

Operations Management

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COURSE OVERVIEW

Course Structure

Session 1: Introduction to Operations Management

Session 2: Inventory Management

Session 3: Forecasting

Session 4: Scheduling

Session 5: Lean Production

Session 6: Project Management

Session 7: Quality

Session 8: Supply Chain Management

Objectives

- Understand operations as “managing processes”
- Understand the different manufacturing and service processes, and the implications of these differences
- Be familiar with process improvement concepts, including lean and six sigma
- Understand the role and use of inventory
- Ability to apply basic forecasting, ordering and scheduling techniques
- Basic insights into machine scheduling & assembly line balancing
- Understand the implications of all these decisions

Housekeeping

Example Classes: Four examples classes instead of small group supervisions

- Taught by Dr. Robin McKenzie

Examples Class	Date	Time & Location
1 st	2 February 2016, Tuesday	4-6pm, LT1
2 nd	16 February, 2016, Tuesday	
3 rd	1 March 2016, Tuesday	
4 th	15 March 2016, Tuesday	

- I will release the examples papers a week before the class
- Dr. McKenzie will release the cribs after the class

Housekeeping (cont'd)

Assessment: Examination

- All content covered in the lectures is relevant for the exam

Textbook: 4th edition of the main textbook (Slack *et al.*, *Operations Management*) is online at:

<http://www.myilibrary.com/browse/open.asp?ID=60096>

Session 1 – Introduction to Operations Management

Objectives for Today

- Obtain an **overview** of operations management (OM)
- Understand the importance of **process thinking**
- Identify the **objectives** involved in operations management, the costs, and the trade-offs
- Understand the importance of **variety** and **volume** on process design
- Compare **manufacturing** and **service** industry process designs

Exercise

- Your task: Design an operation that delivers 250,000 lettuces to Tesco every day!
 - What are the activities involved in the operation's processes?
 - What resources does the operation's processes need?
 - What should the operation's processes be particularly good at?



Operations Management

What is Operations Management?

- Operations Management (OM) is the field concerned with the
 - efficient and effective planning, scheduling, and control of manufacturing and service entities.**
- OM is concerned with managing the process that converts
 - inputs** (i.e., material, manpower, capital, information, and energy)
 - into
 - outputs** (i.e., goods and services).

What is Operations Management? (cont'd)

- OM uses **process thinking** to meet and exceed customer demand while using all resources efficiently in order to maximise the value of the organisation.
- Anything which **repeats** in the operation can be seen as a **process**. The repetitive nature of processes allows for improvement!
- Distinction between operations which manufacture **goods** and those which provide **services**

... but is this distinction really meaningful?

The Key Operations Decisions

- **Structural** – long term decisions related to the delivery process, and the flow of goods and services
 - Location
 - Capacity
 - Technology
 - Vertical Integration
- **Infrastructural** – short term decisions related to planning and control systems of operations
 - Workforce
 - Quality Management
 - Organization Structure
 - Policies/Procedures



Source: Hayes & Wheelwright (1984)

Difference between OM and SCM

- Operations Management (OM) typically refers to processes within a **single** firm
- Supply Chain Management (SCM) refers to processes and exchanges across **multiple** firms
- Both OM and SCM are covered in this course!

Why does OM Matter?

One of the core activities of an organisation along with:

Product/service development, Marketing and sales, Finance, Human resources

HUMAN RESOURCES

selection and management of labor

RESEARCH & DEVELOPMENT

*develop new products
and services*

**PRODUCTION &
OPERATIONS**
*selection, organization,
and control of
resources to produce a
good or service*

SALES / MARKETING
*sales of products or
services to a customer*

FINANCE

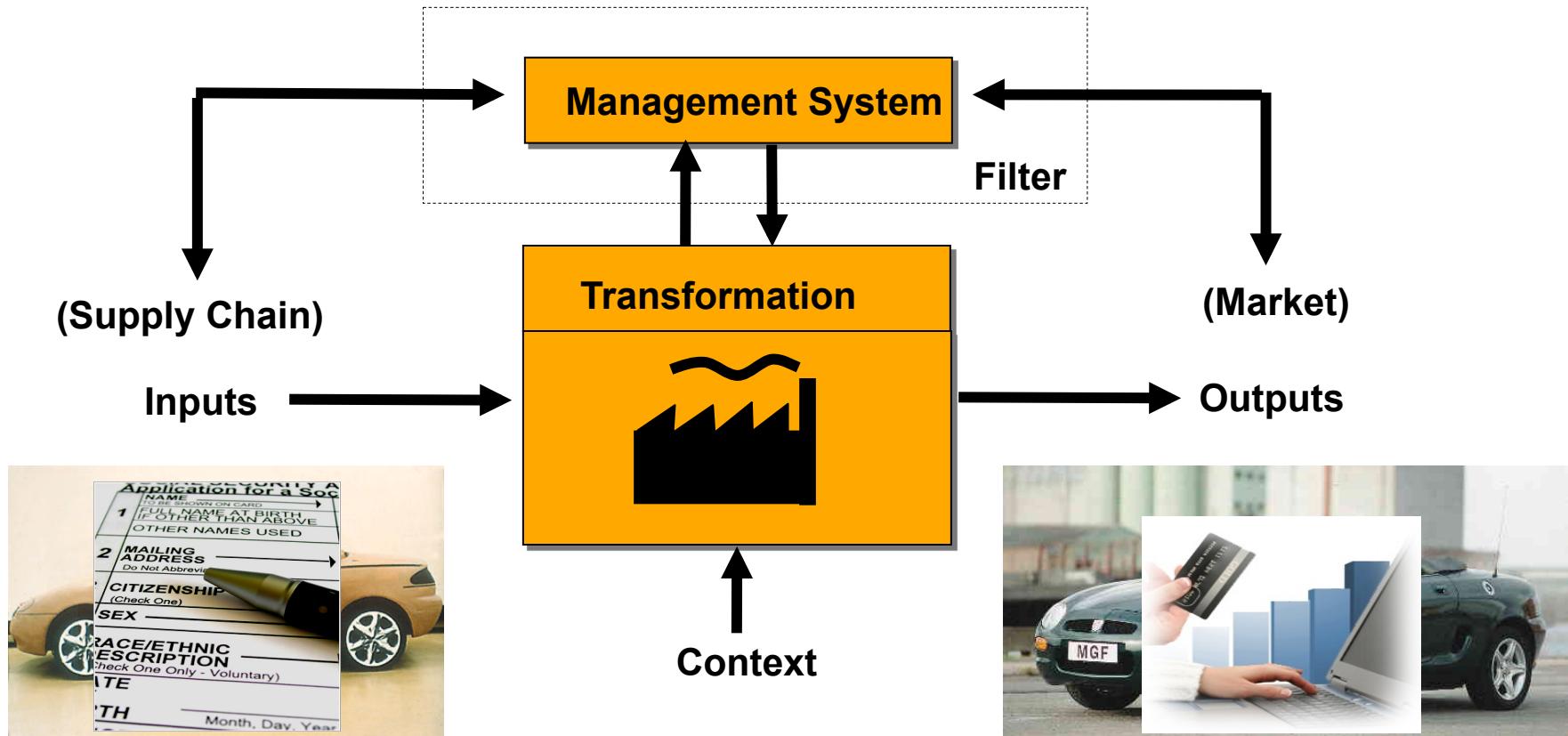
*accumulation and maintenance of resources to create and sustain the
organization*

Why does OM Matter? (cont'd)

- OM involves the greatest portion of a company's employees and capital assets (typically 70-80%)
- Operational decisions have strong financial, social/ethical and ecological implications ...
... and (often forgotten) also determine the day-to-day service level at the customer end!

