

Operational Analytics (Part 1)

LECTURE NOTES COMPILED BY

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FOR INFOSYS E4

References

Operations Management, Seventh Edition

- Nigel Slack, Alistair Brandon-Jones, Robert Johnston

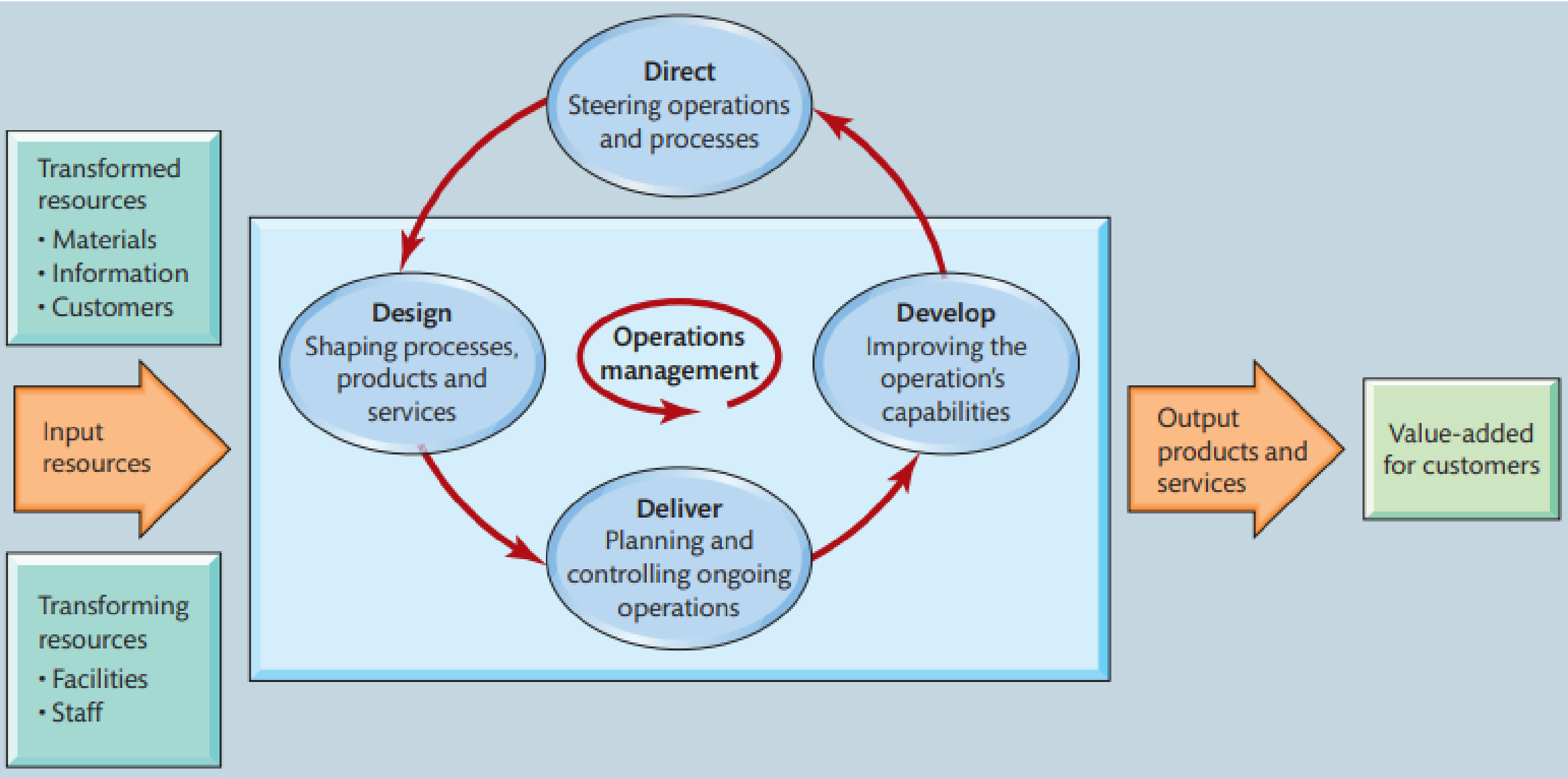
What is Operational Analytics and its Use Cases?

- <https://www.mongodb.com/databases/operational-analytics>

Operational Analytics: Implementation, Best Practices, and Use Cases

- <https://www.netsuite.com/portal/resource/articles/erp/operational-analytics.shtml>

Operations Management



What is operations management? (1)

Operations management is **about how organizations create and deliver services and products.**

- Everything you wear, eat, sit on, use, read, or knock about on the sports field comes to you courtesy of the operations managers who organized its creation and delivery.
- Every book you borrow from the library, every treatment you receive at the hospital, every service you expect in the shops, and every lecture you attend at university – operations have created these.

While the people who supervised their creation and delivery may not always be called operations managers, that is what they really are.

*** Operations principle**

All organizations have 'operations' that produce some mix of services and products.

What is operations management? (2)

Operations management is the managing of resources that create and deliver services and products.

The operations function is the part of the organization that is responsible for this activity.

