

Accounting and profitability

Projects and investing

Production as a part of value chain

Production processes and
production control



**Production systems and
organizations**

Creating value

Production systems and organizations

Case-examples

Production system's capacity: Heathrow airport



In this exercise:

- Heathrow airport
 - Production processes
 - Cycle time
 - Capacity
 - 4V-model
 - Utilization rate and throughput efficiency

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Production processes

- **Flow unit:** airplanes and passengers
- **Transformation:** landings and takeoffs of the airplanes, exiting and boarding of passenger
- **Necessary resources:** airport facilities, air traffic control, customer service, aircraft maintenance, ...
- **The value** of an airport is smooth travel of people and the maintenance of the aircrafts

Production processes

- **The airport is one of the busiest in the world**
 - In 2018, it was world's seventh busiest
- **The airport operates close to the theoretical maximum capacity**
 - Heathrow runways operate at 99% capacity
 - At other major airports, the corresponding capacity is close to 70%
- **Airplanes must wait for landing by flying near the airport**
- **Insufficient capacity leads to jams and flight delays**

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Cycle time

- A total of 1300 aircraft land or take off from runways daily. With an airport operating 24 hours a day, the average cycle time for runways is:

$$\text{Cycle time} = \frac{\text{Time period}}{\text{Amount of flow units}} = \frac{24 * 60 \text{ min}}{1300} = 1,10 \dots \text{ min} \approx 66 \text{ s}$$

- That is, airplanes are required to take off or land at average intervals of 66 seconds

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Production processes

- **33% of all flights at the airport are delayed by at least 15 minutes**

On average, other major European airports have a delay rate of 21-24%

- **Even one factor that slows down the flow, is a reason for delay**
For example, weather conditions and machine failures
- **In the worst cases, certain flights have had to be canceled in order to keep other flights on schedule**
- **Runways are bottlenecks in Heathrow's production system**

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4V-model

- **High production volume**
 - Requires a lot of manpower and equipment (capital)
 - Employees specialized in their tasks
- **Low variability of products**
 - Tasks are defined precisely
 - Standard process
 - Lower unit cost

4V-model

- **Low demand volatility**
 - Demand is known through flight scheduling
 - High utilization of resources
 - Lower unit cost
- **Customer involvement**
 - Customers (airplanes and passengers) have a short tolerance to delays
 - Passenger satisfaction with services depends on production efficiency
 - Efficient communication with customers is required

In this exercise:

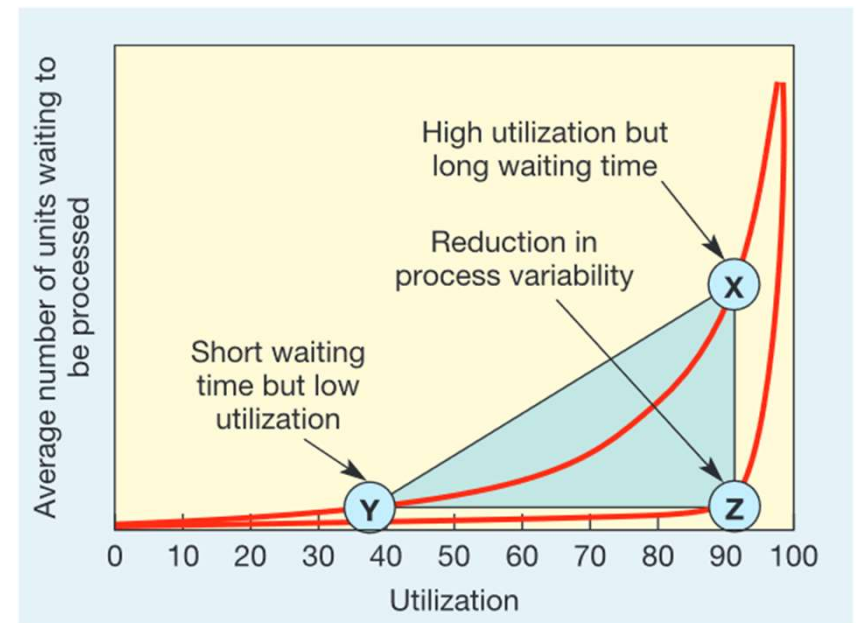
- Heathrow airport
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Utilization rate and throughput efficiency

- **The runways operate at 99% capacity**
 - High utilization rate
 - Even a small change causes a delay. The flow units must wait for the release of resources
 - Bad throughput efficiency
 - The capacity constraint are runways, that are already operating at almost full capacity

