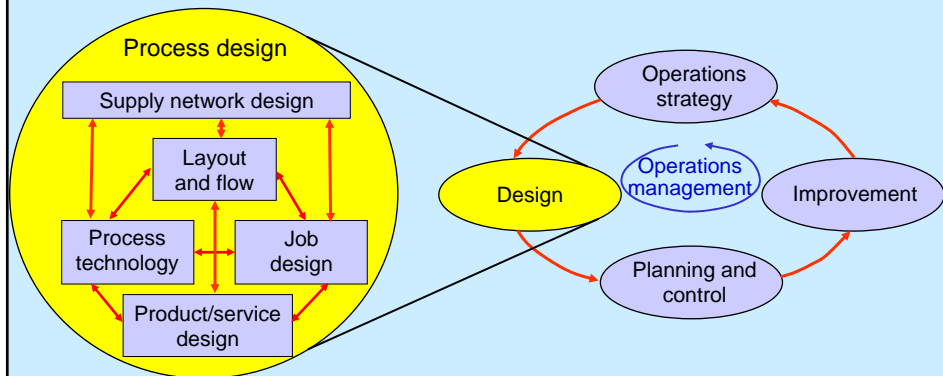


Process design



Source: Joe Schwarz, www.joyrides.com

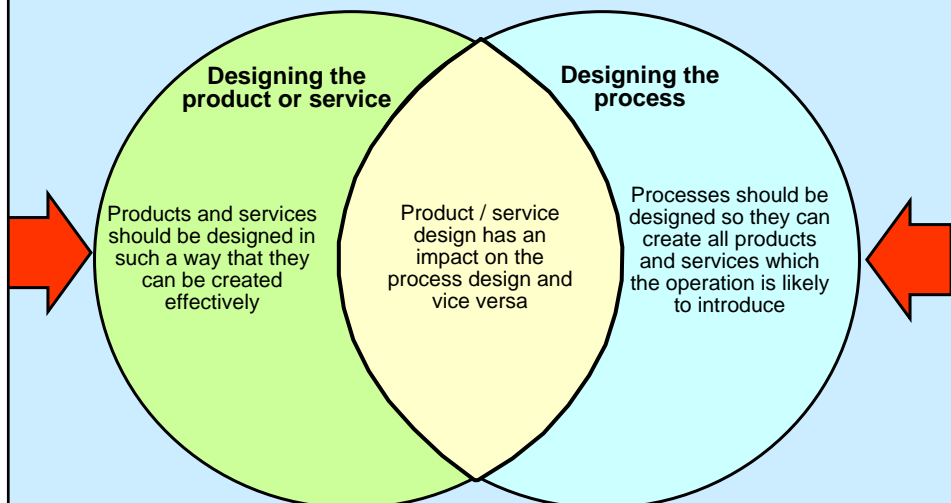
Process design

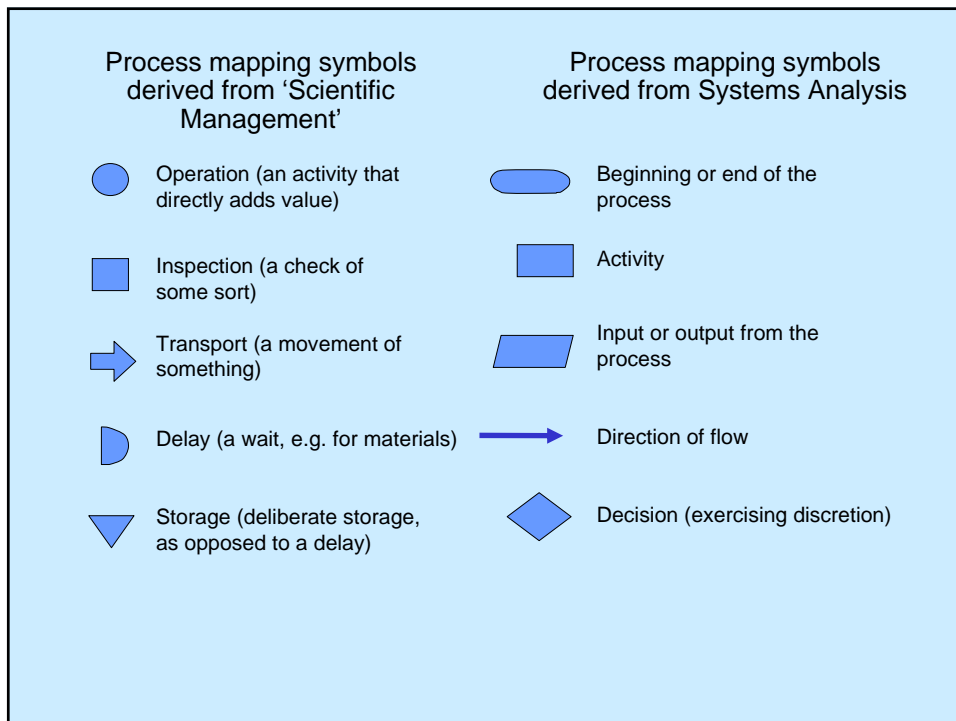
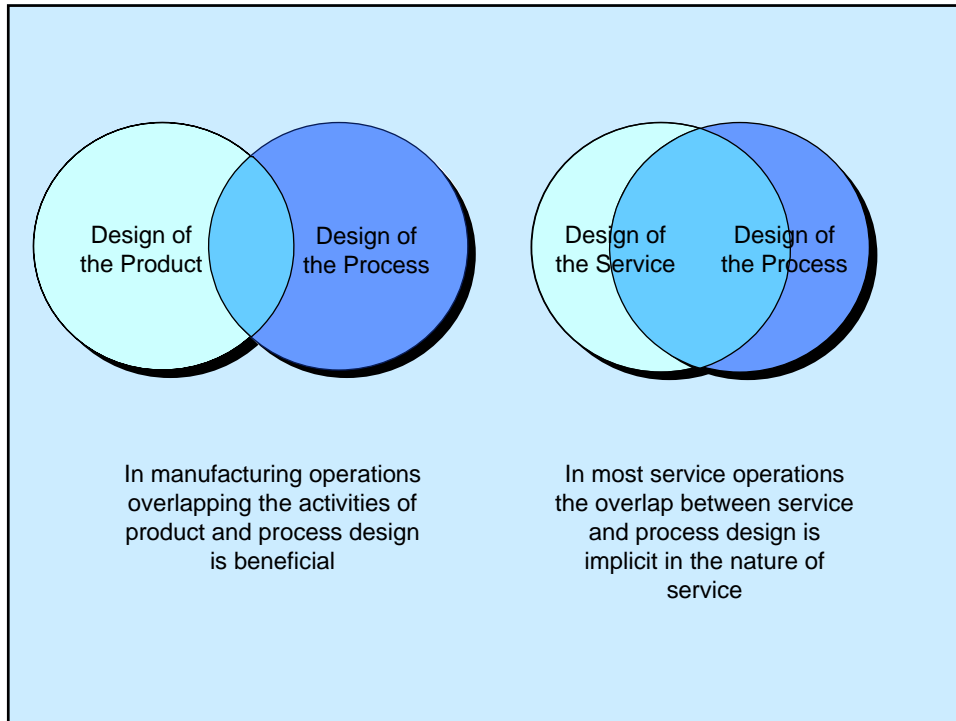