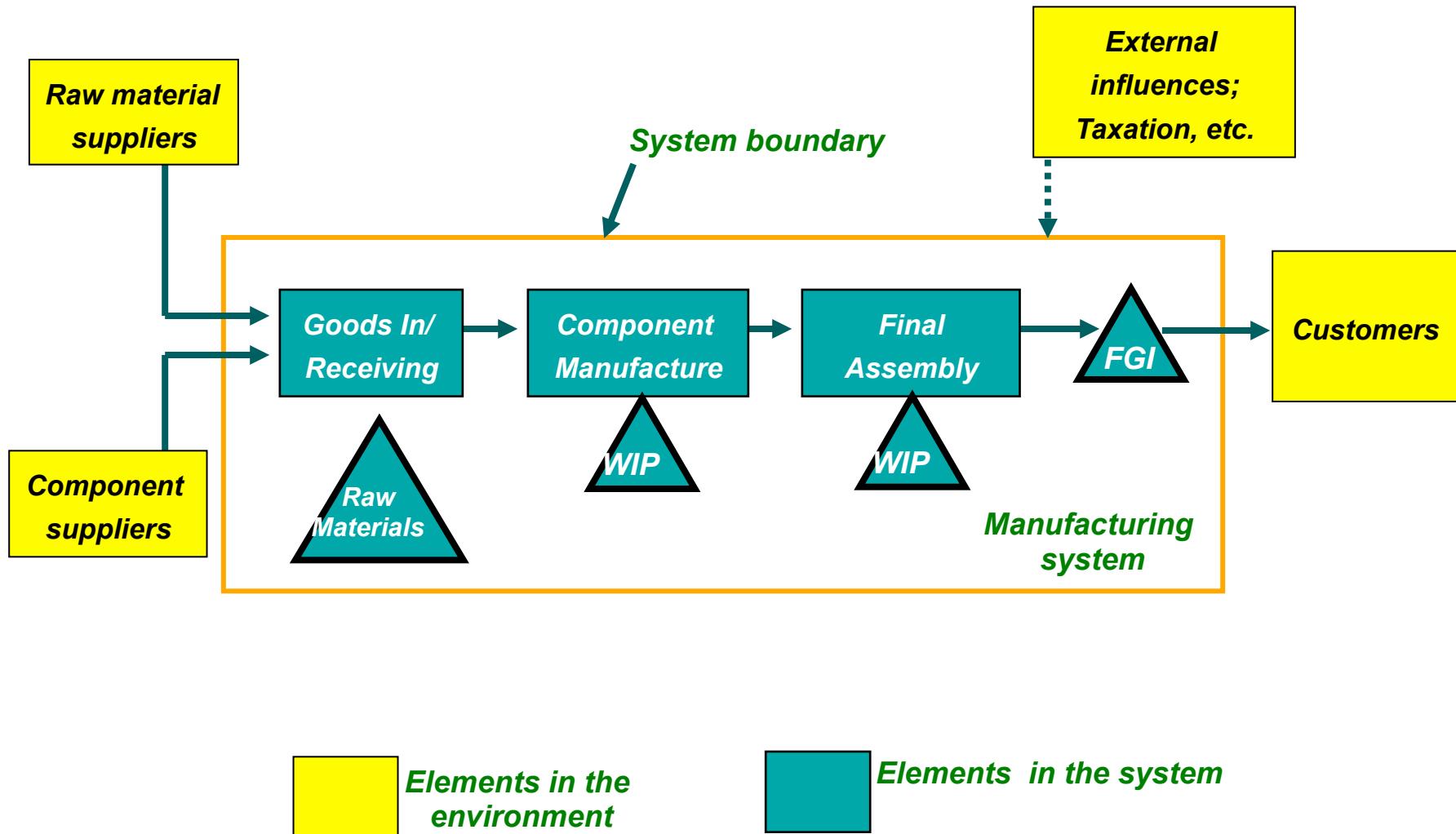
Operations as a Transformation Process

Input-Transformation-Output Model



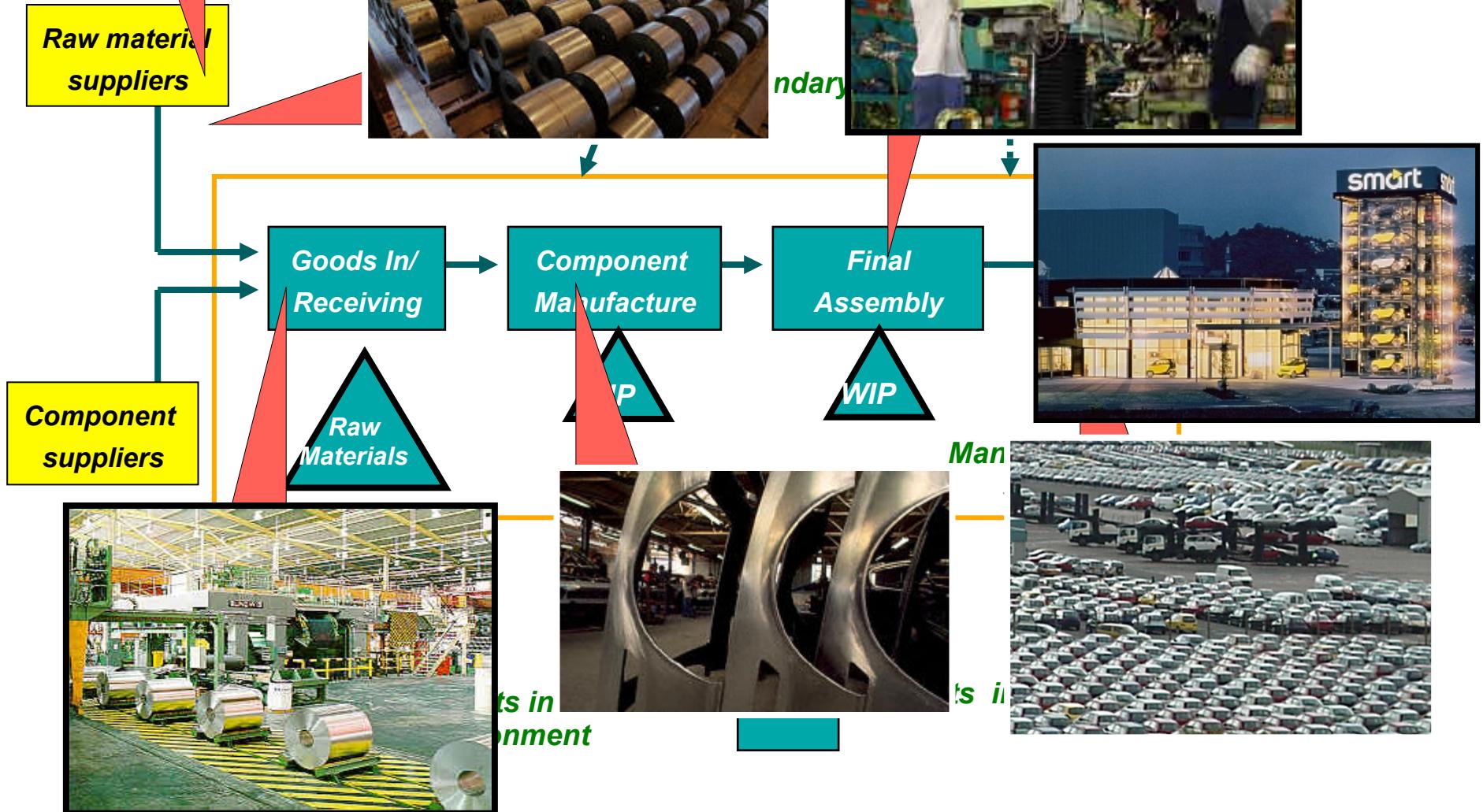
A **process** is the sequence of operations and involved events, taking up time, space, expertise or other resources, which lead/(should lead) to the production of some outcome

A Simplified Manufacturing System

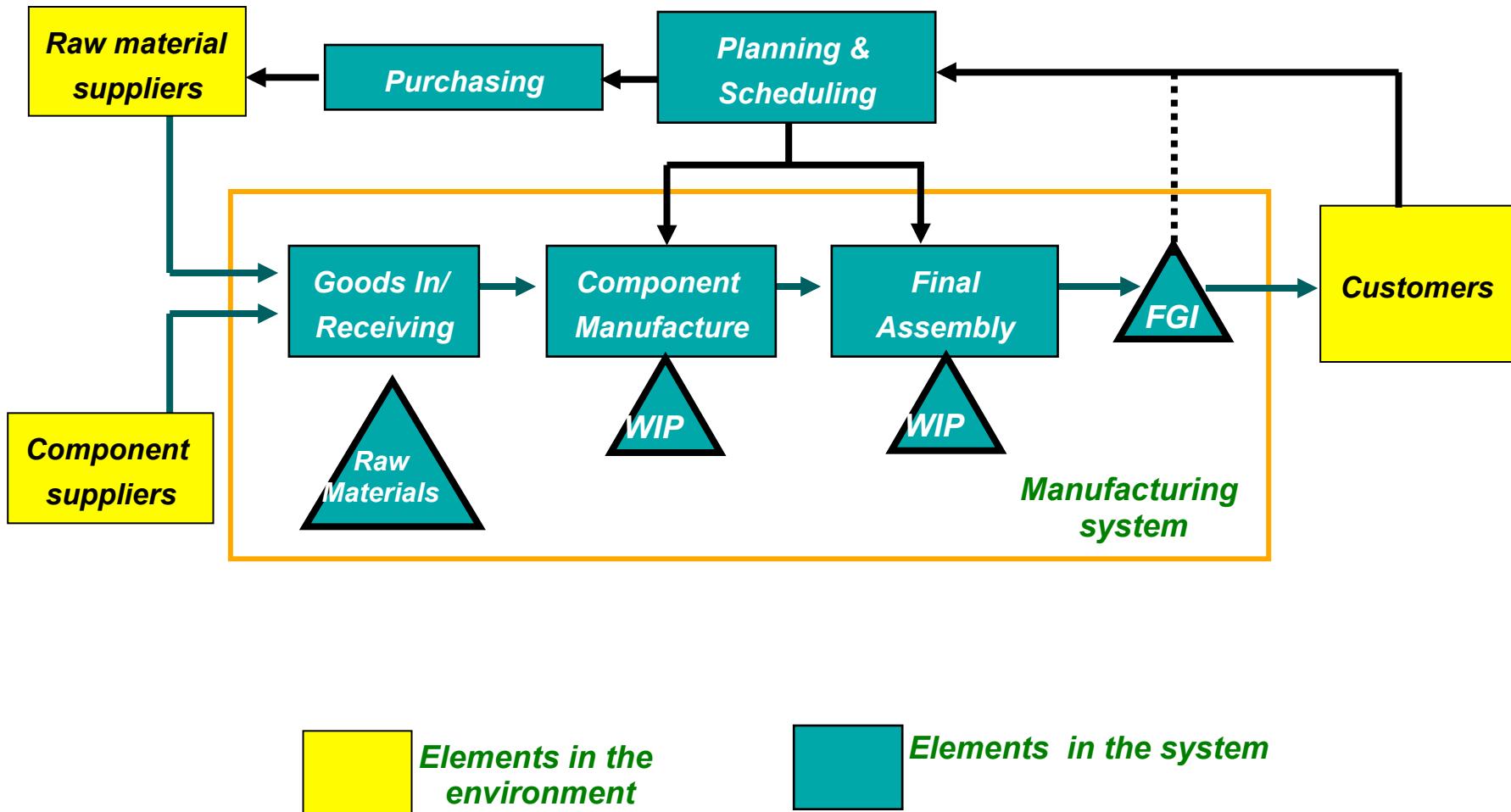




Specialized Manufacturing



A Simplified Manufacturing System with its Management System



The Functions of The Management System

What does the “management” in “operations management” entail?

1. The design of the transformation process
2. The provision of resources (planning)
3. The allocation of resources to tasks (scheduling)
4. The control (measurement) and improvement of the transformation process

All to meet the required performance objectives.