- Every organization has an operations function because every organization creates some type of services and/or products.
- However, not all types of organizations will necessarily call the operations function by this name.
 - The term 'operations function' can also be called 'the operation' or 'operations'
- Operations managers are the people who have particular responsibility for managing some, or all, of the resources which comprise the operations function.
 - In some organizations, the operations manager could be called by some other name like the 'fleet manager' in a distribution company, the 'administrative manager' in a hospital, or the 'store manager' in a supermarket.

Operations in the Organization (1)

The operations function is central to the organization because it creates and delivers services and products, which is its reason for existing.

The operations function is one of the three core functions of any organization:

- **the marketing (including sales) function** – which is responsible for communicating the organization's services and products to its markets to generate customer requests;
- **the product/service development function** – which is responsible for coming up with new and modified services and products to generate future customer requests;
- **the operations function** – which is responsible for the creation and delivery of services and products based on customer requests.

Operations in the Organization (2)

Support functions that enable the core functions to operate effectively:

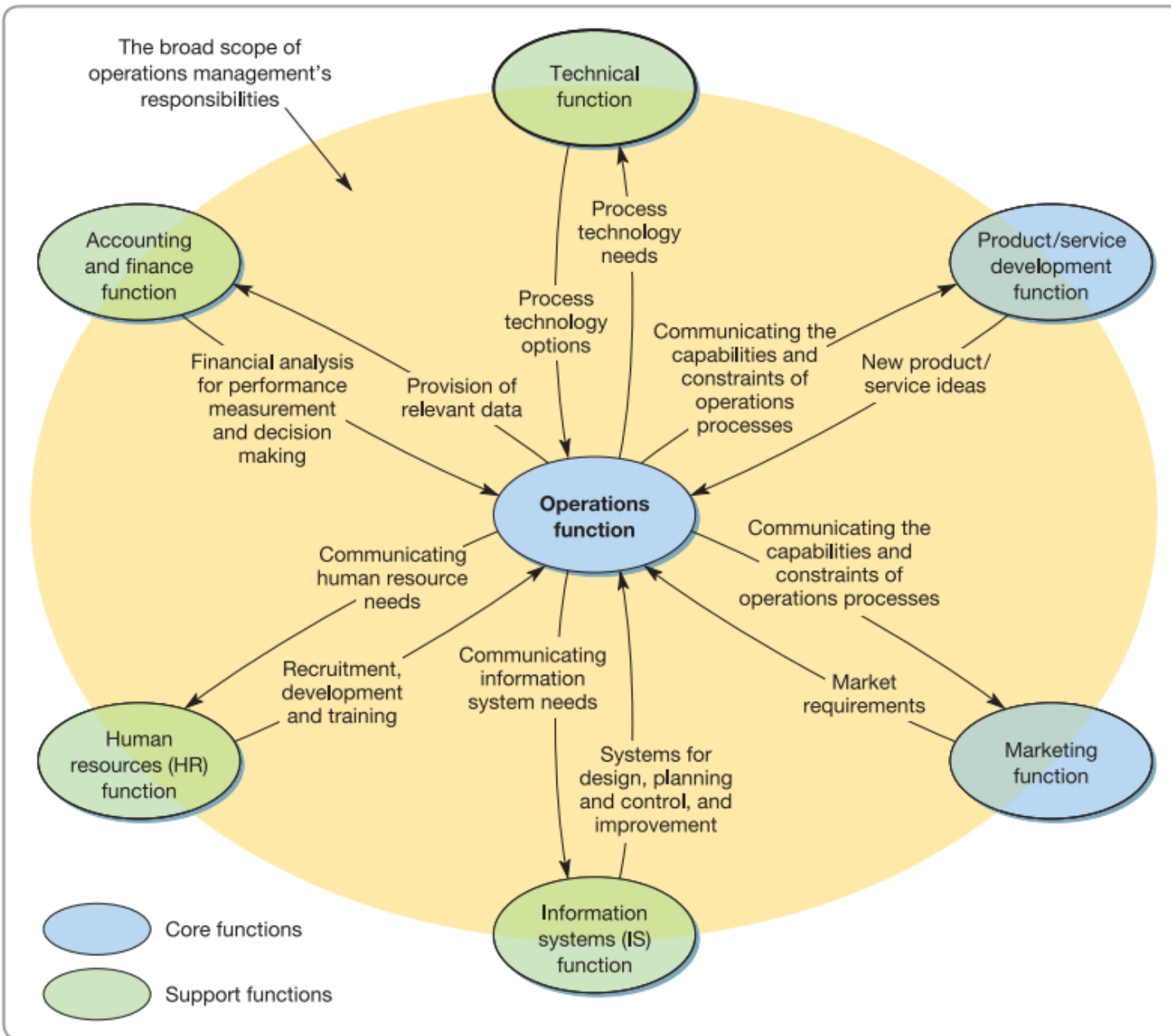
- the accounting and finance function
- the technical function
- the human resources function
- the information systems function
- others

*** Operations principle**

Operations managers need to co-operate with other functions to ensure effective organizational performance.