Nature and purpose of the design activity

- Products, services and the processes which produce them all have to be designed
- Decisions taken during the design of a product or service will have an impact on the decisions taken during the design of the process which produces those products or services, and vice versa

Design of products / services and design of processes are interrelated and should be treated together





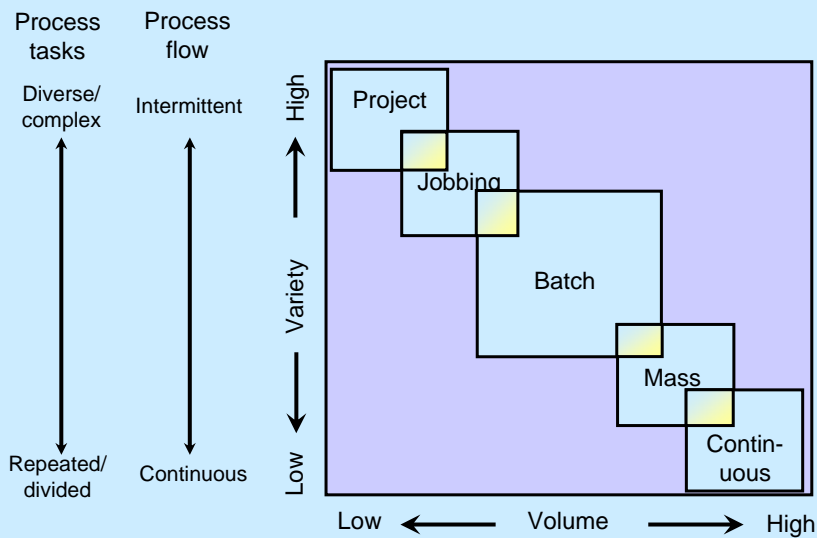
Designing processes

There are different 'process types'

Process types are defined by the volume and variety of 'items' they process

Process types go by different names depending on whether they produce products or services

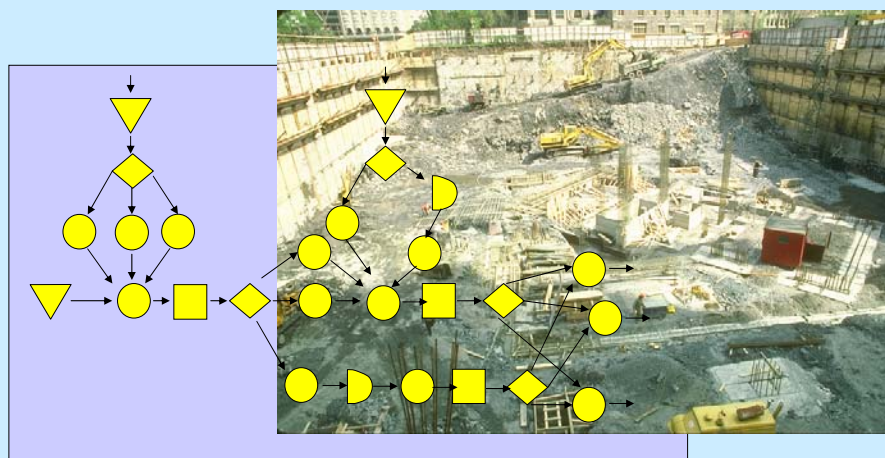
Manufacturing process types



Project processes

- One-off, complex, large-scale 'products' with high work content
- Specially made, every one 'customized'
- Defined start and finish: time, quality and cost objectives
- Many different skills have to be coordinated