Performance Objectives

Process Performance

- Internal objectives: “shareholder value”
 - 100% effective use of resources
 - Minimal operating expenses: zero defects, zero stock
- External objectives:
 - Quality: doing things right, to a standard
 - Speed: time to satisfy order
 - Dependability: reliable delivery when promised
 - Flexibility: ability to change what is delivered
 - Cost: price competitiveness

Quality
Speed
Dependability
Flexibility
Cost

“The right product, at the right time, at the right quality, at the right price”

Cost Implications of OM Decisions

Cost of inventory

- Cost of capital & warehousing
- Cost of handling, quality implications, obsolescence

Cost of production

- Cost of inventory is a function of production batch sizes
- Cost of machines, labour
- Opportunity cost of set-ups

Cost of logistics & distribution

- Cost of transportation, depending on frequency

Cost of sales

- Opportunity cost of lost sales

Cost of making a sale (interface to marketing...)

Contribution to Competitive Advantage

The “strategic objective” of Operations Management is often only seen as to increase the efficiency in production, i.e., reduce unit cost

Can operations provide a competitive advantage?

Competitive Priorities

The customer value equation:

$$\text{Value} = \text{Performance}/\text{Cost}$$

- **Performance** is a function of:
 - **Quality**: doing things right, to a standard
 - **Speed/Dependability**: reliability and speed of delivery
 - **Flexibility**: ability to change (volume, product mix, design)
- Firms differentiated by their trade-off across these performance objectives

Competing on Cost

- Offering product at a low price relative to competition
- Typically high volume products
- Often limit product range & offer little customization
- May invest in automation to reduce unit costs
- Can use lower skill labour
- Low cost does not necessarily mean low quality



Competing on Quality

- Quality is often subjective
- Quality is defined differently depending on who is defining it
- Service quality is meeting and exceeding customer requirements
- High quality services companies demonstrate:
 - Superior product features
 - Excellent customer service
 - Consistent delivery
 - Process quality – error free delivery



Competing on Speed / Dependability

Time related issues involve:

- Rapid delivery
 - Focused on shorter time between order placement and delivery, minimal wait times
- On-time delivery
 - Deliver product exactly when needed every time
- Availability
 - Convenient and readily available when customer requires



Competing on Flexibility

- Company environment changes rapidly
 - Company must accommodate change by being flexible
- Easily customize product/service to meet specific requirements of a customer
 - Ability to ramp capacity up and down to match market demands



Flexibility

- Flexibility has several distinct meanings but is always associated with an operation's **ability to change**

BUT change what ?

- The products and services it brings to the market –
Product/service flexibility
- The mix of products and services it produces at any one time –
Mix flexibility
- The volume of products and services it produces –
Volume flexibility
- The delivery time of its products and services –
Delivery flexibility

What does Flexibility Mean in ...

... an Automobile Plant?



- Introducing new models
- Range of options and model mix produced
- The ability to adjust the number of vehicles manufactured
- The ability to alter manufacturing priorities and reschedule

What does Flexibility Mean in ...

... A Hospital?



- Introducing new treatments
- A wide variety/mix of treatments
- The ability to adjust the number of patients treated
- The ability to reschedule appointments

All OM Decisions are Trade-offs

Customer service vs. operational cost

- Response time, order fulfilment

Setup cost vs. inventory

- What are the optimal batch sizes in production?

Inventory cost vs. ordering cost

- What are optimal order quantities?

... Where to find the balance?

FORTUNE May 22,
2006

Interview with Bill
Amelio, CEO of
Lenovo



Q: Will you manufacture everything in China?

A: For notebooks it's definitely in China, but for desktops we'll do final assembly close to the customer. You don't want to stick them on a boat, because a PC's value drops each week anywhere from half-a-percent to a percent and a half.

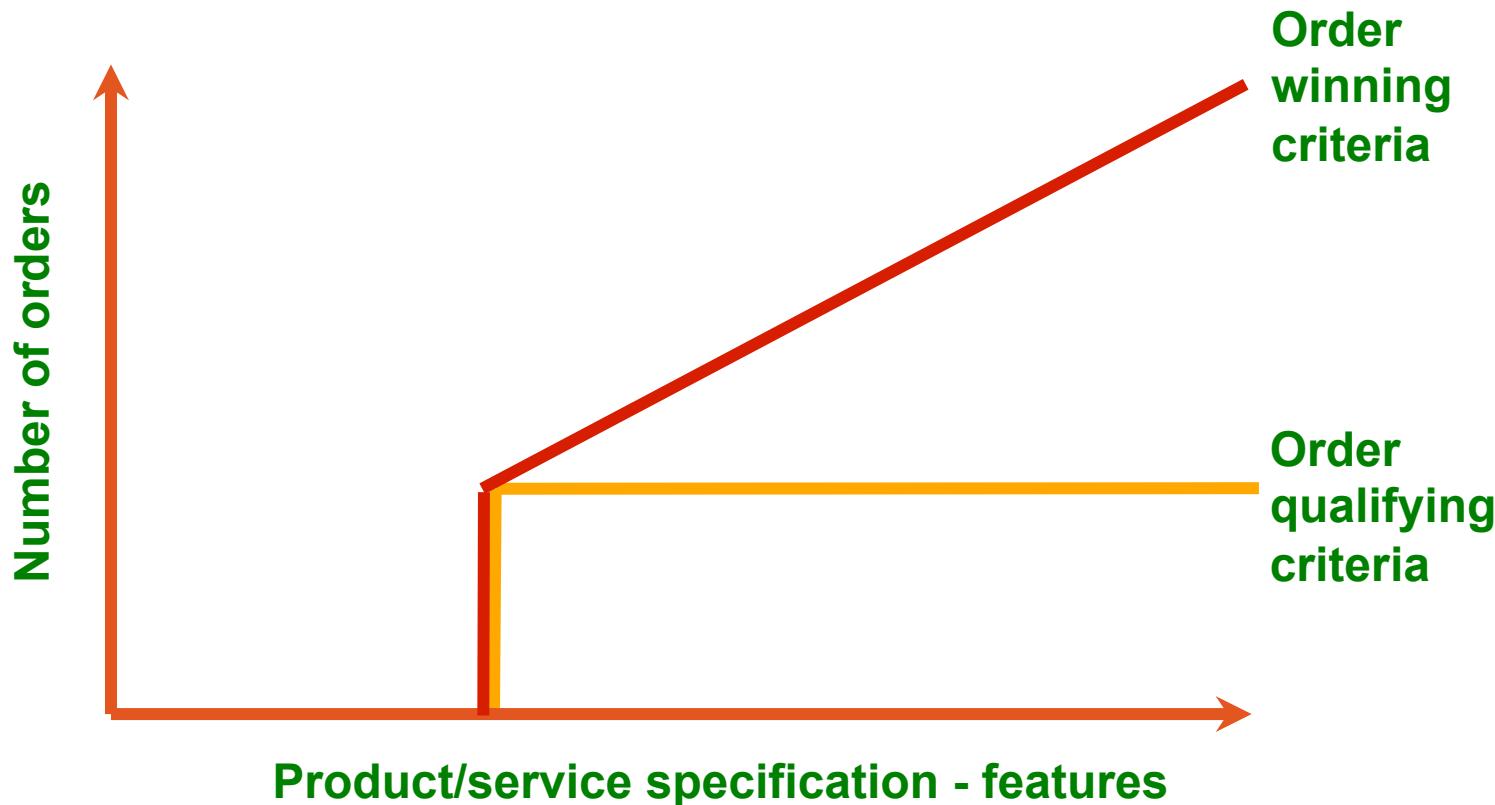
The Need for Trade-offs?

- Decisions about competitive capabilities must emphasise performance objectives that support business strategy.
- World-class service companies no longer view cost, quality, speed of delivery, and even flexibility as trade-offs. They have become order qualifiers.

Distinguish Order Winners from Order Qualifiers

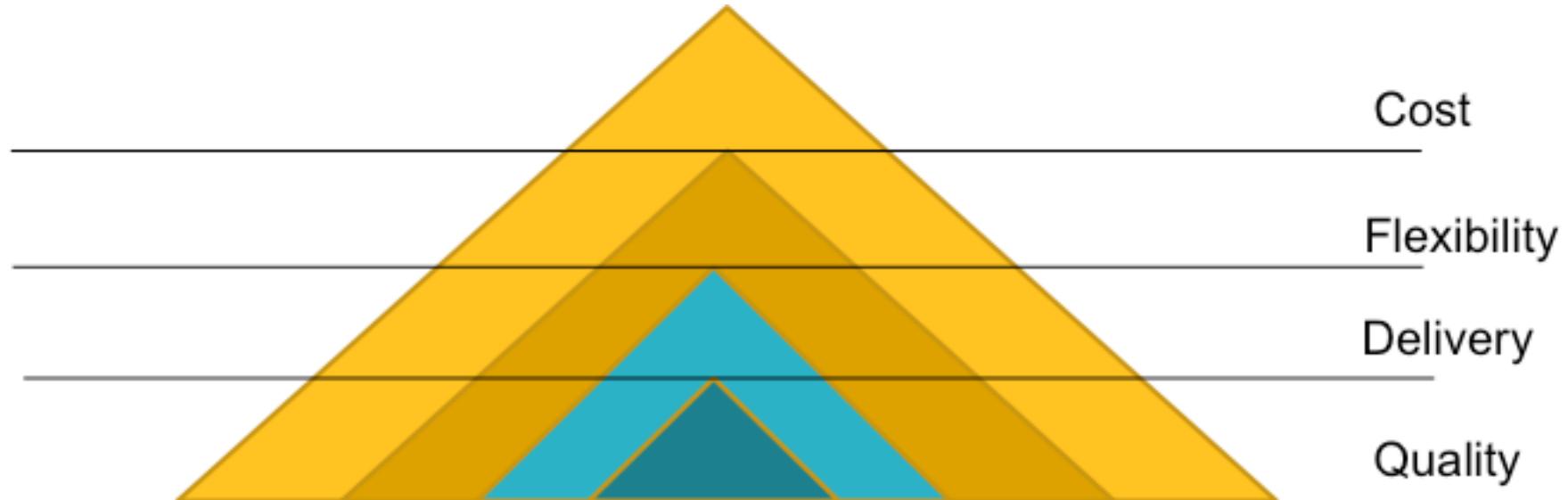
Order Qualifiers: hygiene factor, needed to be considered by customer

