Business Process Management
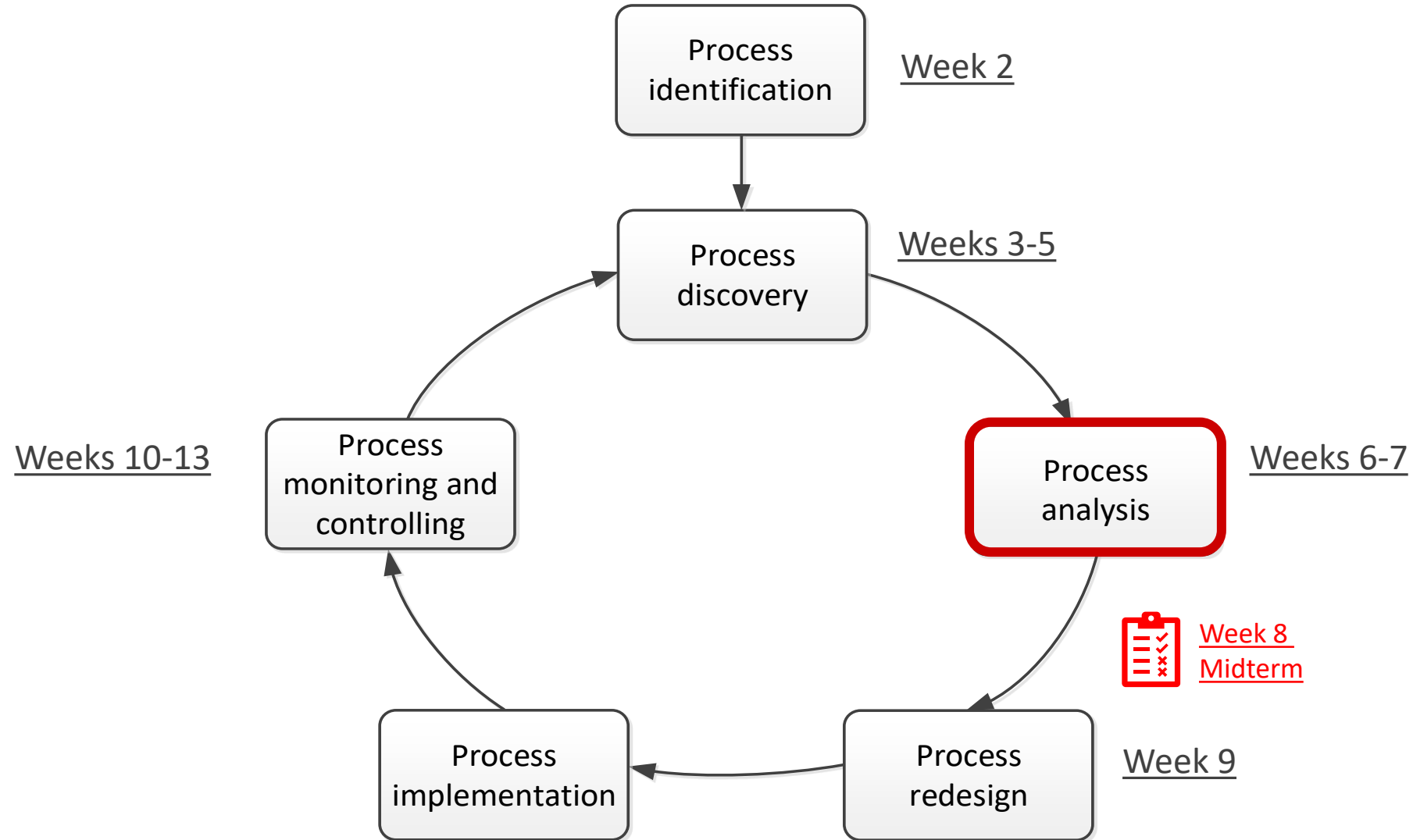
Lecture 6
Qualitative Process Analysis