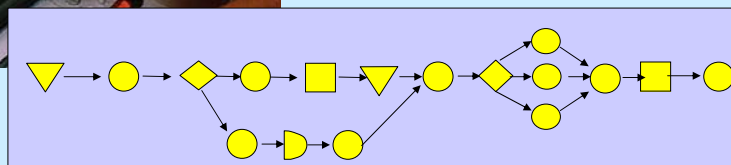
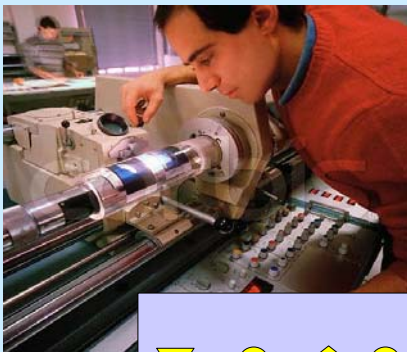
A project process with a small part of the process map that would describe the whole process



Jobbing processes

- Very small quantities: 'one-offs', or only a few required
- Specially made: high variety, low repetition, 'strangers', every one 'customized'
- Skill requirements are usually very broad
- Skilled jobber, or team, completes whole product

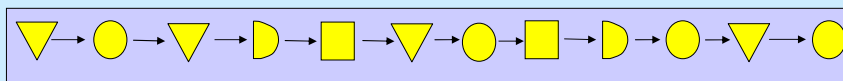
Preparing photolithography materials on a jobbing basis with a typical process map



Batch processes

- Higher volumes and lower variety than for jobbing
- Standard products, repeating demand. But can make specials
- Specialized, narrower skills
- Set-ups (changeovers) at each stage of production

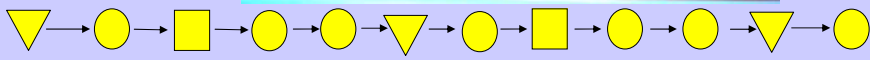
A batch process in a kitchen together with an illustrative process map



Mass (line) processes

- Higher volumes than batch
- Standard, repeat products ('runners')
- Low and/or narrow skills
- No set-ups, or almost instantaneous ones

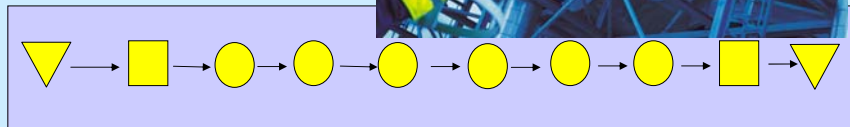
A mass process – a packing process

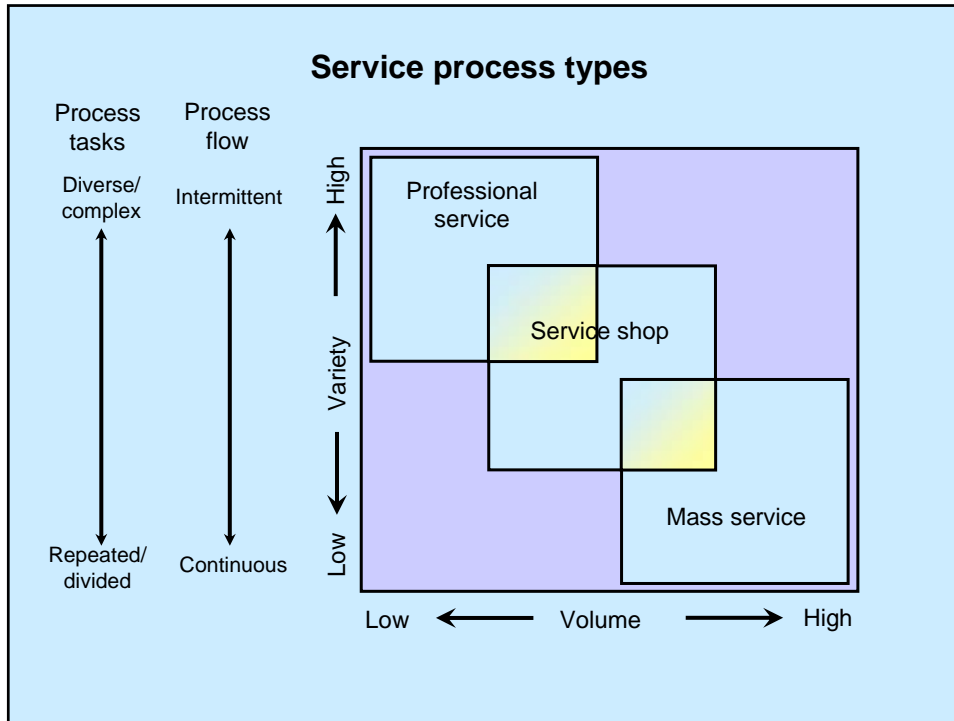


Continuous processes

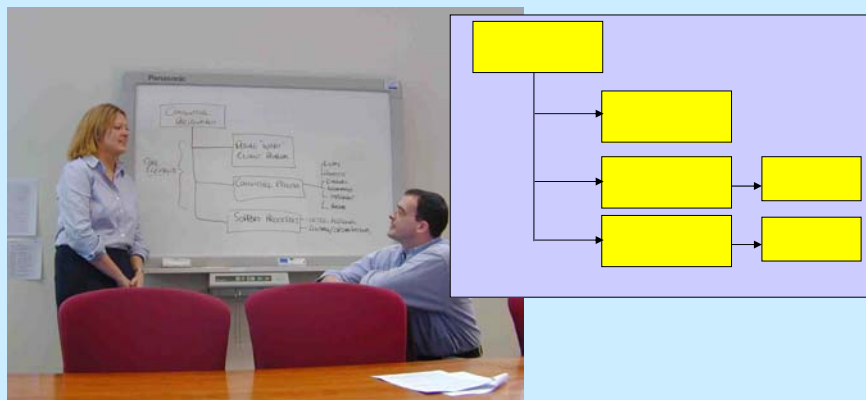
- Extremely high volumes and low variety: often single product
- Standard, repeat products ('runners')
- Highly capital-intensive and automated
- Few changeovers required
- Difficult and expensive to start and stop the process