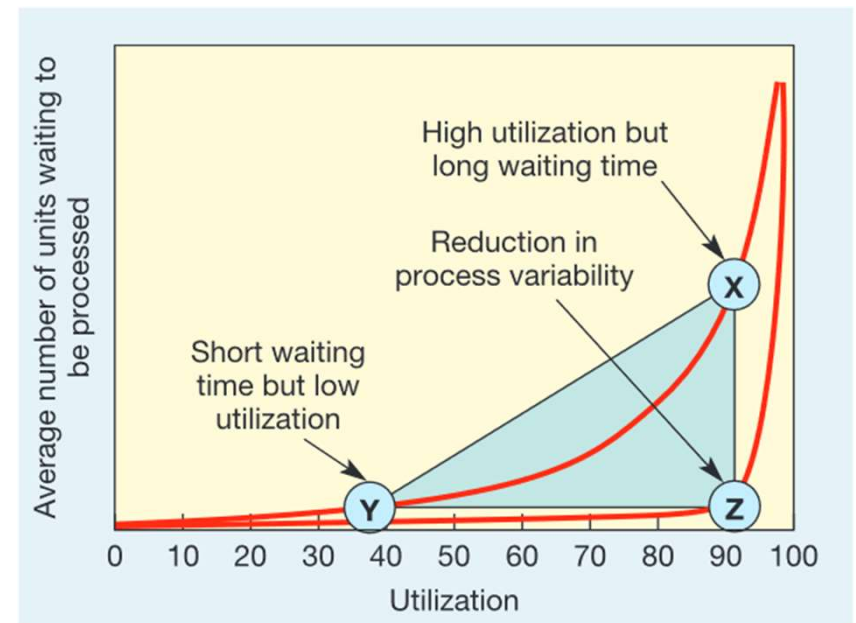
Utilization rate and variability in the time consumed by the process

- Number of units waiting is shown in y axis and utilization rate in x axis
- **Point Y:** low utilization rate, but high throughput efficiency
- **Point X:** high utilization rate, but low throughput efficiency



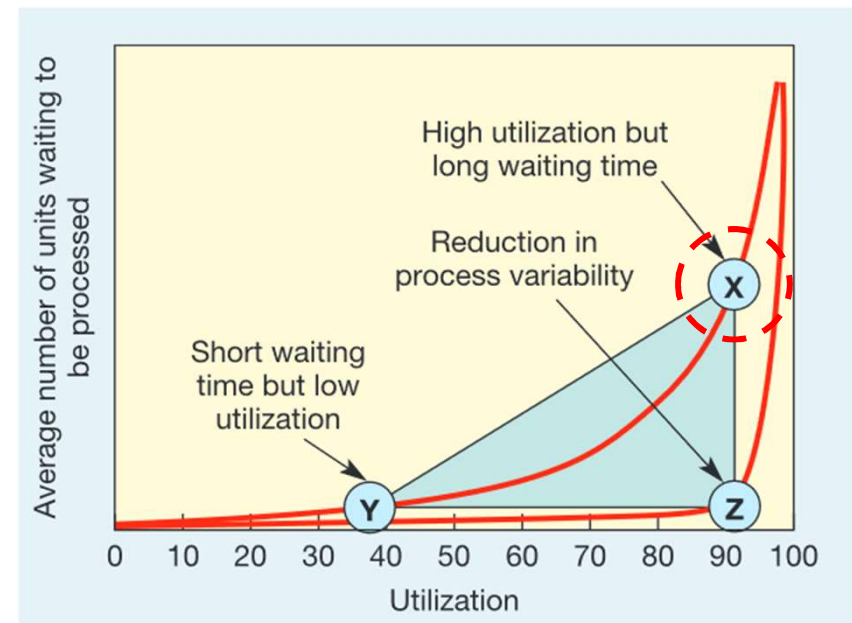
Utilization rate and changes in the duration of the process

- **Point Z:** Reduction in process variability
- **High utilization rate and throughput efficiency**



Utilization rate and changes in the duration of the process


- **Point X represents Heathrow airport**
 - A small change in the process time required, causes the flow units to queue
 - Almost theoretical capacity, which results in high resource utilization



A solution to the bottleneck

- A third runway is planned for the airport to improve throughput efficiency

British Courts In Favour Of Third Runway At Heathrow

by Jay Singh · May 3, 2019 ·  One comment ·  2 minute read

London Heathrow is Britain's most well-known airport. For years, the airport has seen the number of free slots dwindle. Nowadays, coming across slots at Heathrow are next to impossible. Heathrow's solution was to build a third runway, however, some were opposed to this for various reasons. It seems now that the British Courts are siding with Heathrow and allowing the Heathrow Expansion Plan to continue.

A solution to the bottleneck

- A third runway will increase airport capacity
- More capacity will lead to better resistance against volatility
 - Better throughput efficiency
 - Surplus capacity decreases utilization rate