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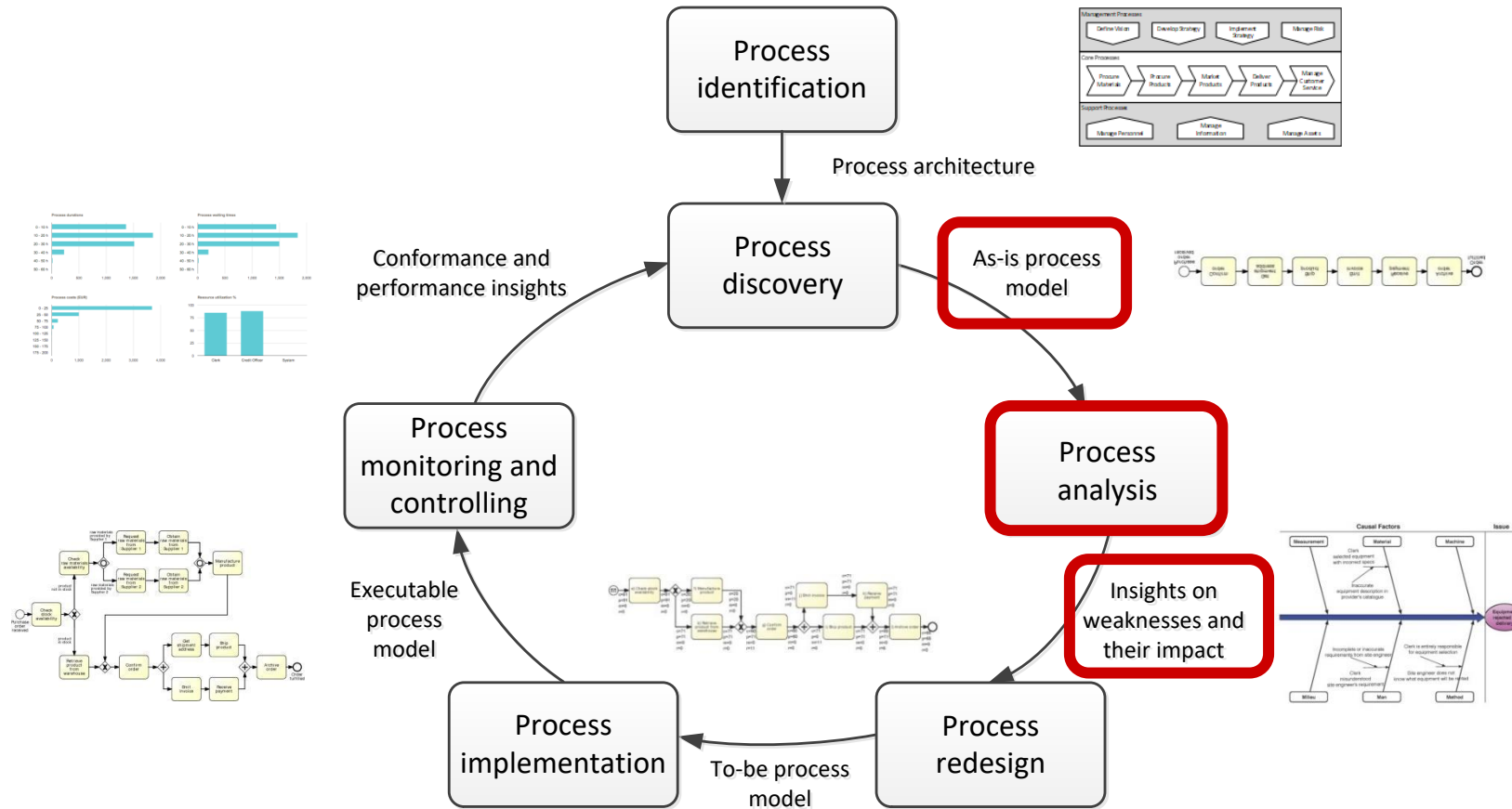
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Course structure