Part of a continuous process and a typical process map

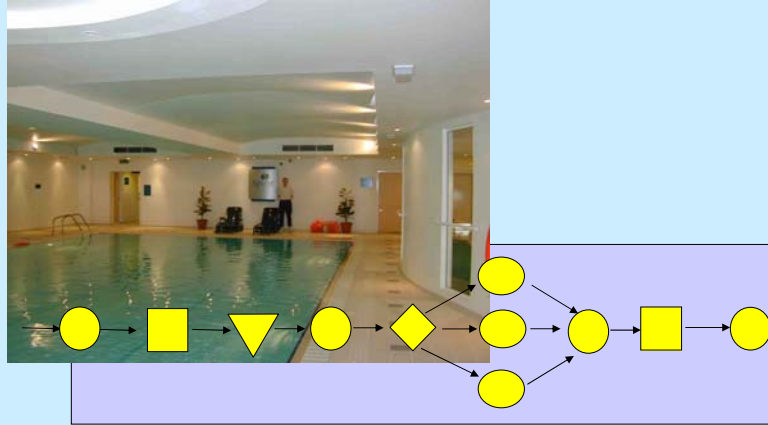




A professional service – Consultants planning how best to help their client



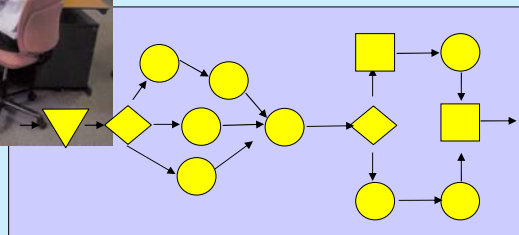
A service shop – This health club offers some variety within a standard set of facilities and processes



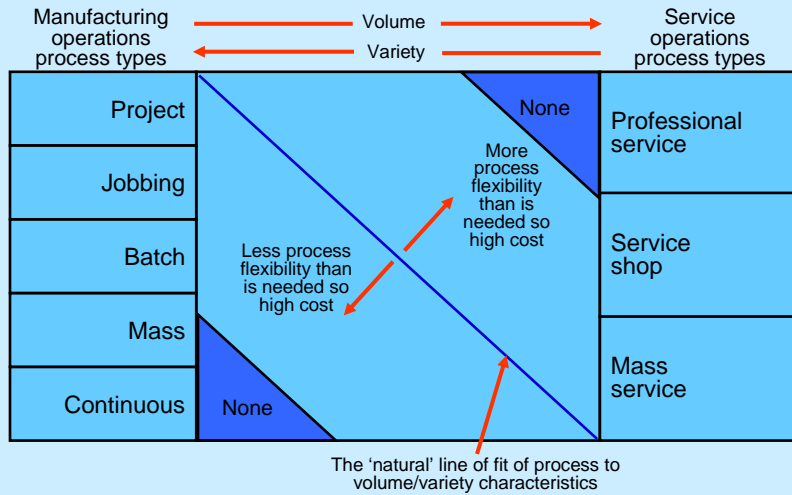
A mass service – This call centre can handle a very high volume of customer enquiries because it standardizes its process



