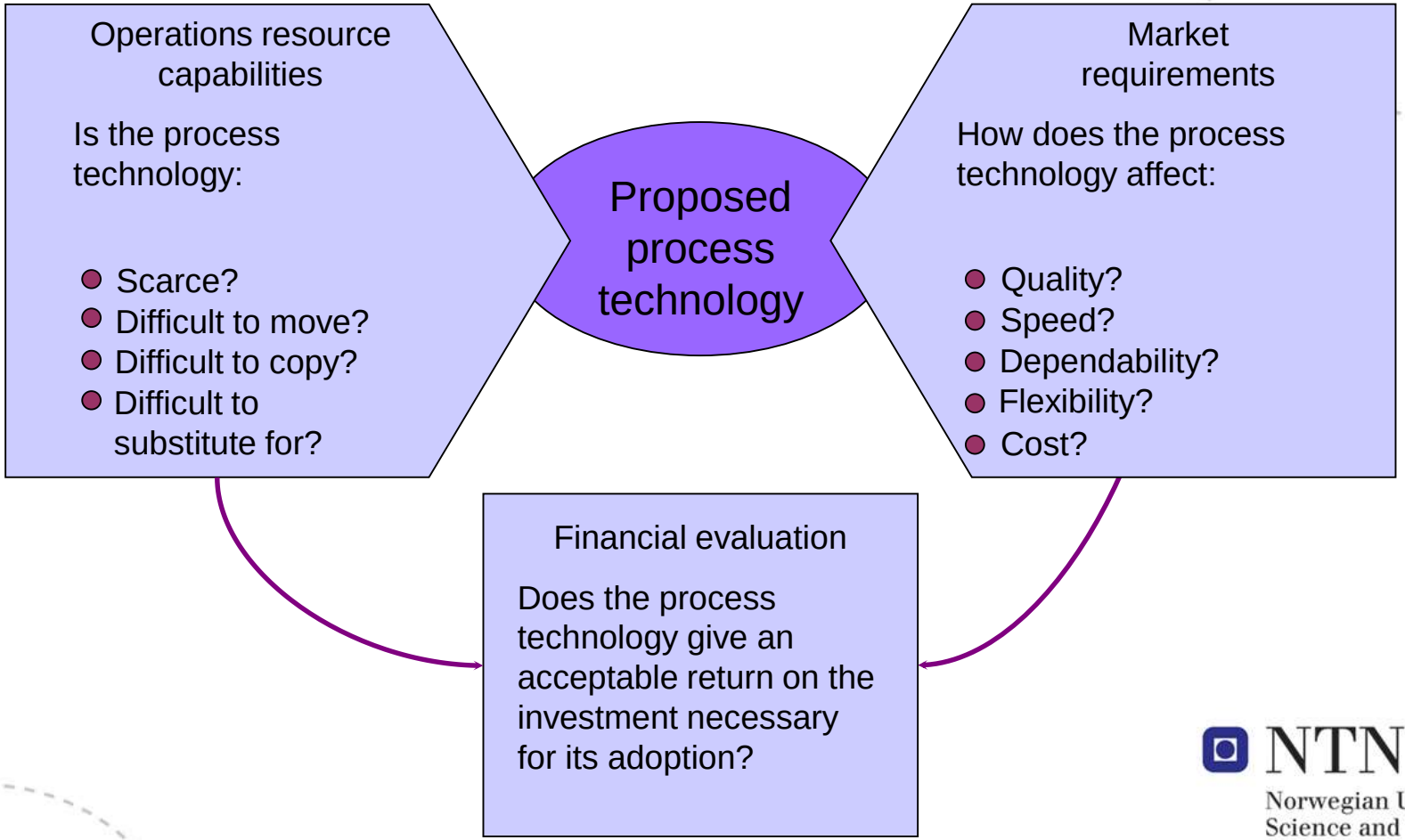


- The choice of process technology *shapes* the trade-off curve

Evaluation criteria for assessing concepts



Assessing the 'acceptability of a process technology



End of presentation

Process Technology Choices: Managing Technology in Multi-site Networks

1. Product and service standardisation
2. Stability of technology
3. Basis for learning and improvement
4. Different levels of volume and scale
5. Labour force impacts