The activities of core functions in some organizations

<i>Core functional activities</i>	<i>Internet service provider (ISP)</i>	<i>Fast food chain</i>	<i>International aid charity</i>	<i>Furniture manufacturer</i>
Operations	Maintain hardware, software and content Implement new links and services	Make burgers, etc. Serve customers Maintain equipment	Give service to the beneficiaries of the charity	Make components Assemble furniture
Marketing and sales	Promote services to users and get registrations Sell advertising space	Advertise on TV Devise promotional materials	Develop funding contracts Mail out appeals for donations	Advertise in magazines Determine pricing policy Sell to stores
Product/service development	Devise new services and commission new information content	Design hamburgers, pizzas, etc. Design decor for restaurants	Develop new appeals campaigns Design new assistance programmes	Design new furniture Co-ordinate with fashionable colours



- Although this image is not comprehensive, it gives an idea of the nature of each relationship.
- However, note that the support functions have a different relationship with operations than the other core functions.
- Operations management's responsibility to support functions is primarily to make sure that they understand operations' needs and help them to satisfy these needs.

The relationship between the operations function and other core and support functions of the organization

The Importance of Operations Management in all types of Organizations (1)



Source: Shutterstock/Evgeny Varlamov

Automobile assembly factory – *operations management uses machines to efficiently assemble products that satisfy current customer demands*

* Operations principle

The economic sector of an operation is less important in determining how it should be managed than its intrinsic characteristics.



Source: Shutterstock/PT Images

Physician (general practitioner) – *operations management uses knowledge to effectively diagnose conditions in order to treat real and perceived patient concerns*

The Importance of Operations Management in all types of Organizations (2)



Source: Shutterstock/Zurijeta

Disaster relief charity – *operations management uses our and our partners' resources to speedily provide the supplies and services that relieve community suffering*



Source: Shutterstock/Diego Cervo

Management consultant – *operations management uses people to effectively create the services that will address current and potential client needs*



Source: Shutterstock/Luciano Mortula

Advertising agency – *operations management uses our staff's knowledge and experience to creatively present ideas that delight clients and address their real needs*

Operations management uses resources to appropriately create outputs that fulfil defined market requirements.

Operations management uses . . .

resources

to

appropriately

create

outputs

that

fulfil

defined

market

requirements

experience

people

machines

knowledge

partners

etc.

effectively

efficiently

creatively

etc.

produce

change

sell

assemble

move

cure

shape

etc.

ideas

products

services

etc.

match

satisfy

exceed

delight

etc.

potential

perceived

current

emerging

real

etc.

citizens'

client

customer

society

etc.

dreams

demands

needs

concerns

etc.

Operations management for the smaller organization

Irrespective of their size, all companies need to create and deliver their services and products efficiently and effectively.

However, in practice, managing operations in a small or medium size organization has its own set of problems.

Large companies may have the resources to dedicate individuals to specialized tasks, but smaller companies often cannot, so people may have to do different jobs as the need arises.

Such an informal structure can allow the company to respond quickly as opportunities or problems present themselves.

But decision making can also become confused as individuals' roles overlap.

Small companies may have the same operations management issues as large ones, but they can be more difficult to separate from the mass of other issues in the organization.

Operations management in not-for-profit organizations (1)

Operations management is also relevant to organizations whose purpose is not primarily to earn profits.

Managing the operations in an animal welfare charity, hospital, research organization or government department is essentially the same as in commercial organizations.

Operations must take the same decisions:

- how to create and deliver services and products
- invest in technology
- contract out some of their activities
- devise performance measures
- improve their operations performance
- And so on

Operations management in not-for-profit organizations (2)

The strategic objectives of not-for-profit organizations may be more complex and involve a mixture of political, economic, social or environmental objectives.

Because of this, there may be a greater chance of operations decisions being made under conditions of conflicting objectives.

For example, it is the operations staff in a children's welfare department who must face the conflict between the cost of providing extra social workers and the risk of a child not receiving adequate protection.