Order Winners: distinguishing factors that drive customer choice

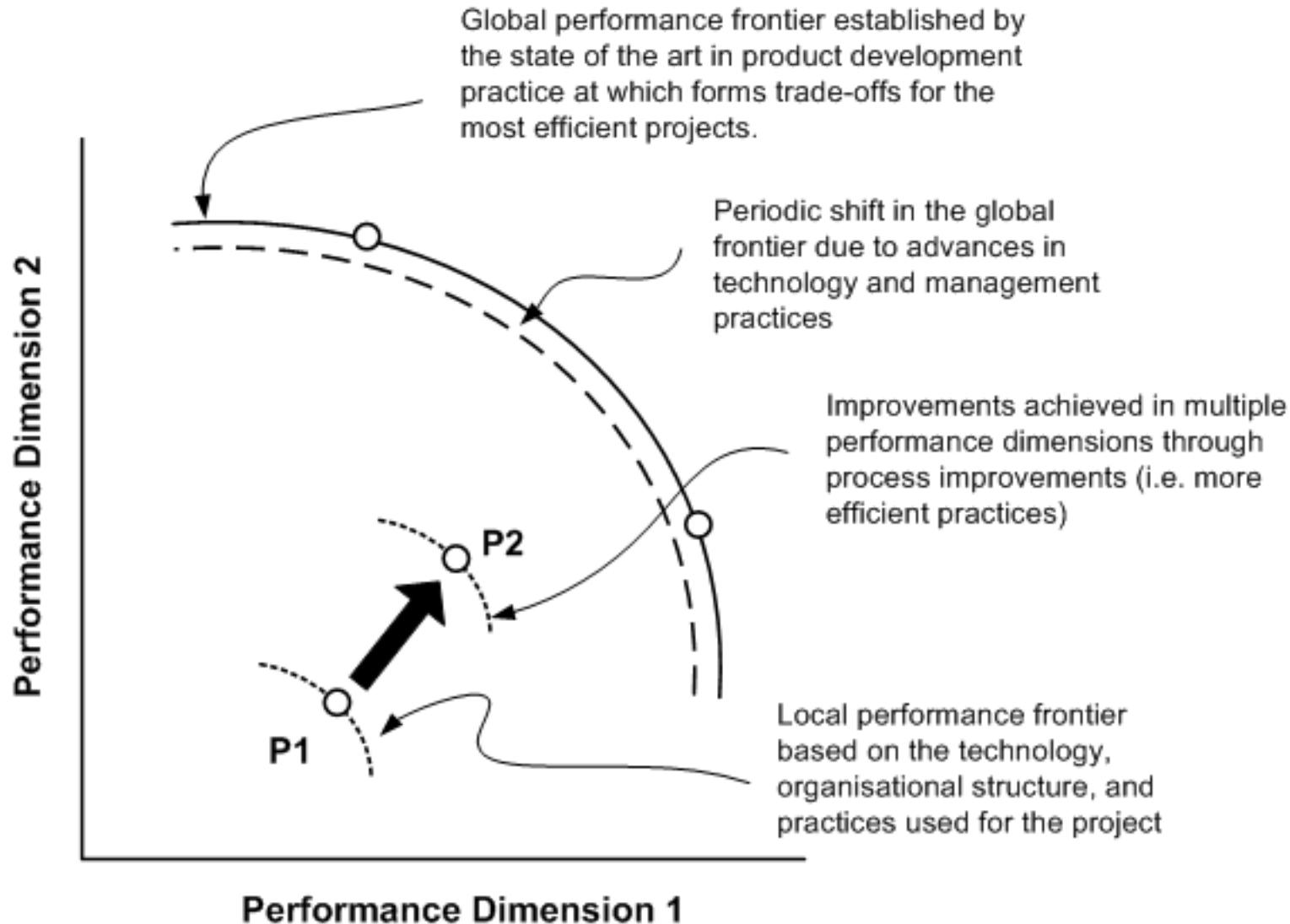


Cumulative Capabilities

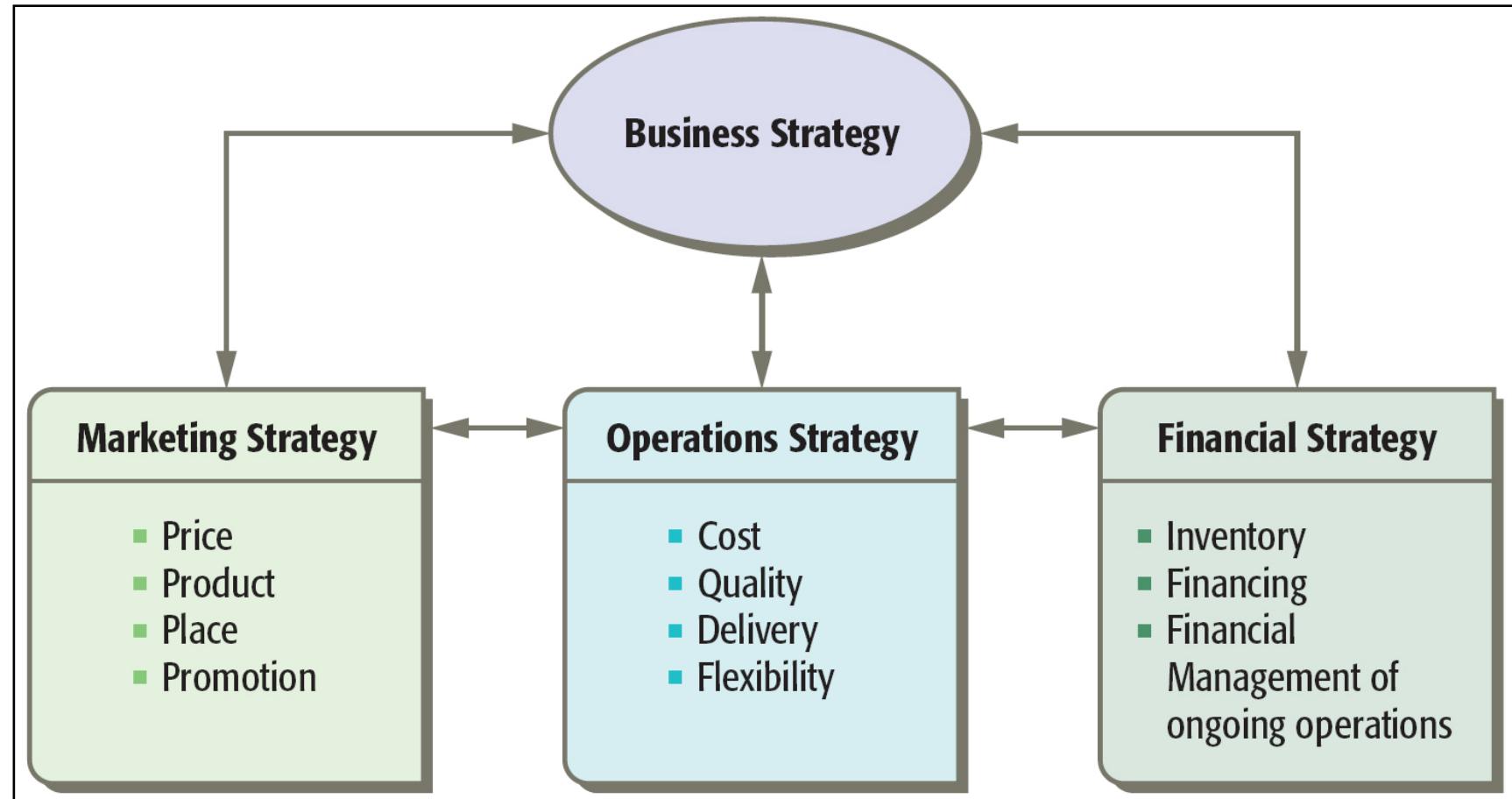
- The Sandcone Model (Ferdows & DeMeyer, 1991)
- These firms asked a new question - What capabilities can we use to attack new markets?
 - Implications for role of operations within the firm