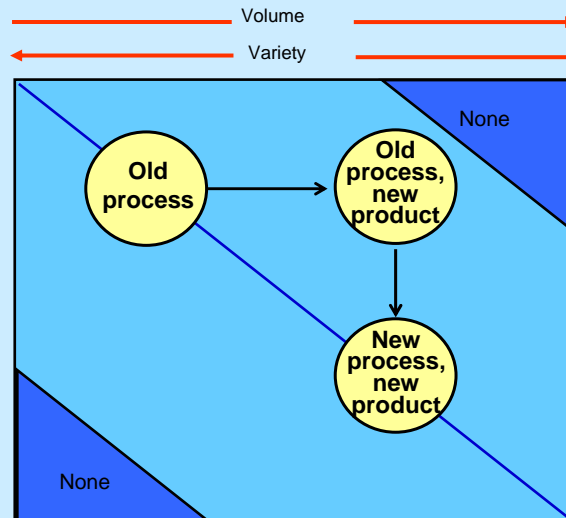
Source: Royal Bank of Scotland Group

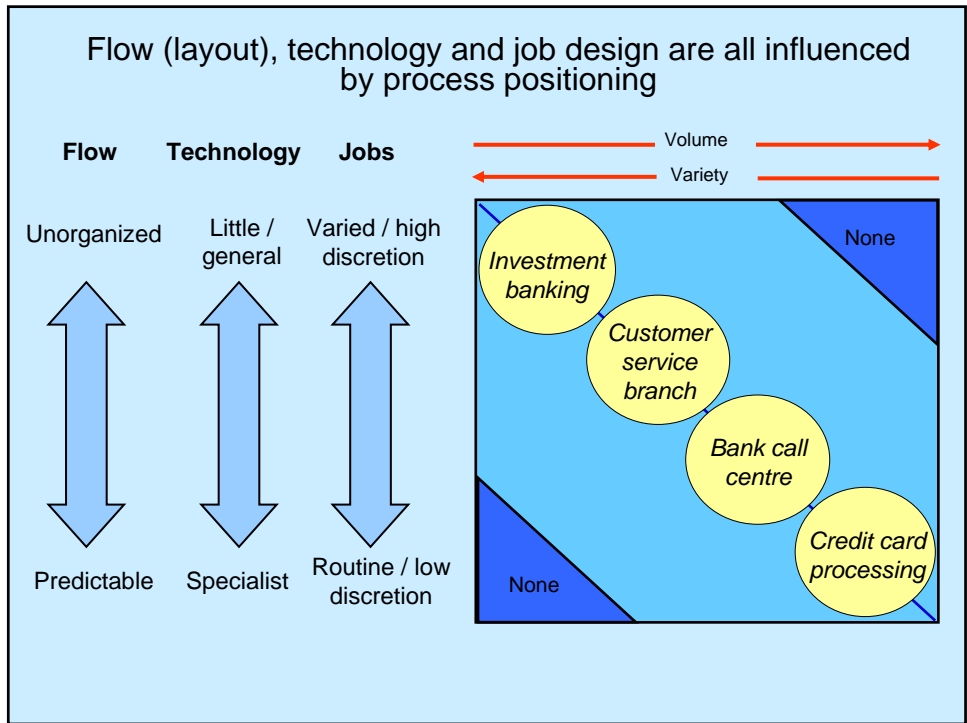
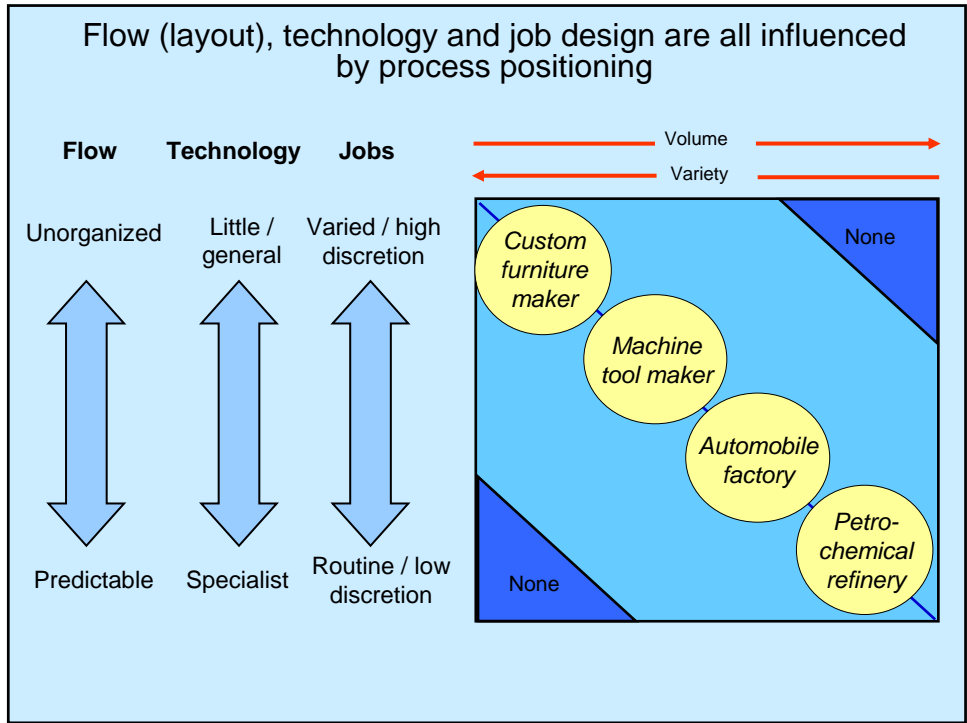