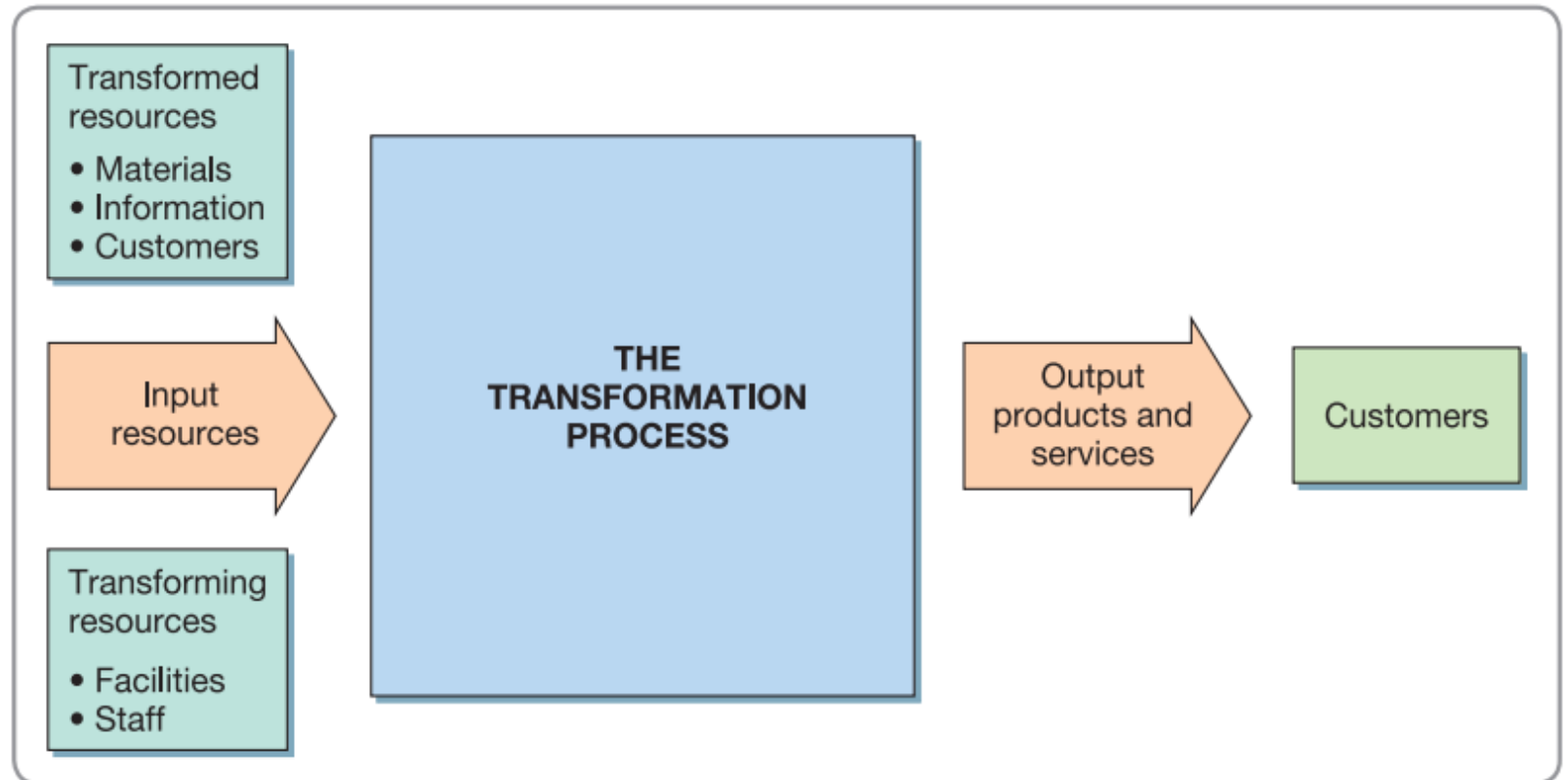
The Input– Transformation– Output Process

I-T-O Process done by operations (1)

All operations create and deliver services and products by changing inputs into outputs using an 'input-transformation-output' process

* Operations principle

All processes have inputs of transforming and transformed resources that they use to create products and services.



All operations are input-transformation-output processes

I-T-O Process done by operations (2)

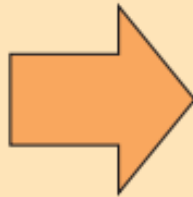
Put simply, operations are processes that take in a set of input resources which are used to transform something, or are transformed themselves, into outputs of services and products.

And although all operations conform to this general input-transformation-output model, they differ in their specific inputs and outputs.

The business environment is changing . . .

For example . . .

- Increased cost-based competition
- Higher quality expectations
- Demands for better service
- More choice and variety
- Rapidly developing technologies
- Frequent new product/service introduction
- Increased ethical sensitivity
- Environmental impacts are more transparent
- More legal regulation
- Greater security awareness



Prompting operations responses . . .

For example . . .

- Globalization of operations networking
- Information-based technologies
- Co-creation of service
- Internet-based integration of operations activities
- Supply chain management
- Customer relationship management
- Flexible working patterns
- Mass customization
- Fast time-to-market methods
- Lean process design
- Environmentally sensitive design
- Supplier 'partnership' and development
- Failure analysis
- Business recovery planning

Changes in the business environment are shaping a new operations agenda

Inputs to the process (1)

One set of inputs to any operation's processes are **transformed resources**.

- These are the resources that are treated, transformed or converted in the process.

Transformed resources are usually a mixture of the following:

Materials

- Operations which process materials could do so to transform their ***physical properties*** (shape or composition, for example) like manufacturing operations.
- Other operations process materials to change their ***location*** (parcel delivery companies, for example).
- Retail operations change the ***possession*** of the materials.
- Some operations ***store*** materials, such as warehouses.

* Operations principle

Transformed resource inputs to a process are materials, information or customers.

Inputs to the process (2)

Information

- operations which process information could do so to transform their ***informational properties*** (that is ,the purpose or form of the information) like what accountants do.
- Some change the ***possession*** of the information (for example market research companies sell information).
- Some ***store*** the information, for example archives and libraries.
- Some operations, such as telecommunication cmpanies, change the ***location*** of the information.