Performance Frontiers



Relationships Between Business and Functional Strategies



Source: Verma & Boyer 2010

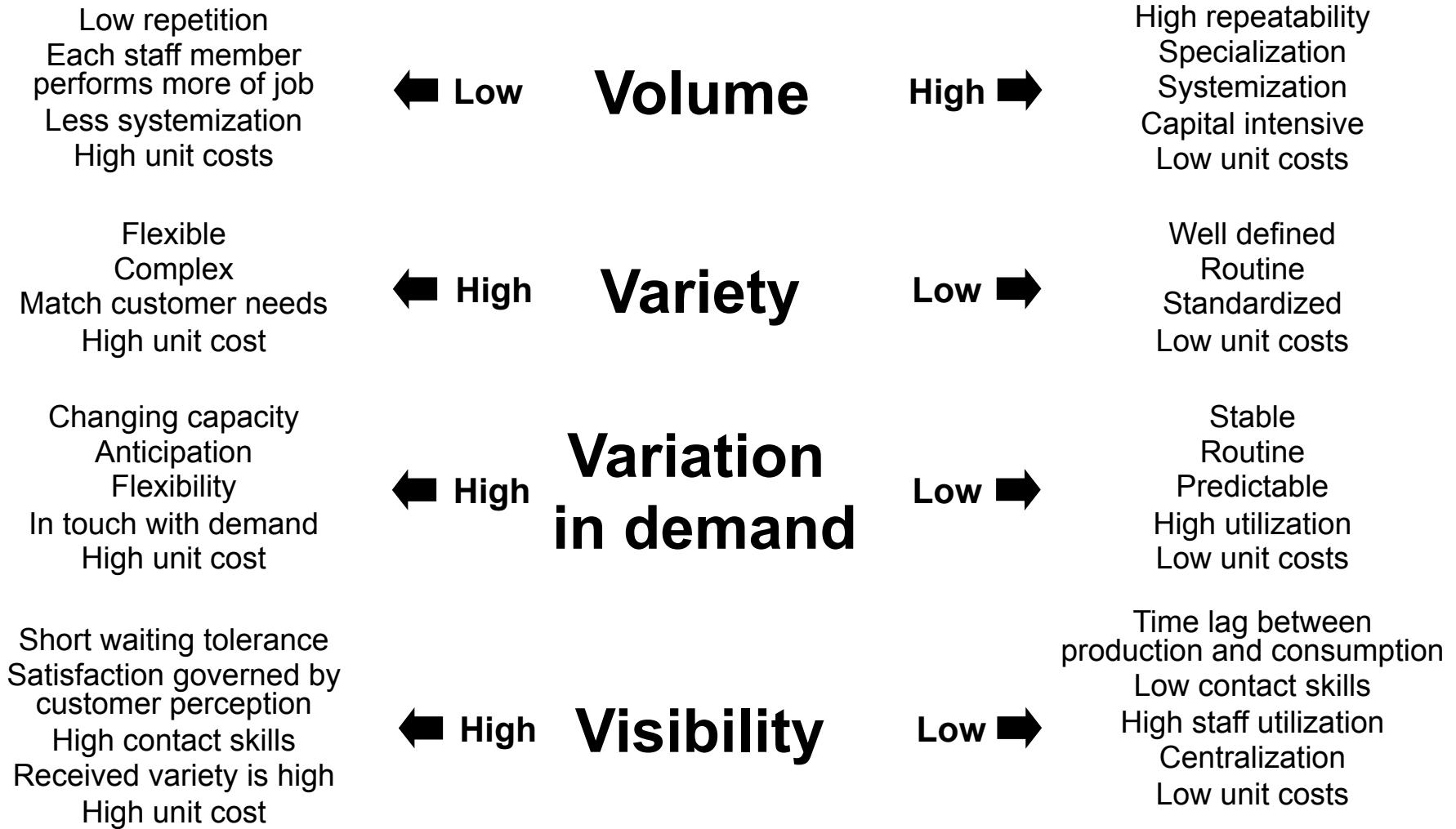
Design of Manufacturing Operations

Plane and Car Manufacture

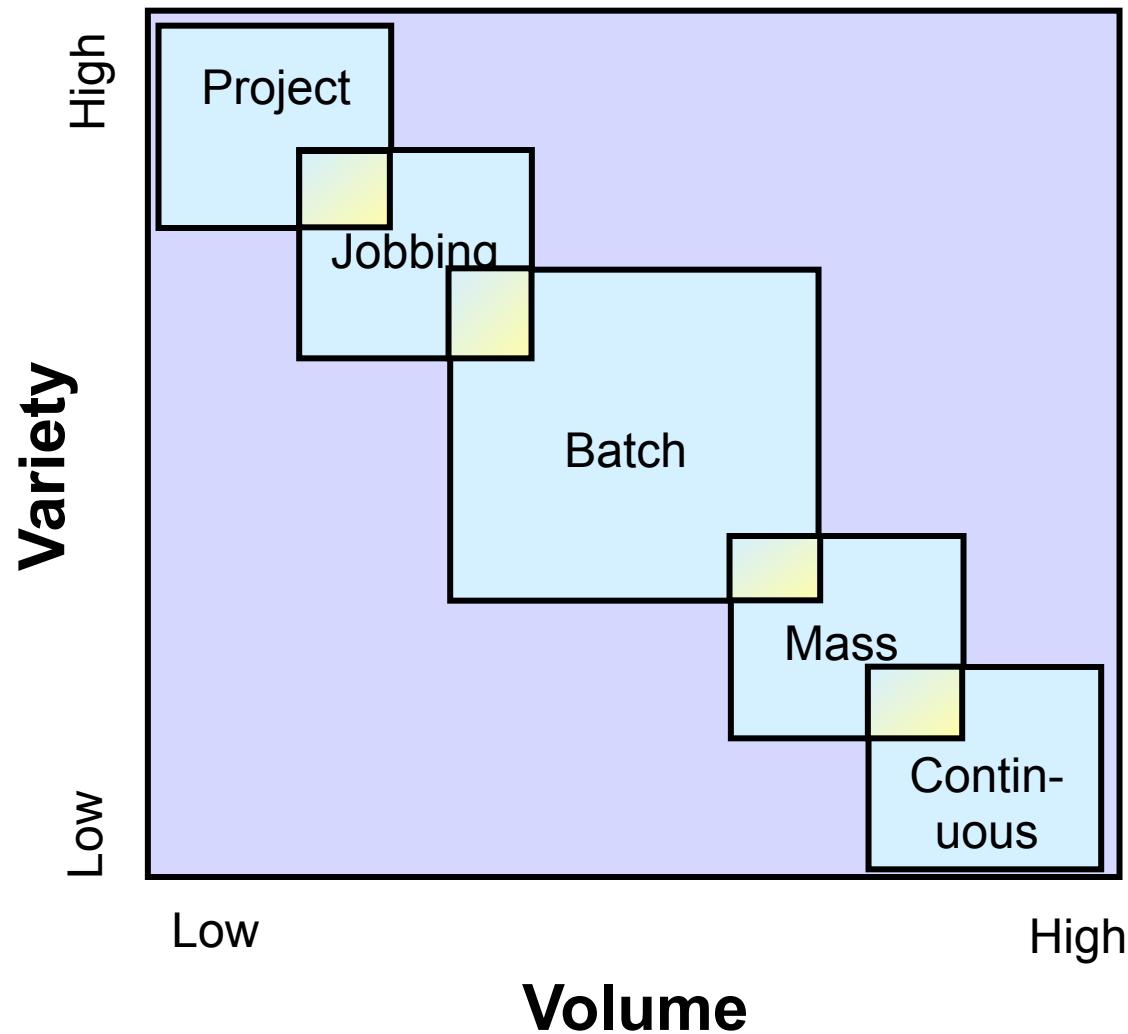
- Observe the manufacturing operations in these two videos
- How do these two operations differ?



Typology of Operations – The 4V's



Manufacturing Process Types



Projects: Millau Viaduct



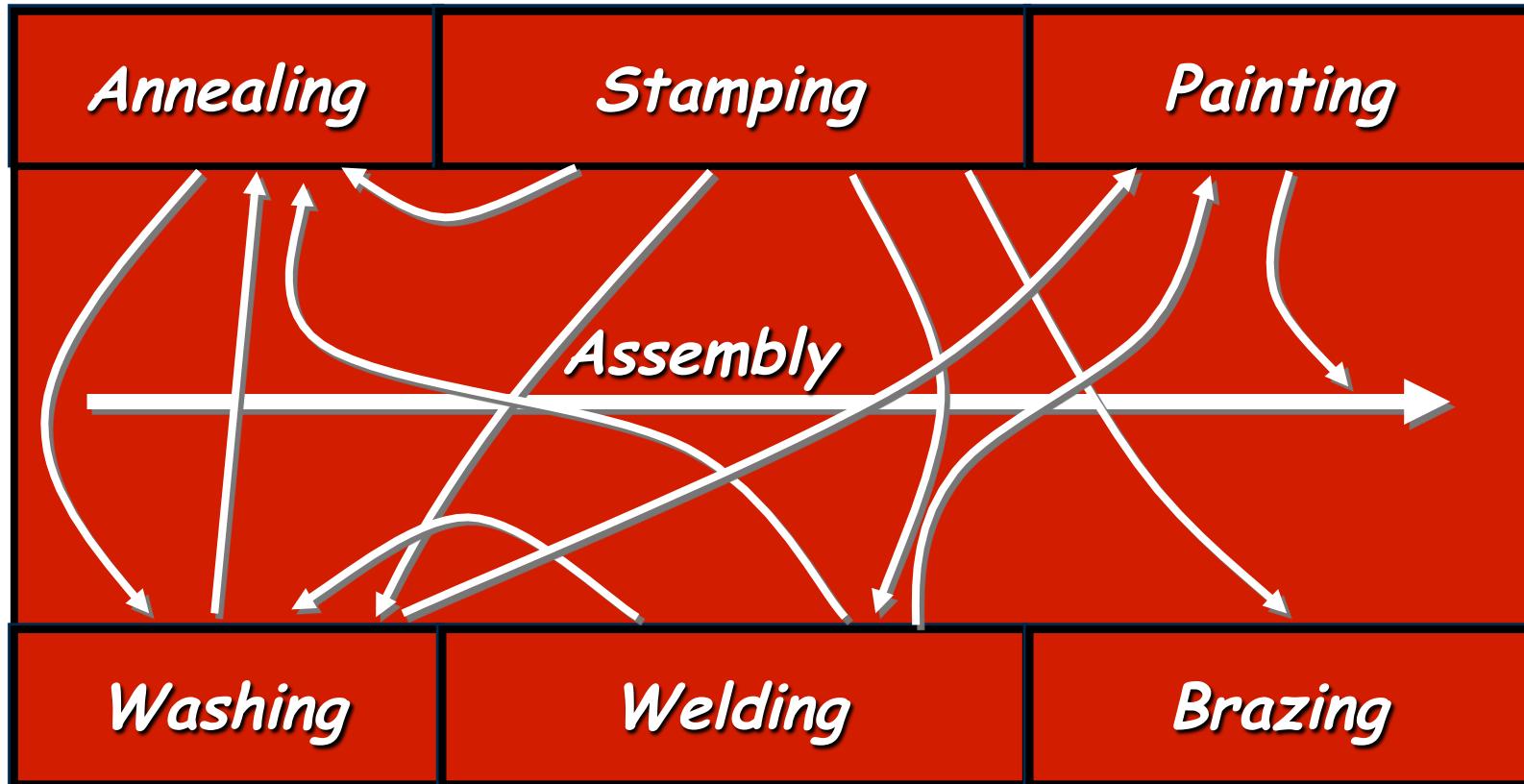
- Labour and equipment is often brought to location of assembly and re-allocated afterwards
- Physical size and degree of customisation key factors

Job Shop: Aero Engines & Machine Tools



- Volume does not justify dedicated lines or machinery
- Parts often travel between work-shops, thus “job shop”
- Work centres are grouped by type of process: welding, drilling, painting

Job Shop: Flow Chart



- Process-driven
- Split into centres
- Complex routing and scheduling.