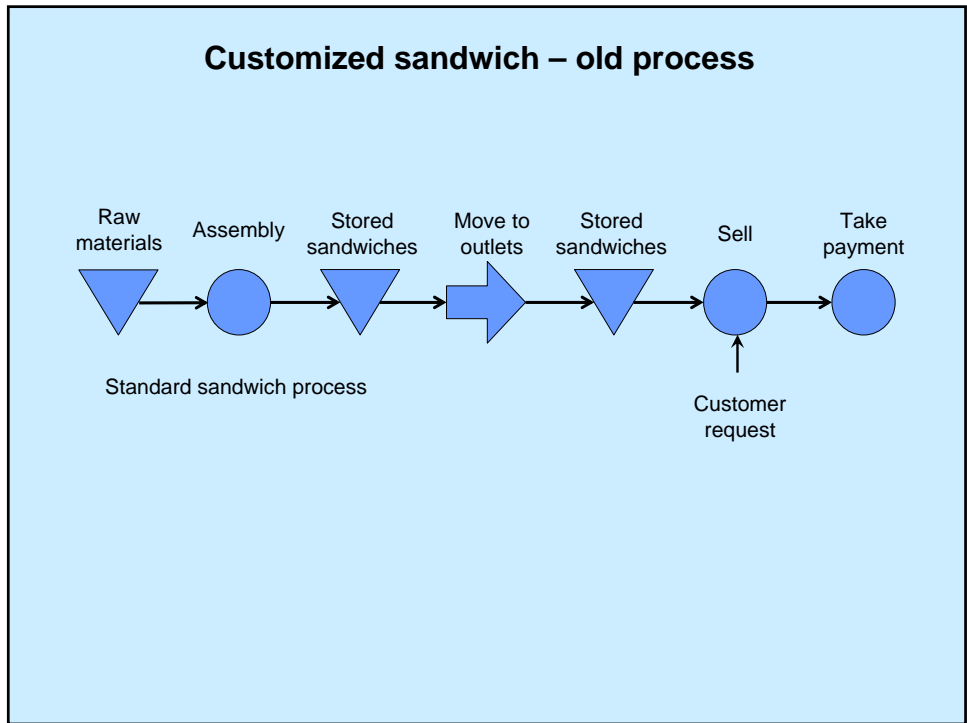
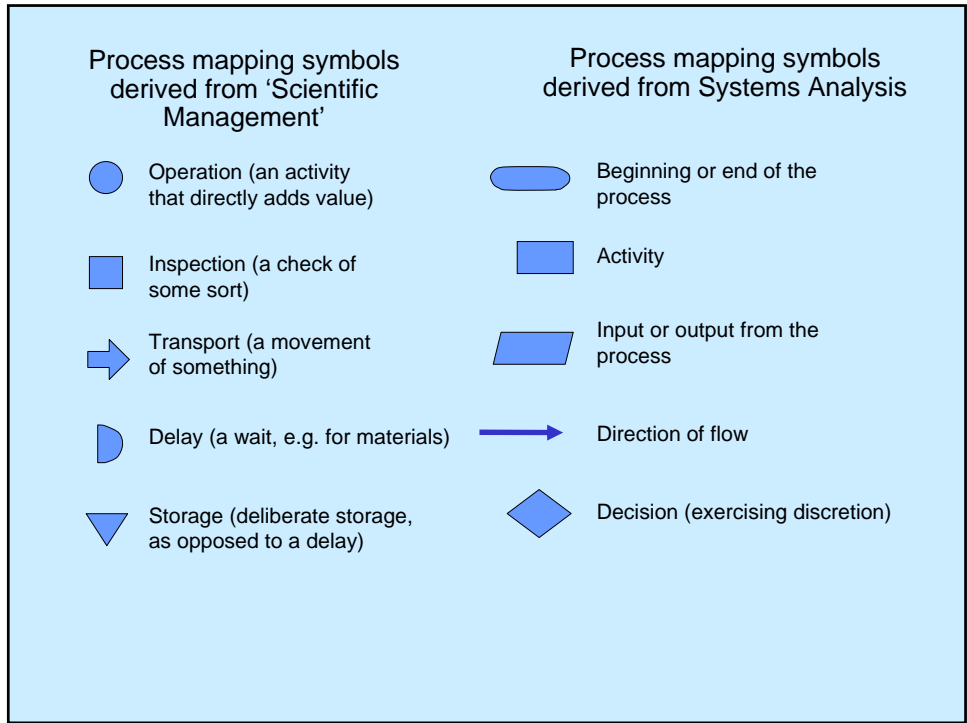
Deviating from the 'natural' diagonal on the product-process matrix has consequences for cost and flexibility



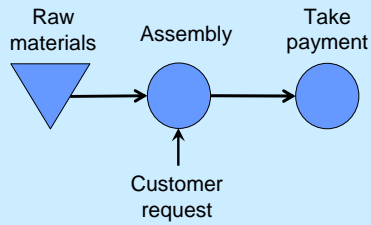
Deviating from the 'natural' diagonal on the product-process matrix has consequences for cost and flexibility