Inputs to the process (3)

Customers

- operations which process customers might change their *physical properties* in a similar way to materials processors like hairdressers or cosmetic surgeons.
- Some **store** (or more politely **accommodate**) customers like hotels.
- Airlines, mass rapid transport systems and bus companies transform the *location* of their customers
- Hospitals transform their customers' *physiological state*.
- Some are concerned with transforming their *psychological state* like most entertainment services such as music, theatre, television, radio and theme parks.

Inputs to the process (4)

Customers (continued)

- But customers are not always simple 'passive' items to be processed but play a more active part in many operations and processes
 - they create the atmosphere in a restaurant;
 - they provide the stimulating environment in learning groups in education;
 - they provide information at check-in desks, and so on.
- When customers play this role, it is usually referred to as **co-production** (or co-creation for new services) because the customer plays a vital part in the provision of the product/service offering.

Inputs to the process (5)

Predominantly processing inputs of materials

All manufacturing operations
Mining companies
Retail operations
Warehouses
Postal services
Container shipping line
Trucking companies

Predominantly processing inputs of information

Accountants
Bank headquarters
Market research company
Financial analysts
News service
University research unit
Telecoms company

Predominantly processing inputs of customers

Hairdressers
Hotels
Hospitals
Mass rapid transports
Theatres
Theme parks
Dentists

Dominant transformed resource inputs of various operations

Inputs to the process (6)

The other set of inputs to any operations process are **transforming resources**.

- These are the resources which act upon the transformed resources.

There are two types which form the 'building blocks' of all operations:

Facilities

- the buildings, equipment, plant and process technology of the operation;

Staff

- the people who operate, maintain, plan and manage the operation.
- The exact nature of both facilities and staff will differ between operations.
 - To a five-star hotel, its facilities consist mainly of 'low-tech' buildings, furniture and fittings.
 - To a nuclear-powered aircraft carrier, its facilities are 'high-tech' nuclear generators, and sophisticated electronic equipment.
- Staff will also differ between operations.
 - Most staff employed in a factory assembling domestic refrigerators may not need a very high level of technical skill.
 - In contrast, most staff employed by an accounting company are highly skilled in their own 'technical' skill (accounting).

* Operations principle

All processes have transforming resources of facilities (equipment, technology, etc.) and people.

Outputs from the process (1)

Products and services are different.

Products are usually tangible things.

- A car or a newspaper or a restaurant meal

Services are activities or processes.

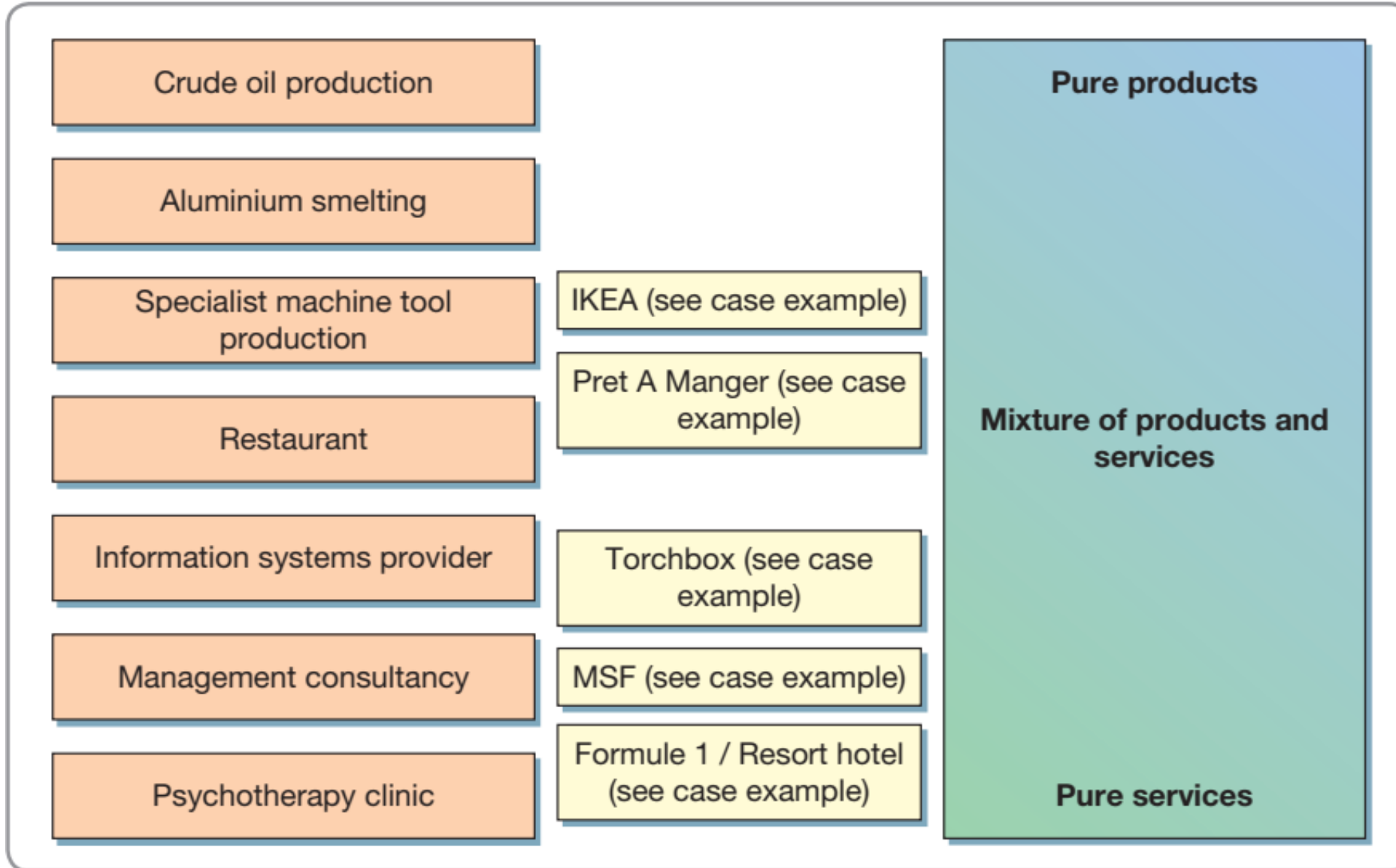
- A service is the activity of the customer using or consuming that product