Batch: Textile Production



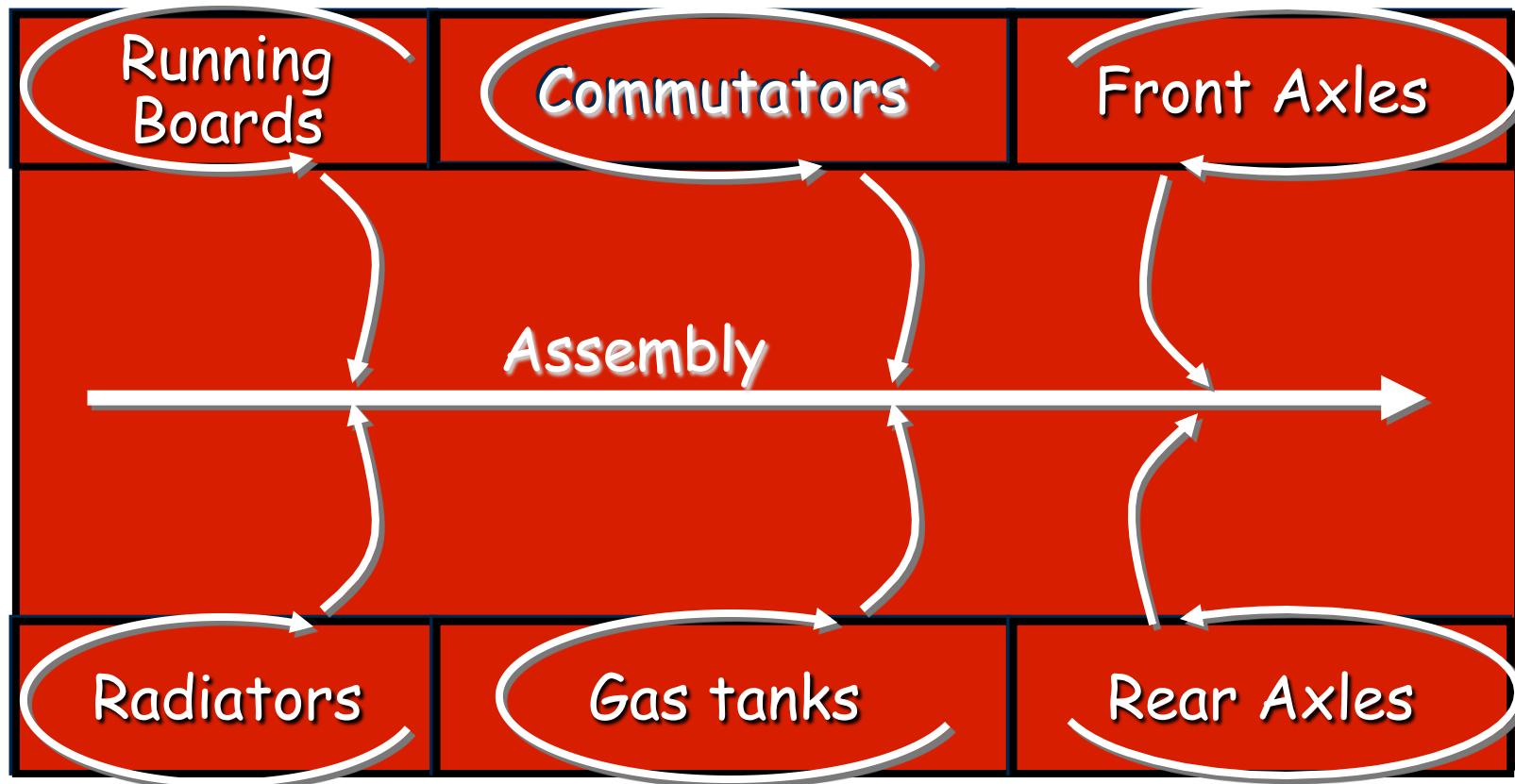
- Volume key factor in justifying automation
- Short life cycle (seasons) means that machines need to be flexible for re-use with next batch/product
- Changeovers between products

Mass/Line Production: Automobiles



- Volume does justify dedicated lines
- Cycle time is set to pace entire factory
- Multi-model lines
- Limited flexibility regarding volume and new models

Ford Highland Park Moving Assembly Line in 1913



250,000 Vehicles Per Year, One Model

Continuous Processing: Oil Refinery



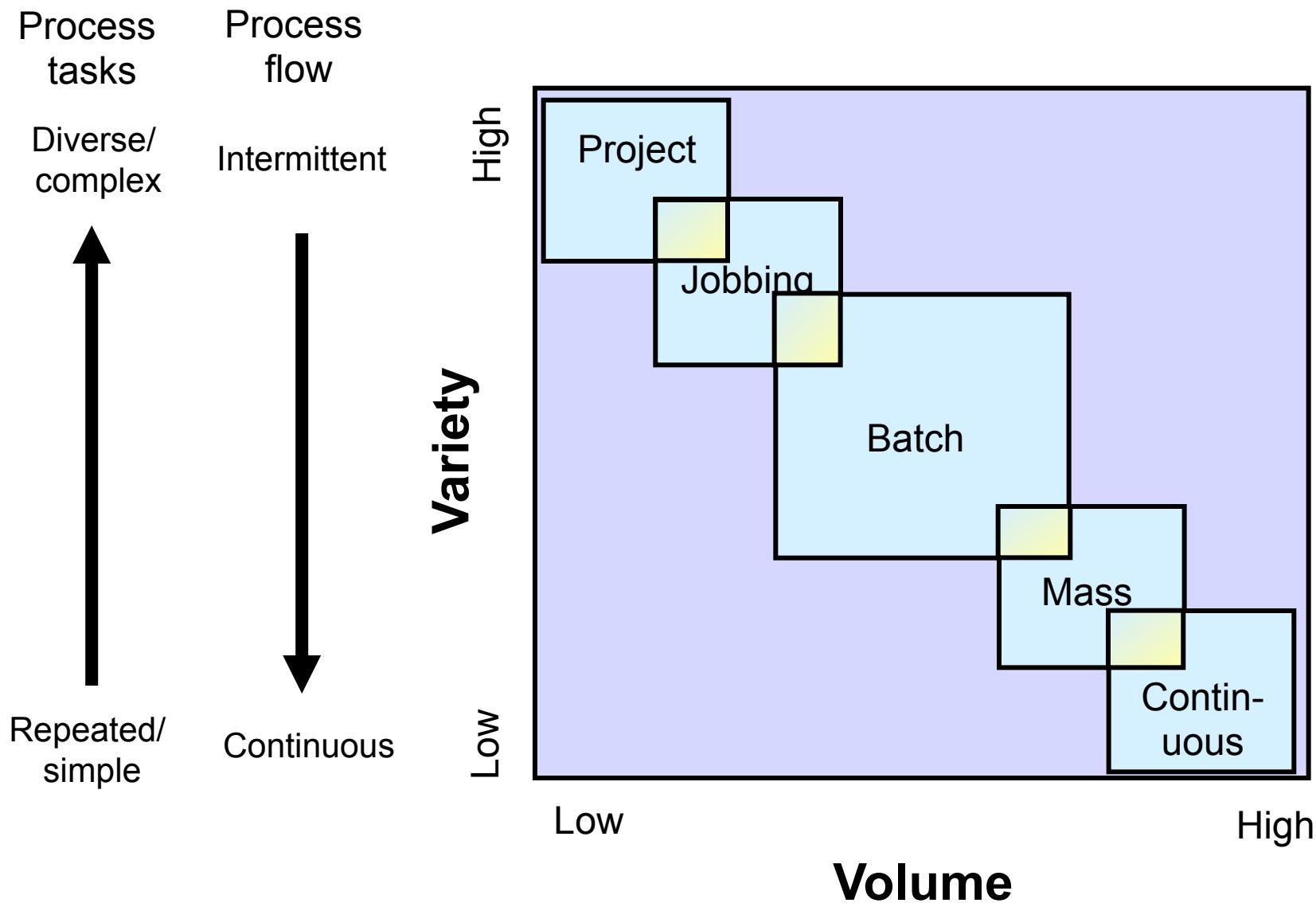
- Flow processes, often driven by chemical/physical needs
- Individual product is often not an entity (e.g., petrol)

Process Characteristics

The single most important feature of a process in a business operation is the trade-off in its design between **production volume** and **product variety**

- Defines types of job design required
- Defines necessary tools and technology
- Defines cost structure
- Defines relationship with suppliers
- Establishes customer expectations - cheap or customised