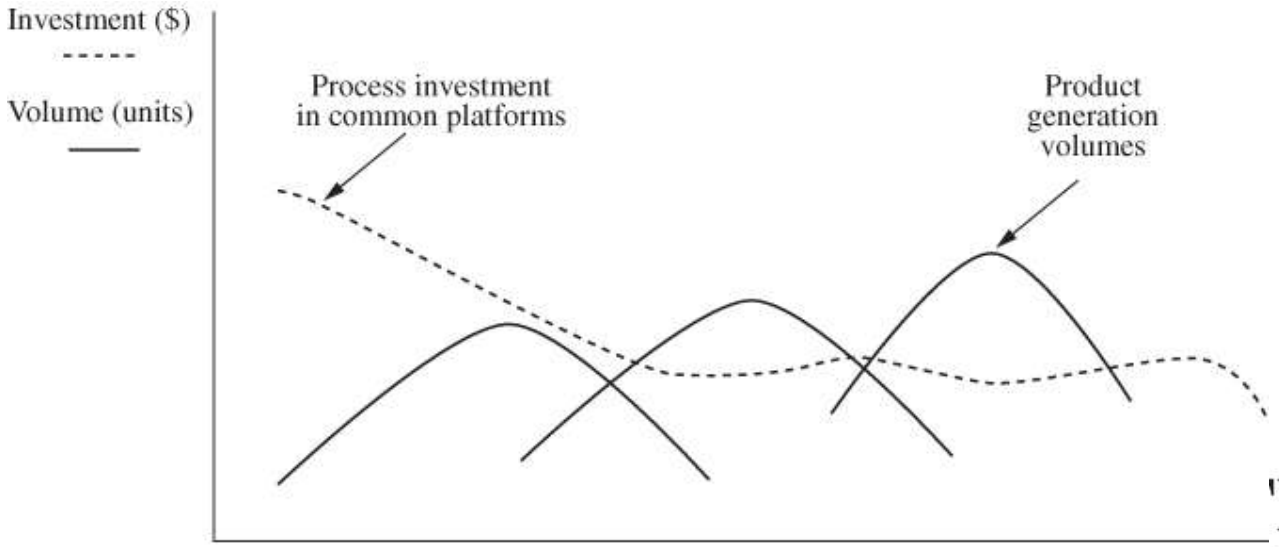
Managing Technology in Multi-site Networks: Centralization and Standardization

EXHIBIT 3.27 Centralization and Standardization Options

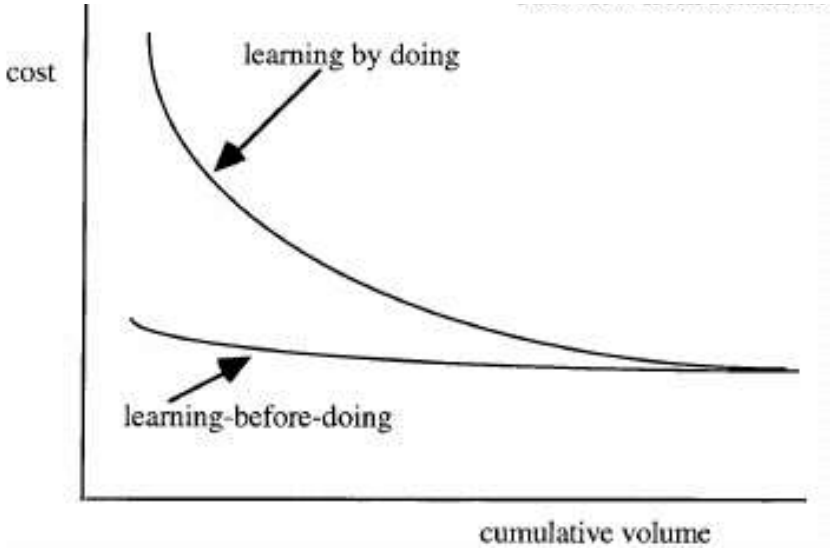
	Standardized Processes	Nonstandardized Processes
Centralized Process Development and Management	Reduces start-up costs, as each site can learn from those that have gone before it Facilitates cross-plant learning, as a central organization gathers and communicates knowledge Reduces initial capital outlays, as a single pilot facility can test and fine tune the process before roll out	Captures some of the efficiencies of standardized processes, while allowing local sites to adapt the processes to local needs in a controlled fashion
Decentralized Process Development and Management	Extremely difficult to do, unless a good deal of overhead is spent on coordination and sharing	Allows the local site to respond to site specific conditions such as: M arket differences Labor differences Supplier differences Eliminates the overhead associated with coordination across the corporation