Some services do not involve products.

- Consultancy advice or a haircut is a process (though some products may be supplied in support of the service, such as a report or a hair gel).

While most products can be stored, at least for a short time, service only happens when it is consumed or used.

- accommodation in a hotel room will perish if it is not sold that night
- a restaurant table will remain empty unless someone uses it that evening.



Some operations create and deliver **services only**, while others create and deliver **products only**

But **most operations combine both elements.**

This figure shows several operations (including some described as examples in this chapter) positioned in a spectrum from 'pure' products to 'pure' services.

Outputs from the process (2)

Pure Products

- **Crude oil producers** are concerned almost exclusively with the **product** that comes from their oil wells.

Mixture of products and services

- **Aluminum smelters** are concerned with their **product** but might also deliver some **services** such as **technical advice**.
 - Services in these circumstances are called **facilitating services**.
- **Machine tool manufacturers** deliver facilitating services such as **technical advice** and **applications engineering**.
- The **services** delivered by a **restaurant** are an essential part of what the customer is paying for.
 - It is both a **manufacturing operation** that creates and delivers meals and a **provider of service** in the **advice, ambiance, and service of the food**.

* Operations principle

Most operations produce a mixture of tangible products and intangible services.

Outputs from the process (3)

- An information systems provider (ISP) may create software 'products', but primarily it is providing a service to its customers together with facilitating products.
- A management consultancy, although it produces reports and documents, would see itself primarily as a service provider.

Pure services

- solely create and deliver services such as a psychotherapy clinic.

*** Operations principle**

Whether an operation produces tangible products or intangible services is becoming increasingly irrelevant. In a sense all operations produce service for their customers.

Outputs from the process (4)

The distinction between services and products is difficult to define and not particularly useful.

For example:

- Software is a product (sold on a disc) and a service when sold over the internet or used by the customer.
- A restaurant meal is both a product and a service as it is delivered and consumed.

All operations are service providers that may create and deliver products as part of the offering to their customers.

This is why operations management is vital to all organizations.

Whether organizations see themselves as manufacturers or service providers is a secondary issue.

Outputs from the process (5)

Customers

Customers may be an input to many operations, but they are also the reason for their existence.

If there were no customers (whether business customers, users, or consumers), there would be no operation.

So **operations managers must be aware of customer needs**, both *current* and *potential*.

- This information will determine what the operation has to do and how it has to do it (its strategic performance objectives), which in turn defines the service/product offering to be designed, created, and delivered.

The Process Hierarchy (1)

Inside any operation is a collection of processes (can be called “units” or “departments”) interconnecting with each other to form a network.

Each process acts as a smaller version of the whole operation of which they form a part, and transformed resources flow in between them.

Within any operation, the mechanisms that transform inputs into outputs are these processes.

Processes

- arrangement of resources that create some mixture of services and products.
- the “building blocks” of all operations.
- they form an ‘internal network’ within an operation

Each process is, at the same time, an **internal supplier** and an **internal customer for other processes**.

- This ‘internal customer’ concept provides a model to analyze the internal activities of an operation.
- It is also a useful reminder that, by treating internal customers with the same degree of care as external customers, the effectiveness of the whole operation can be improved.

Some operations described in terms of their processes

<i>Operation</i>	<i>Some of the operation's inputs</i>	<i>Some of the operation's processes</i>	<i>Some of the operation's outputs</i>
Airline	Aircraft Pilots and air crew Ground crew Passengers and freight	Check passengers in Board passengers Fly passengers and freight around the world Care for passengers	Transported passengers and freight
Department store	Products for sale Sales staff Information systems Customers	Source and store products Display products Give sales advice Sell products	Customers and products 'assembled' together.
Police	Police officers Computer systems Information systems Public (law-abiding and criminals)	Crime prevention Crime detection Information gathering Detaining suspects	Lawful society, public with a feeling of security
Frozen food manufacturer	Fresh food Operators Processing technology Cold storage facilities	Source raw materials Prepare food Freeze food Pack and freeze food	Frozen food

The Process Hierarchy (2)

Within each process is another network of individual units of resource, such as individual people and individual items of process technology (machines, computers, storage facilities, etc.).