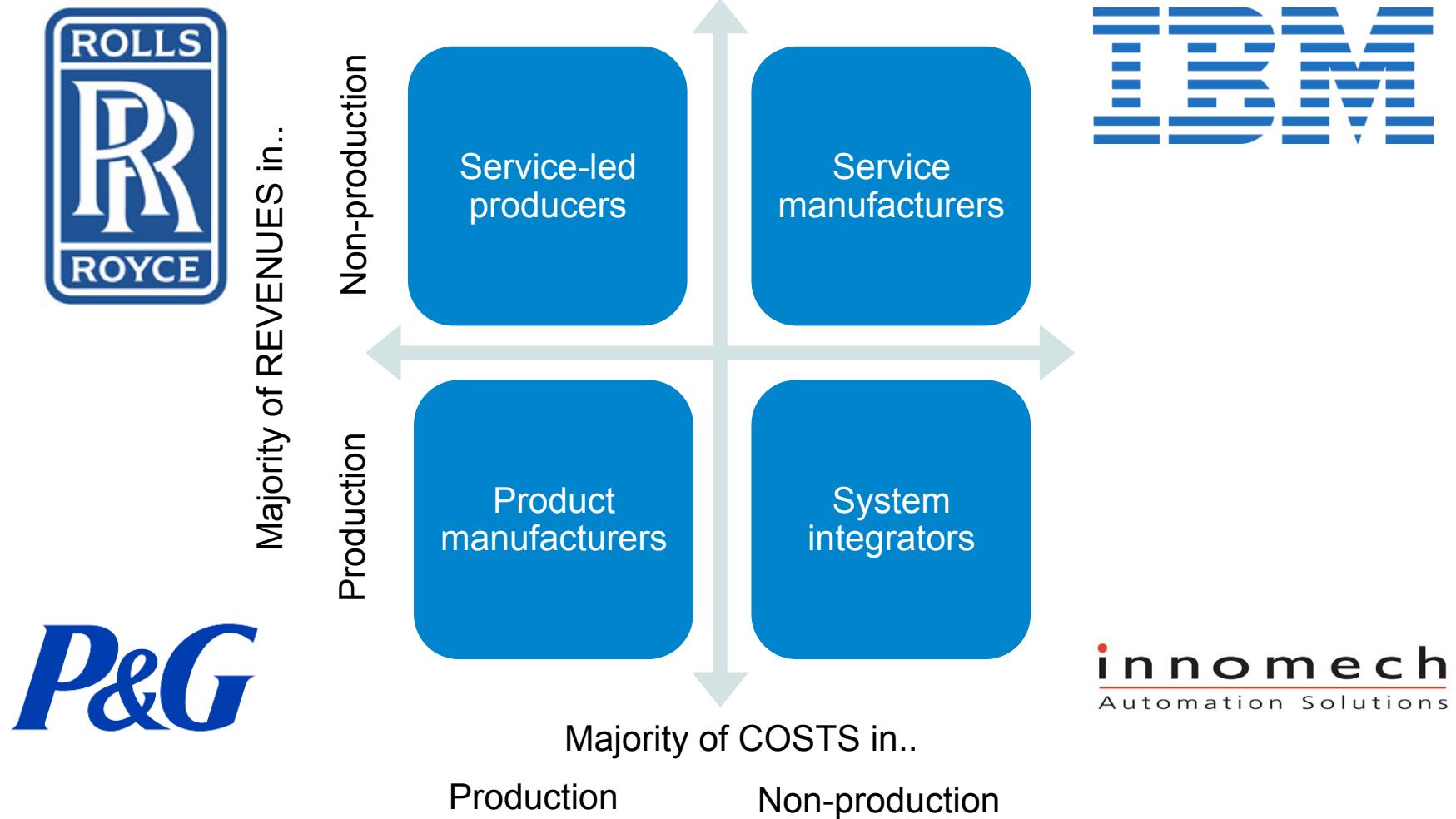
Manufacturing Process Types



The “Natural” Diagonal

- There is a **trade-off** between high flexibility and high volume/low cost per unit. For example:
 - **Project or job shop** processes provide a high degree of flexibility and a variety of products but with limited volume and at a high cost per unit
 - **Mass and continuous** processes are limited in flexibility but produce a high volume of product at a low cost per unit
- **Technology** can facilitate increased flexibility because may be used to make changes to processes without needing new equipment
- Nevertheless there are **extra costs** involved in having too much or too little flexibility

Manufacturing and Service are Inevitably Linked: Where is the “Centre of Gravity”?



Source: *High-value manufacturing, IfM, 2006*

Design of Service Operations

Goods versus Services

Pure Goods

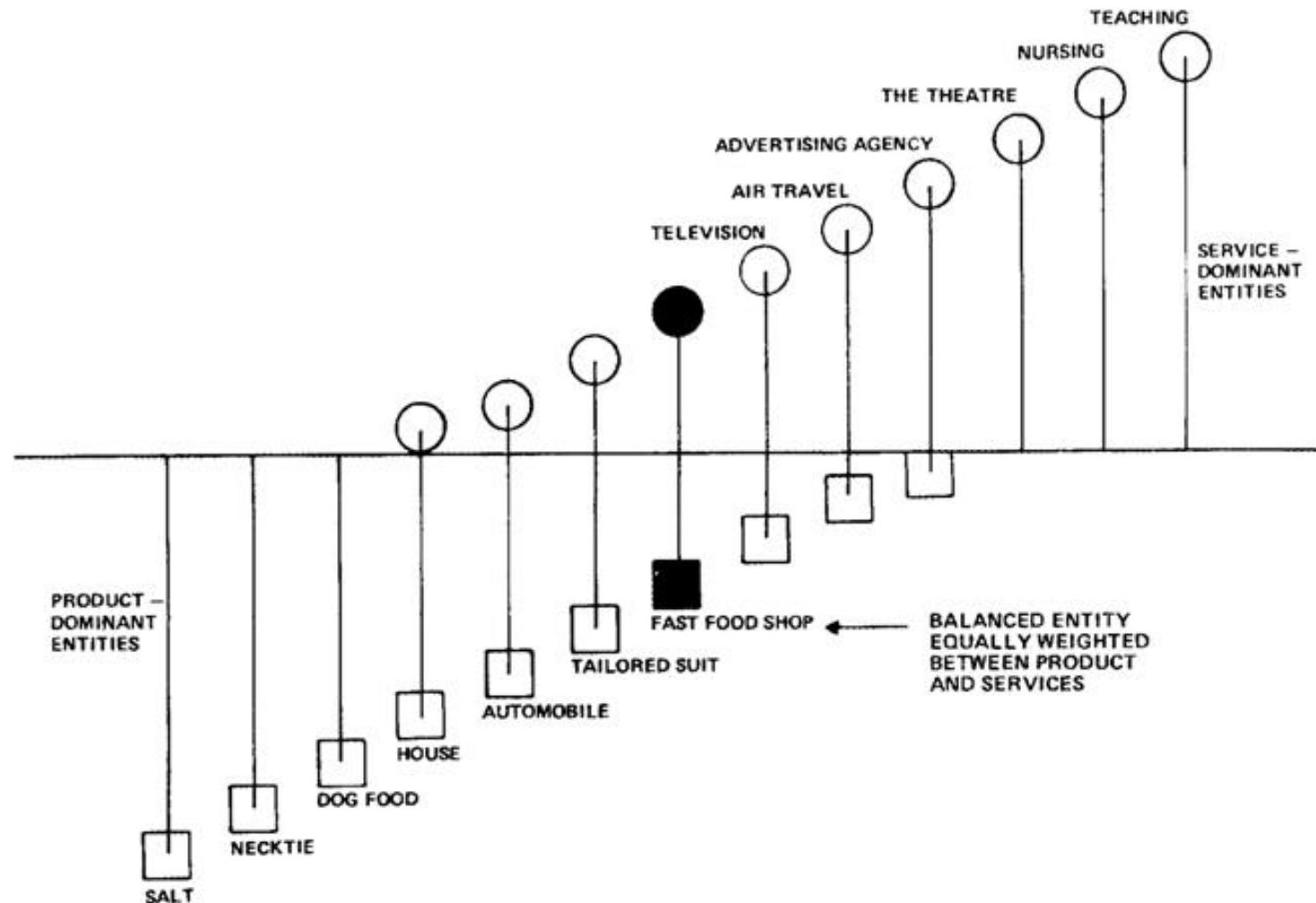
- Tangible
- Can be stored
- Production precedes consumption
- Low customer contact
- Can be transported
- Quality is evident

Pure Services

- Intangible
- Cannot be stored
- Production and consumption are simultaneous
- High customer contact → inherent variability
- Cannot be transported
- Quality difficult to judge