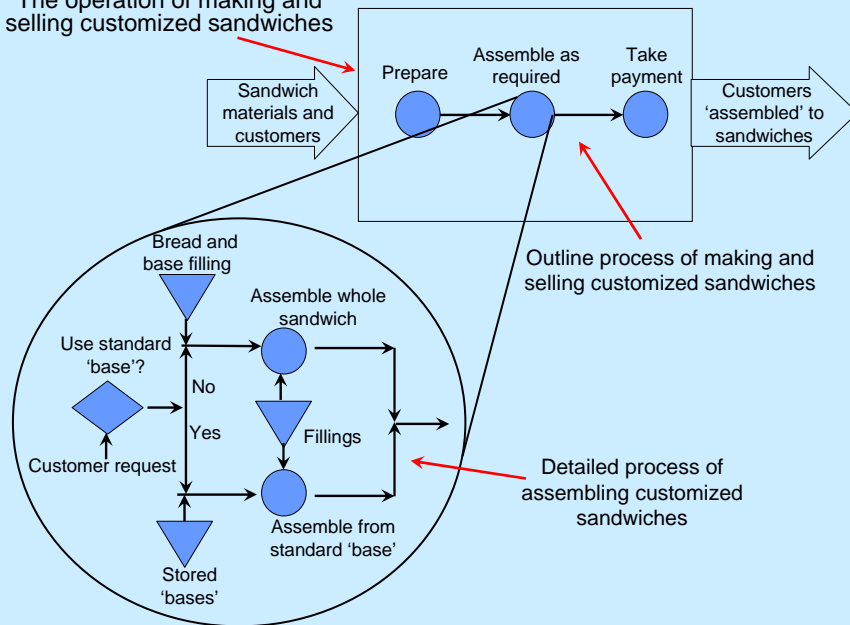




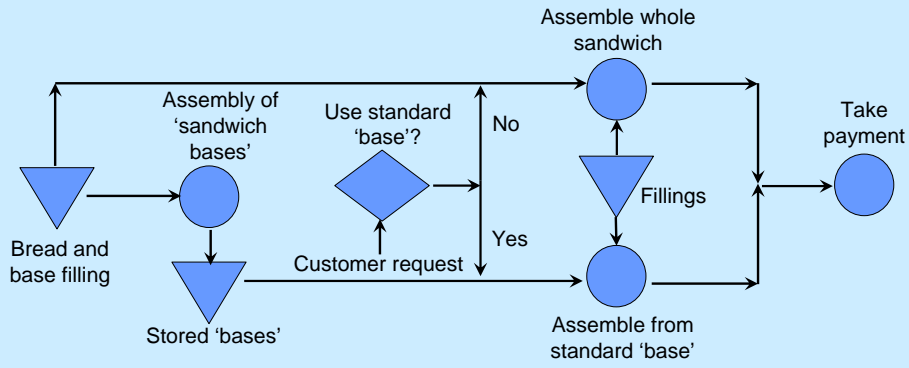
Customized sandwich – old process



The operation of making and selling customized sandwiches



Customized sandwich – new process



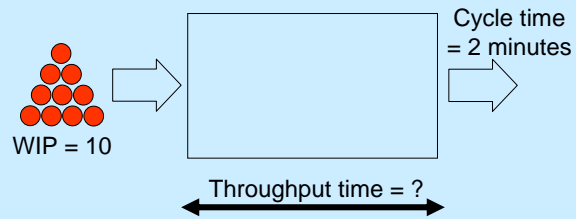
Flow process charts for processing expense reports at Intel before and after improving the process

	Description of activity	○	⇒	□	▽
1	Report arrives	○	⇒	□	▽
2	Wait for processing	○	⇒	□	▽
3	Check expenses report	○	⇒	□	▽
4	Stamp and date report	○	⇒	□	▽
5	Send cash to receipt desk	○	⇒	□	▽
6	Wait for processing	○	⇒	□	▽
7	Check advance payment	○	⇒	□	▽
8	Send to accounts receivable	○	⇒	□	▽
9	Wait for processing	○	⇒	□	▽
10	Check employee record	○	⇒	□	▽
11	Send to account payable	○	⇒	□	▽
12	Attach payment voucher	○	⇒	□	▽
13	Log report	○	⇒	□	▽
14	Check against rules	○	⇒	□	▽
15	Wait for batching	○	⇒	□	▽
16	Collect reports into batch	○	⇒	□	▽
17	Batch to audit desk	○	⇒	□	▽
18	Wait for processing	○	⇒	□	▽
19	Batch of reports logged	○	⇒	□	▽
20	Check payment voucher	○	⇒	□	▽
21	Reports to batch control	○	⇒	□	▽
22	Batch control number	○	⇒	□	▽
23	Copy of reports to filing	○	⇒	□	▽
24	Reports filed	○	⇒	□	▽
25	Payment voucher to keying	○	⇒	□	▽
26	Confirm payment	○	⇒	□	▽
Totals		7	8	5	1

	Description of activity	○	⇒	□	▽
1	Report arrives	○	⇒	□	▽
2	Stamp and date report	○	⇒	□	▽
3	Check expenses report	○	⇒	□	▽
4	Attach payment voucher	○	⇒	□	▽
5	Wait for batching	○	⇒	□	▽
6	Collect reports into batch	○	⇒	□	▽
7	Batch to audit desk	○	⇒	□	▽
8	Wait for processing	○	⇒	□	▽
9	Check reports and vouchers	○	⇒	□	▽
10	Reports to batch control	○	⇒	□	▽
11	Batch control number	○	⇒	□	▽
12	Copy of reports to filing	○	⇒	□	▽
13	Reports filed	○	⇒	□	▽
14	Payment voucher to keying	○	⇒	□	▽
15	Confirm payment	○	⇒	□	▽
Totals		5	5	2	1

Little's law (a really quite useful law)

$$\text{Throughput (TH)} = \text{Work in process (WIP)} \times \text{Cycle time (CT)}$$



$$\begin{aligned} \text{Throughput time} &= 10 \times 2 \text{ minutes} \\ &= 20 \text{ minutes} \end{aligned}$$

Little's law (a really quite useful law)

$$\text{Throughput (TH)} = \text{Work in process (WIP)} \times \text{Cycle time (CT)}$$

500 exam scripts need to be marked in 5 days (working 7 hours a day).
It takes 1 hour to mark a script. How many markers are needed?

$$\text{Throughput time} = 5 \text{ days} \times 7 \text{ hours} = 35 \text{ hours}$$