Again, transformed resources flow between each unit of transforming resource.

Any business or operation is made up of a network of processes and any process is made up of a network of resources.

- Also, any business or operation can itself be viewed as part of a greater network of businesses or operations.
- It will have operations that supply it with the services and products it needs and, unless it deals directly with the end consumer, it will supply customers who themselves may go on to supply their own customers.

Moreover, any operation could have several suppliers and several customers and may be in competition with other operations creating similar services or products to itself.

This network of operations is called the **supply network**.

The Process Hierarchy (3)

In this way, the input–transformation–output model can be used at several different ‘levels of analysis’.

Here we have used the idea to analyze businesses at three levels:

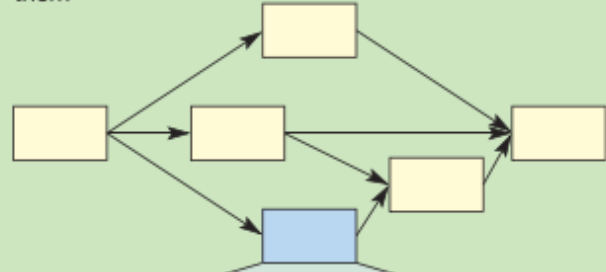
- the process
- the operation, and
- the supply network.

*** Operations principle**

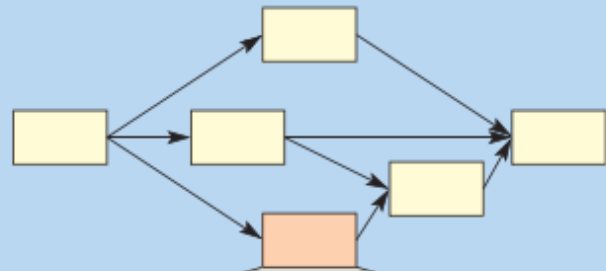
A process perspective can be used at three levels: the level of the operation itself, the level of the supply network, and the level of individual processes.

But one could define many different ‘levels of analysis’, moving upwards from small to larger processes, right up to the huge supply network that describes a whole industry.

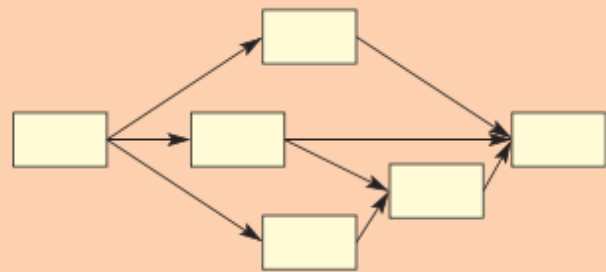
Analysis at the **level of the supply network** – a supply network is a network of operations with flow between them



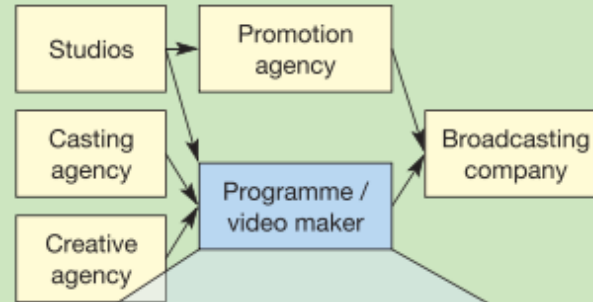
Analysis at the **level of the operation** – an operation is a network of processes with flow between them



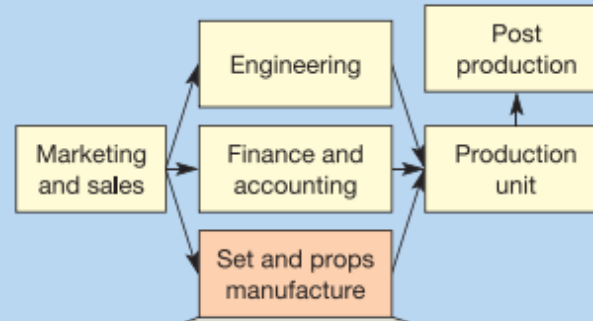
Analysis at the **level of the process** – a process is a network of resources with flow between them



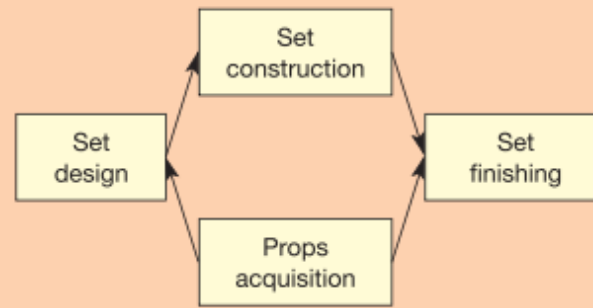
The programme and video supply network



The programme and video operation



The 'Set and props manufacturing' process



Operations and process management require analysis at three levels: **the supply network, the operation, and the process**