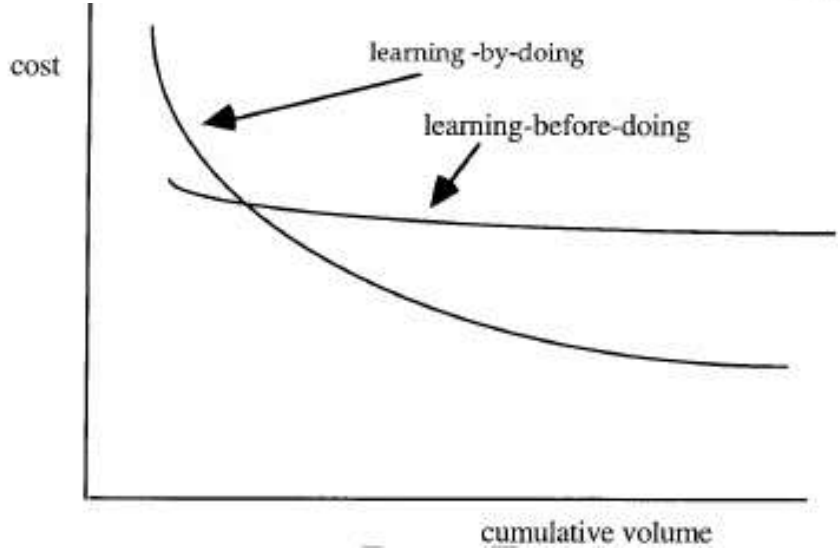
Process Technology Choices: Stability of technology