$$35 \text{ hours} = 500 \text{ scripts} \times \text{Cycle time}$$

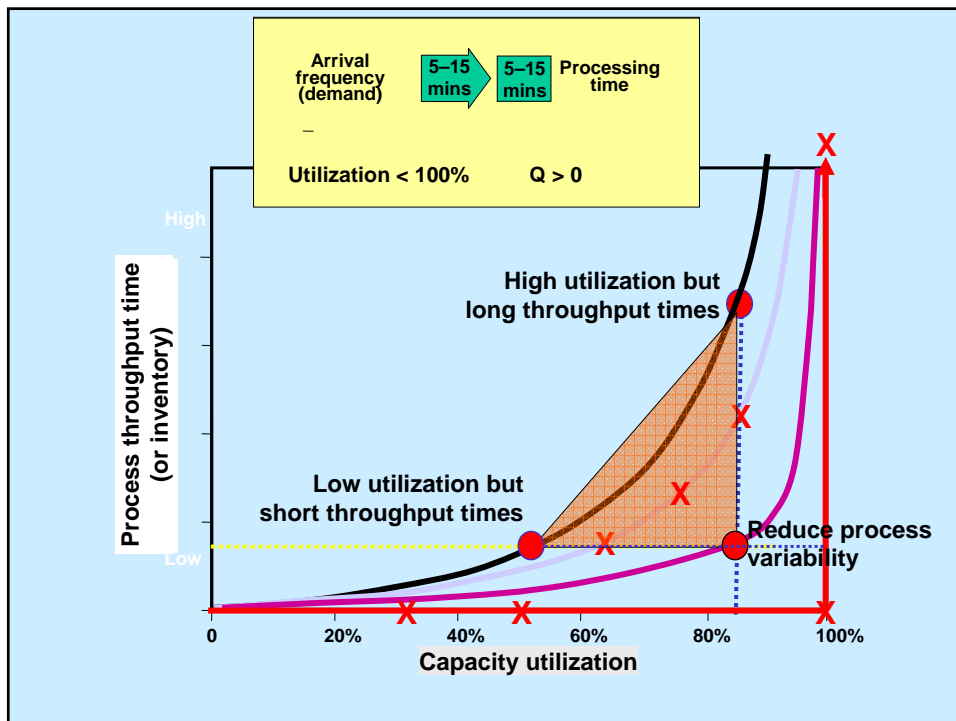
$$\text{Cycle time} = \frac{35 \text{ hours}}{500 \text{ scripts}} = 0.07 \text{ hours}$$

$$\text{Number of markers} = \frac{\text{Work content}}{\text{Cycle time}} = \frac{1 \text{ hour}}{0.07} = 14.29$$

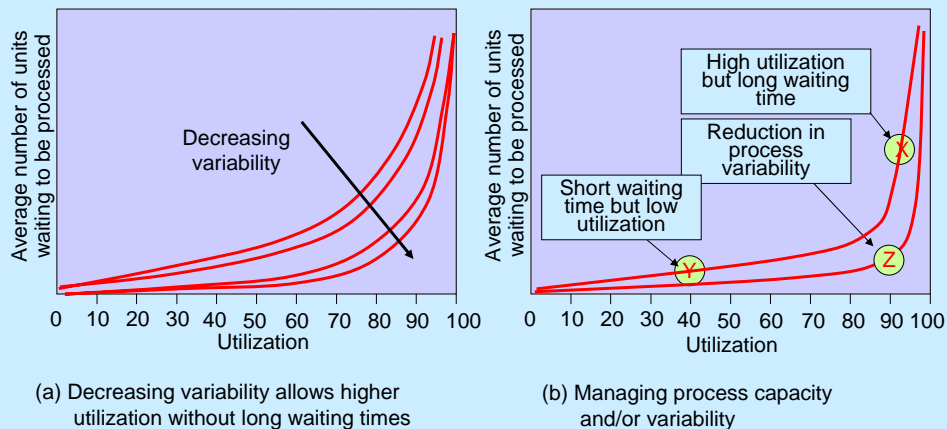
Throughput efficiency

Throughput efficiency is the work content of whatever is being processed as a percentage of its throughput time

$$\text{Throughput efficiency} = \frac{\text{Work content}}{\text{Throughput time}} \times 100$$



The relationship between process utilization and number of units waiting to be processed for variable arrival and activity times



Key Terms Test

Throughput time

The time for a unit to move through a process.

Utilization

The ratio of the actual output from a process or facility to its design capacity.

Life cycle analysis

A technique that analyzes all the production inputs, the life cycle use of a product and its final disposal in terms of total energy used and wastes emitted.

Key Terms Test

Process types

Terms that are used to describe a particular general approach to managing processes. In manufacturing these are generally held to be project, jobbing, batch, mass and continuous processes; in services they are held to be professional services, service shops and mass services.

Project processes

Processes that deal with discrete, usually highly customized, products.

Jobbing processes

Processes that deal with high variety and low volumes, although there may be some repetition of flow and activities.

Key Terms Test

Batch processes

Processes that treat batches of products together, and where each batch has its own process route.

Continuous processes

Processes that are high volume and low variety; usually products made on continuous processes are produced in an endless flow, such as petrochemicals or electricity.

Professional services

Service processes that are devoted to producing knowledge-based or advice-based services, usually involving high customer contact and high customization. Examples include management consultants, lawyers, architects, etc.

Key Terms Test

Service shops

Service processes that are positioned between professional services and mass services, usually with medium levels of volume and customization.

Mass services

Service processes that have a high number of transactions, often involving limited customization, for example mass transportation services, call centres, etc.

Product–process matrix

A model derived by Hayes and Wheelwright that demonstrates the natural fit between volume and variety of products and services produced by an operation on one hand, and the process type used to produce products and services on the other.

Key Terms Test

Process mapping

Describing processes in terms of how the activities within the process relate to each other (may also be called process blueprinting or process analysis).

Process mapping symbols

The symbols that are used to classify different types of activity, usually derived either from scientific management or from information systems flowcharting.

High-level process mapping

An aggregated process map that shows broad activities rather than detailed activities (sometimes called an outline process map).

Key Terms Test

Work content

The total amount of work required to produce a unit of output, usually measured in standard times.

Throughput time

The time for a unit to move through a process.

Cycle time

The average time between units of output emerging from a process.

Key Terms Test

Work-in-process

The number of units within a process waiting to be processed further (also called work-in-progress).

Little's Law

The mathematical relationship between throughput time, work-in-process and cycle time:

$$\text{Throughput time} = \text{work-in-process} \times \text{cycle time}$$