Some examples of processes in non-operations functions

<i>Organizational function</i>	<i>Some of its processes</i>	<i>Outputs from its process</i>	<i>Customer(s) for its outputs</i>
Marketing and sales	Planning process Forecasting process Order-taking process	Marketing plans Sales forecasts Confirmed orders	Senior management Sales staff, planners, operations Operations, finance
Finance and accounting	Budgeting process Capital approval processes Invoicing processes	Budgets Capital request evaluations Invoices	Everyone Senior management, requesters External customers
Human resources management	Payroll processes Recruitment processes Training processes	Salary statements New hires Trained employees	Employees All other processes All other processes
Information technology	Systems review process Help desk process System implementation project processes	System evaluation Advice Implemented working systems and aftercare	All other processes All other processes All other processes

Operations Processes Characteristics

The Volume Dimension

(the volume of the operations processes output)

MCDONALD'S

- High-volume hamburger production
- High repetition of tasks for the staff
- More staff needed
- the order and systemization of work with standard procedures are set down
- more feasible to invest in specialized equipment like fryers and ovens
- gives a low unit cost per burger

CAFETERIA

- Low-volume “short order” dishes
- Low repetition of tasks
- lower number of staff needed (individual staff are more likely to perform a wider range of tasks)
- less open to systemization (but more rewarding for the staff in terms of variation of tasks)
- less feasible to invest in specialized equipment
- likely higher cost per burger (if it is served)

The Variety Dimension

(the variety of the operations processes output)

TAXI COMPANY

- offers a relatively high-variety service (pick up and drop off anytime/anywhere)
- flexible
- drivers must have a good knowledge of the area/communication between the base and the taxis must be effective
- cost per kilometer traveled is higher

BUS COMPANY/SERVICE

- offers only a few well-defined routes with a set schedule
- little to no flexibility is required from the bus operation if all goes to schedule
- service is standardized and regular
- relatively low in cost compared to using a taxi for the same journey

The Variation Dimension

(the variation in the demand for the operations processes output)

SUMMER HOLIDAY RESORT HOTEL

- high variation
- demand pattern is erratic (will be in full capacity at the height of the season but might be only a fraction of its capacity during off-season)
- the operation must change its capacity (like hiring extra staff) as needed
- results to higher unit costs

ORDINARY OR LEVEL-DEMAND HOTEL

- low variation
- level of demand is the same
- can plan its activities (scheduling of staff, food bought on schedule, room cleaning in a routine and predictable manner)
- results in high utilization of resources and lower unit costs

The Visibility Dimension

“BRICKS AND MORTAR” RETAILER

- high visibility operation (customers will directly experience most of its “value-adding” activities)
- time lag is within a few minutes (as much as possible)
- must have staff with good customer contact skills; otherwise, their customers may walk out if they are dissatisfied with the service
- might need many shops close to centers of demand
- high-cost operation

WEB-BASED RETAILER

- low visibility operations
- time lag between ordering, packing, and dispatching of ordered items can take hours or days and is standardized
- staff do not need customer contact skills
- can centralize its operation on one physical site
- lower operation cost

Implications of the four Vs

Put simply, high volume, low variety, low variation, and low customer contact all help to keep processing costs down.

Conversely, low volume, high variety, high variation, and high customer contact generally carry a cost penalty for the operation.

This is why the volume dimension is drawn with its 'low' end at the left, unlike the other dimensions, to keep all the 'low cost' implications on the right.

To some extent, the position of an operation in the four dimensions is determined by the demand of the market it serves.

However, most operations have some discretion in moving themselves on the dimensions.

Implications

Low repetition
Each staff member
performs more of job
Less systemization
High unit costs

Flexible
Complex
Match customer needs
High unit costs

Changing capacity
Anticipation
Flexibility
In touch with demand
High unit costs

Short waiting tolerance
Satisfaction governed
by customer perception
Customer contact skills
needed
Received variety is high
High unit costs



Implications

High repeatability
Specialization
Systemization
Capital intensive
Low unit costs

Well defined
Routine
Standardized
Regular
Low unit costs

Stable
Routine
Predictable
High utilization
Low unit costs

Time lag between production
and consumption
Standardized
Low contact skills
High staff utilization
Centralization
Low unit costs

A typology of
operations.

The Work of an Operations Manager

Directing

Directing the overall nature and strategy of the operation.

A general understanding of operations and processes and their strategic purpose and performance, together with an appreciation of how strategic purpose is translated into reality, is a prerequisite to the detailed design of operations and processes.

Designing

Designing the operation's services, products, and processes.

Design is the activity of determining the physical form, shape, and composition of operations and processes together with the services and products that they create.

Delivery

Planning and control process delivery.

After being designed, the delivery of services and products from suppliers and through the total operation to customers must be planned and controlled.

Develop

Developing process performance.

Increasingly, it is recognized that operations managers, or indeed any process managers, cannot simply routinely deliver services and products in the same way that they always have done.

They have a responsibility to develop the capabilities of their processes to improve process performance.

End of Presentation