- Intel are able to use the same equipement for several product generations

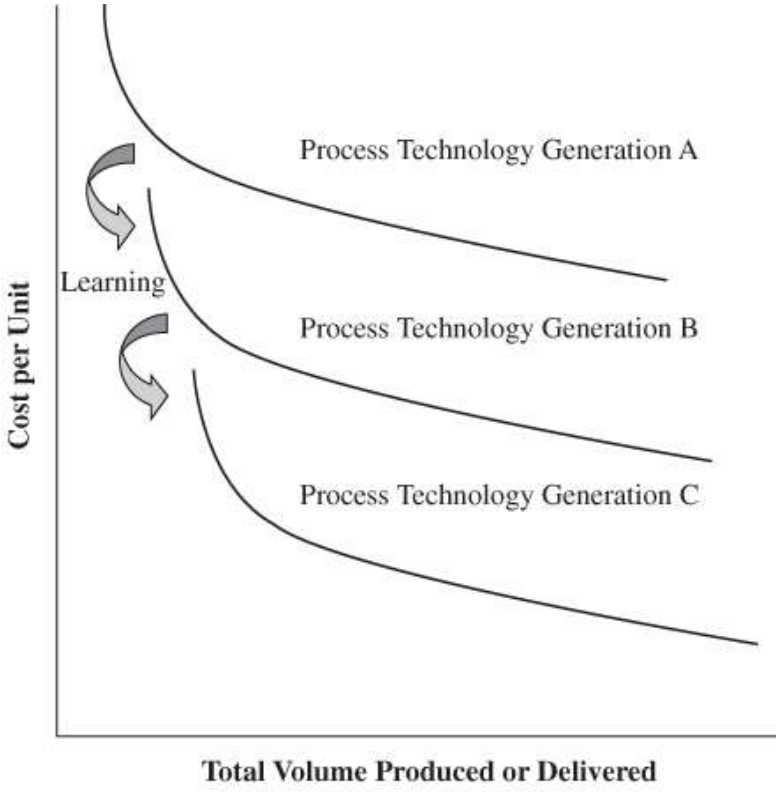


Different models of learning

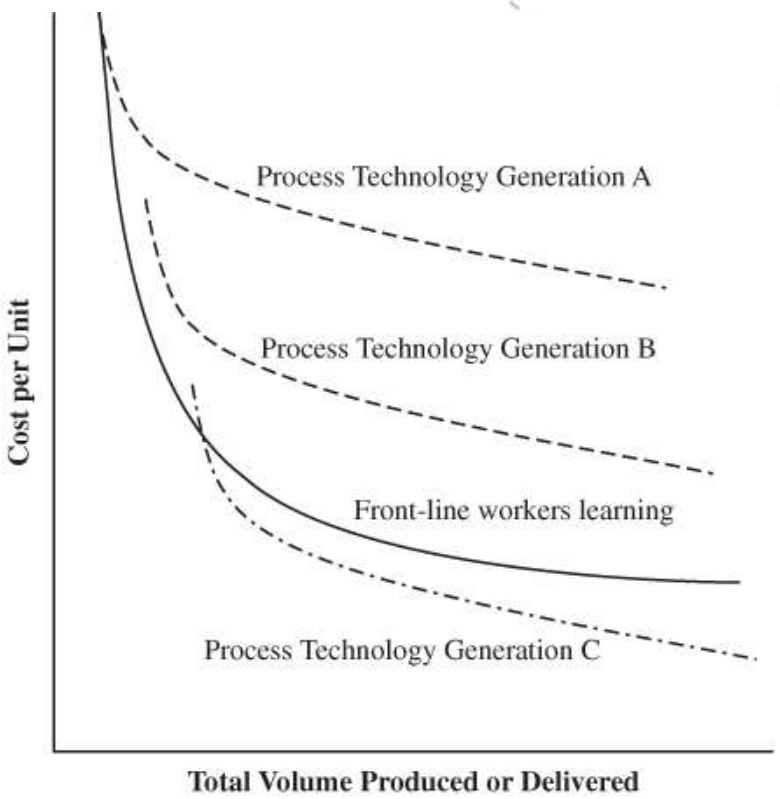




Managing Technology in Multi-site Networks: Learning Approaches



(a) Learning in a centralized process-development context



(b) Learning by front-line workers in a facility

Possible options to pursue

	Semi-Automated	Fully Automated
Autonomous		
Standardized		

Process Technology Strategy Development Approach

1. Understand the business strategy and competitive environment
2. Understand the technology trends in the industry
3. Understand the internal capabilities of the organization
4. Identify and assess process technology investment alternatives
5. Develop an implementation plan
6. Implement, assess and measure benefits

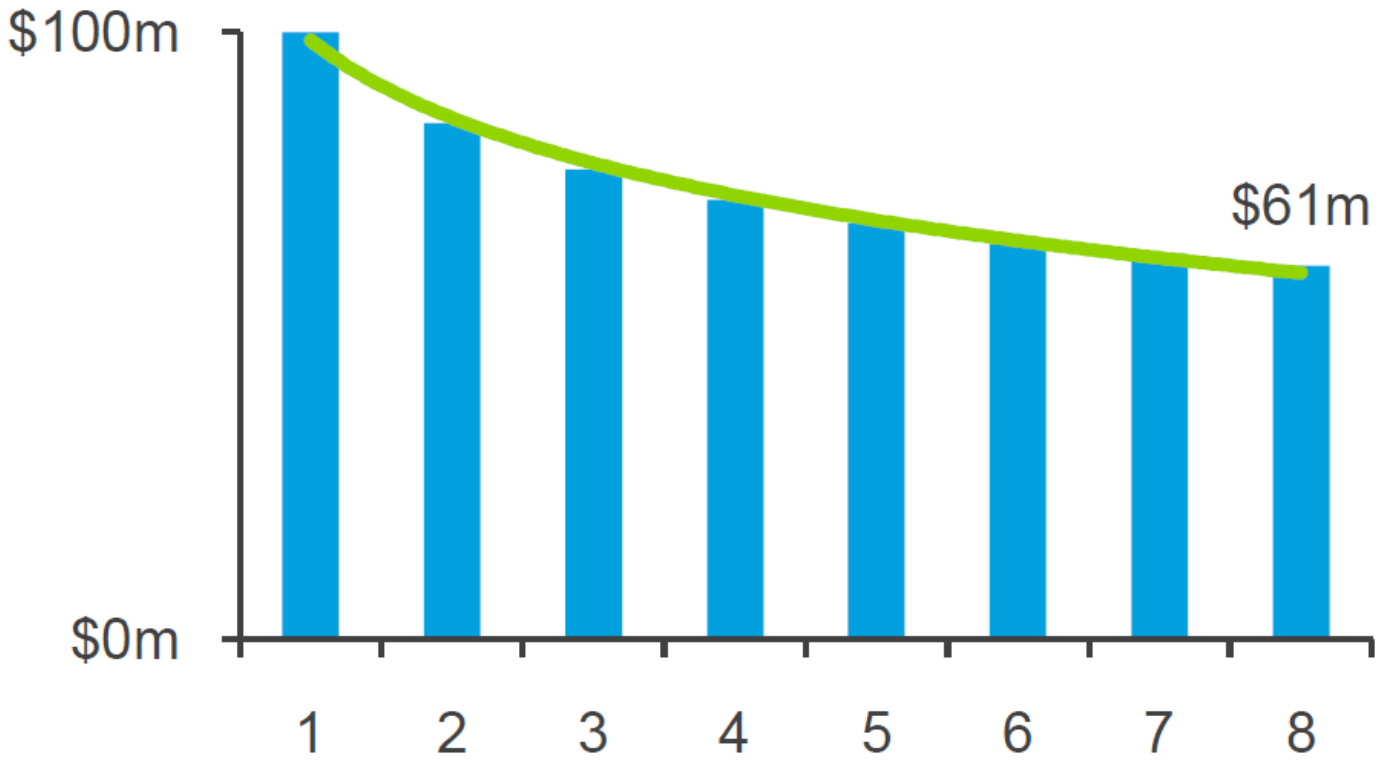


Figure 1: 85% Progress Ratio (PR) over eight units.