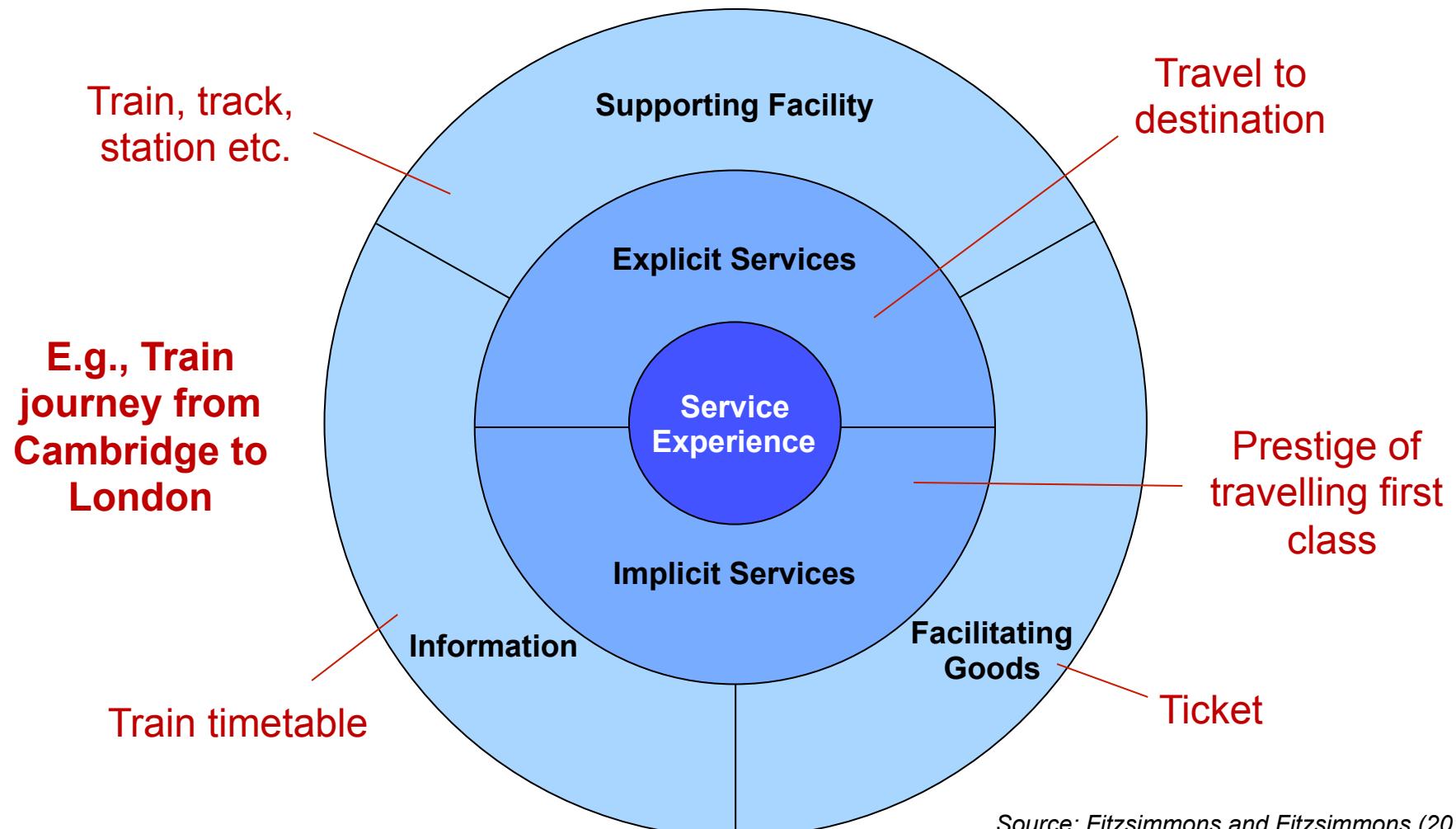
The Product/Service Continuum

There are very few pure products or pure services



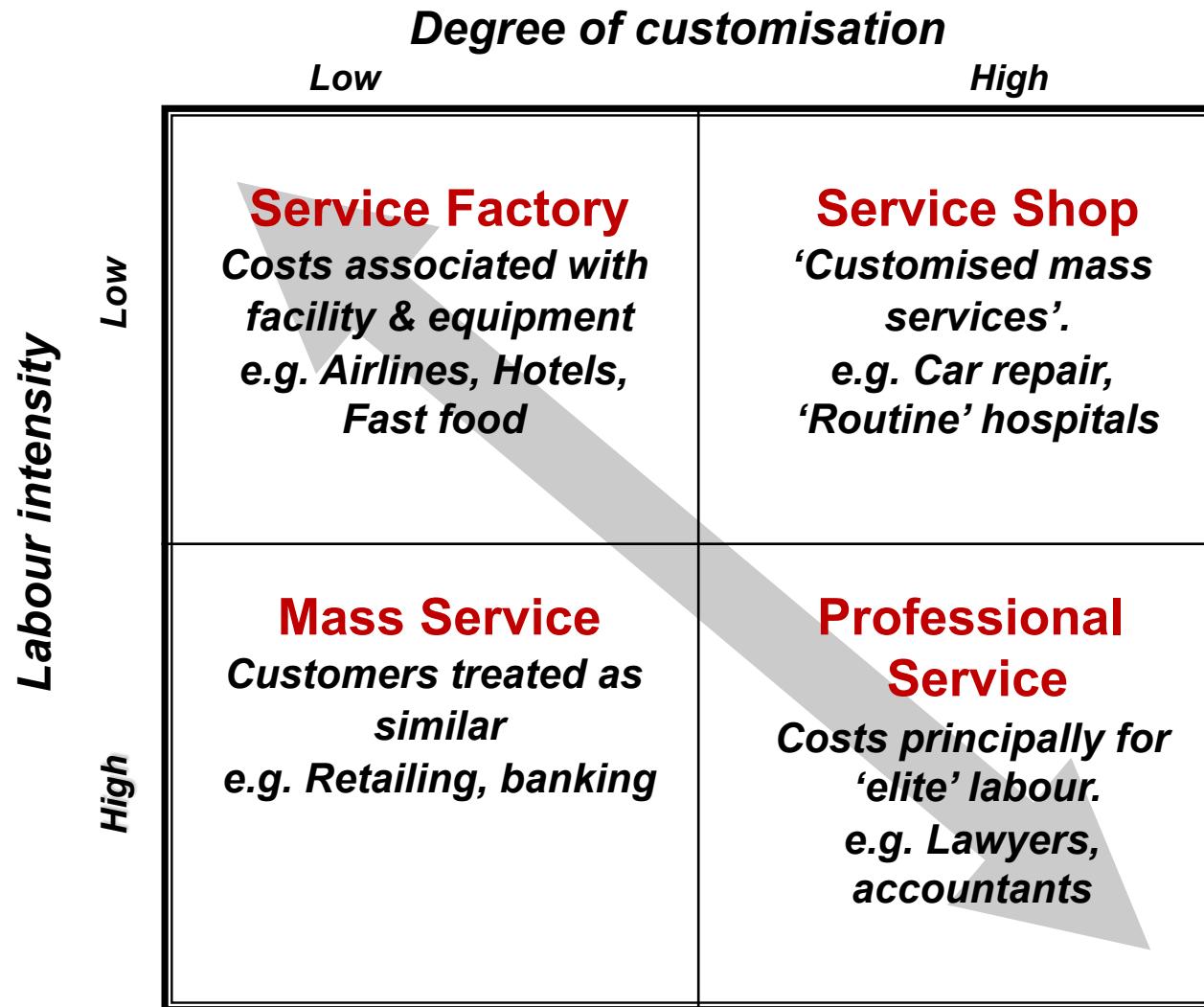
The Service Package

The service experience comes from a package of goods, services and information



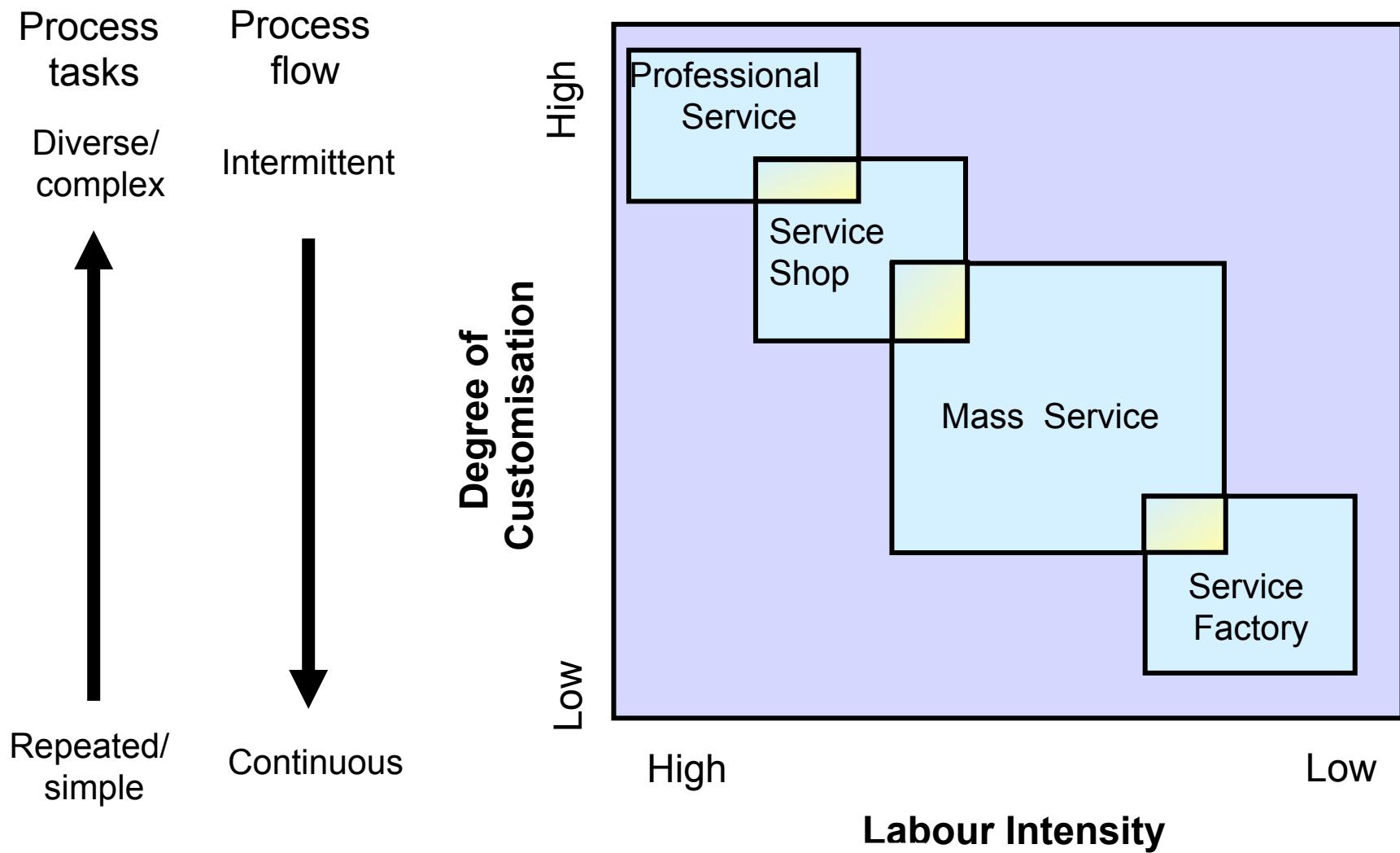
Source: Fitzsimmons and Fitzsimmons (2011)
Service Management

Schmenner's Service Process Matrix



Source: Roger Schmenner, *Service Operations Management*: Prentice Hall

The “Natural” Diagonal for Services?



Takeaways from Today

- The **process** is the basic unit of analysis in OM
- Process effectiveness is determined based on:
 - **Quality, Speed, Dependability, Flexibility and Cost**
- There are **trade-offs** between these performance objectives that can be shifted but not broken
- Manufacturing and service processes conform to distinct types depending on **variety** and **volume**
- The design of service processes shares many similarities with the design of manufacturing processes

Preparation for Next Class

Readings:

- Slack *et al.*, “Operations Management”:
 - Chp 12 (Inventory Planning and Control)

Preparatory Questions:

- What is the role of inventory?
- When is inventory needed and when might you want to reduce it?

Operations Management

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