Process
identification — Week 2

Process
discovery — Weeks 3-5

Process
analysis — Weeks 6-7

Week 8
Midterm

Process
redesign — Week 9

Process
implementation

Process
monitoring and
controlling — Weeks 10-13

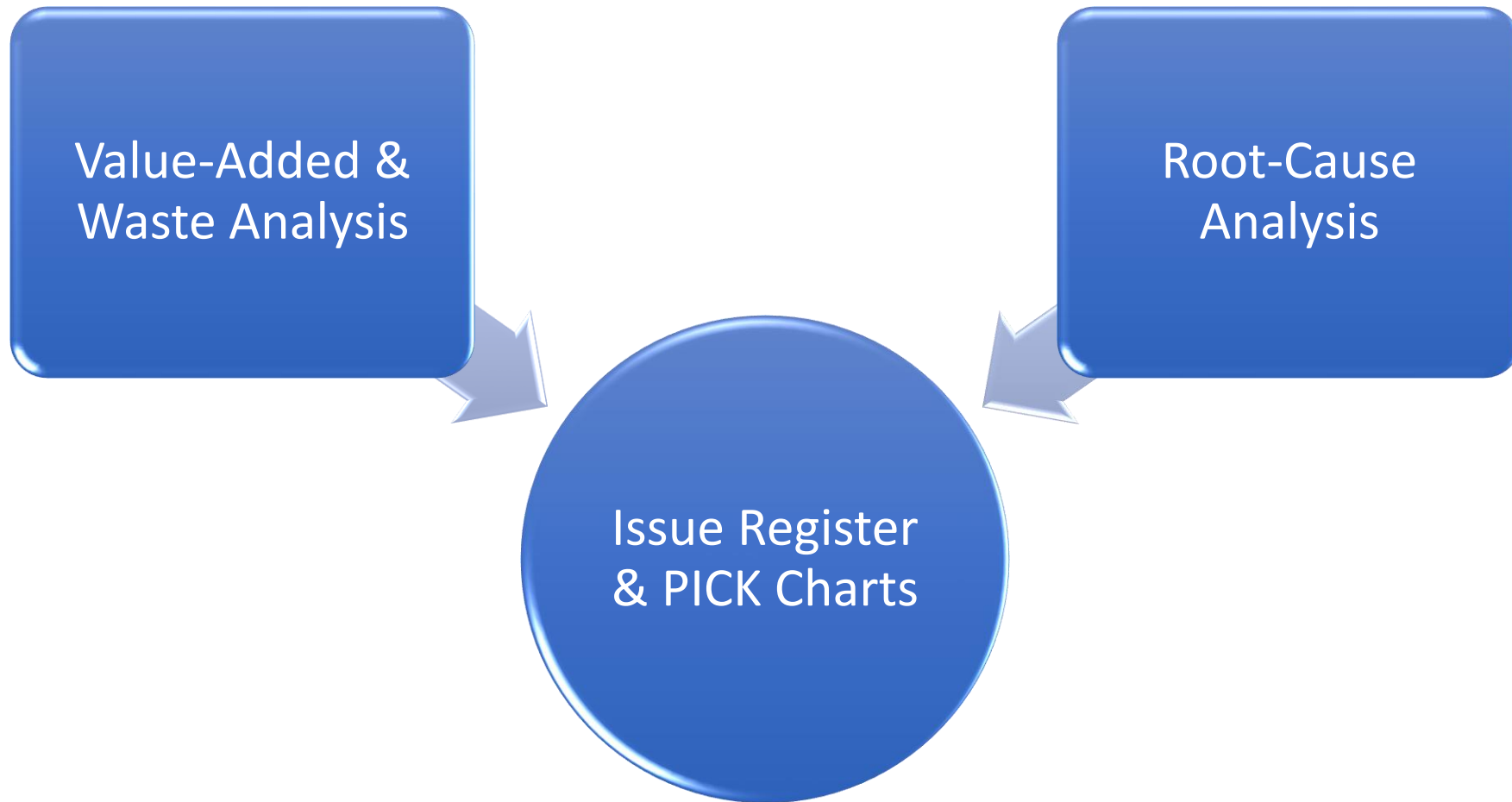# Process Analysis in the BPM Lifecycle

Process Analysis Techniques

Qualitative analysis

- Value-Added & Waste Analysis

- Issue Register

- Root-Cause Analysis

Quantitative Analysis

Qualitative analysis

Value-Added & Waste Analysis

Root-Cause Analysis

Issue Register & PICK Charts

Value-added analysis

1. Decompose the process into steps
   - Steps performed before a task
   - The task itself, possibly decomposed into smaller steps
   - Steps performed after a task, in preparation for the next task

2. Identify the customer of the process
   - What positive outcomes the customer seeks

3. Classify each step
   - Value-adding (VA)
   - Business value-adding (BVA)
   - Non-value-adding (NVA)

Value-adding activities

Maximize

Produce value or satisfaction to the customer

Criteria

- Is the customer willing to pay for this step?
- Would the customer agree that this step is necessary to achieve their goals?
- If the step is removed, would the customer perceive that the end product or service is less valuable?

Examples

- Order-to-cash process: Confirm delivery date, Deliver products
- University admission process: Assess application, Notify admission outcome

Business value-adding activities

Minimize

Necessary or useful for the business to operate

Criteria

- Is this step required in order to collect revenue, to improve or grow the business?
- Would the business (potentially) suffer in the long-term if this step was removed?
- Does it reduce risk of business losses?
- Is this step required in order to comply with regulatory requirements?

Example

- Order-to-cash process: **Check** purchase order, **Check** customer's credit worthiness, Issue invoice, Collect payment, Collect customer feedback
- University admission process: **Verify** completeness of application, **Check** validity of degrees, **Check** validity of language test results

Non-value-adding activities

Remove

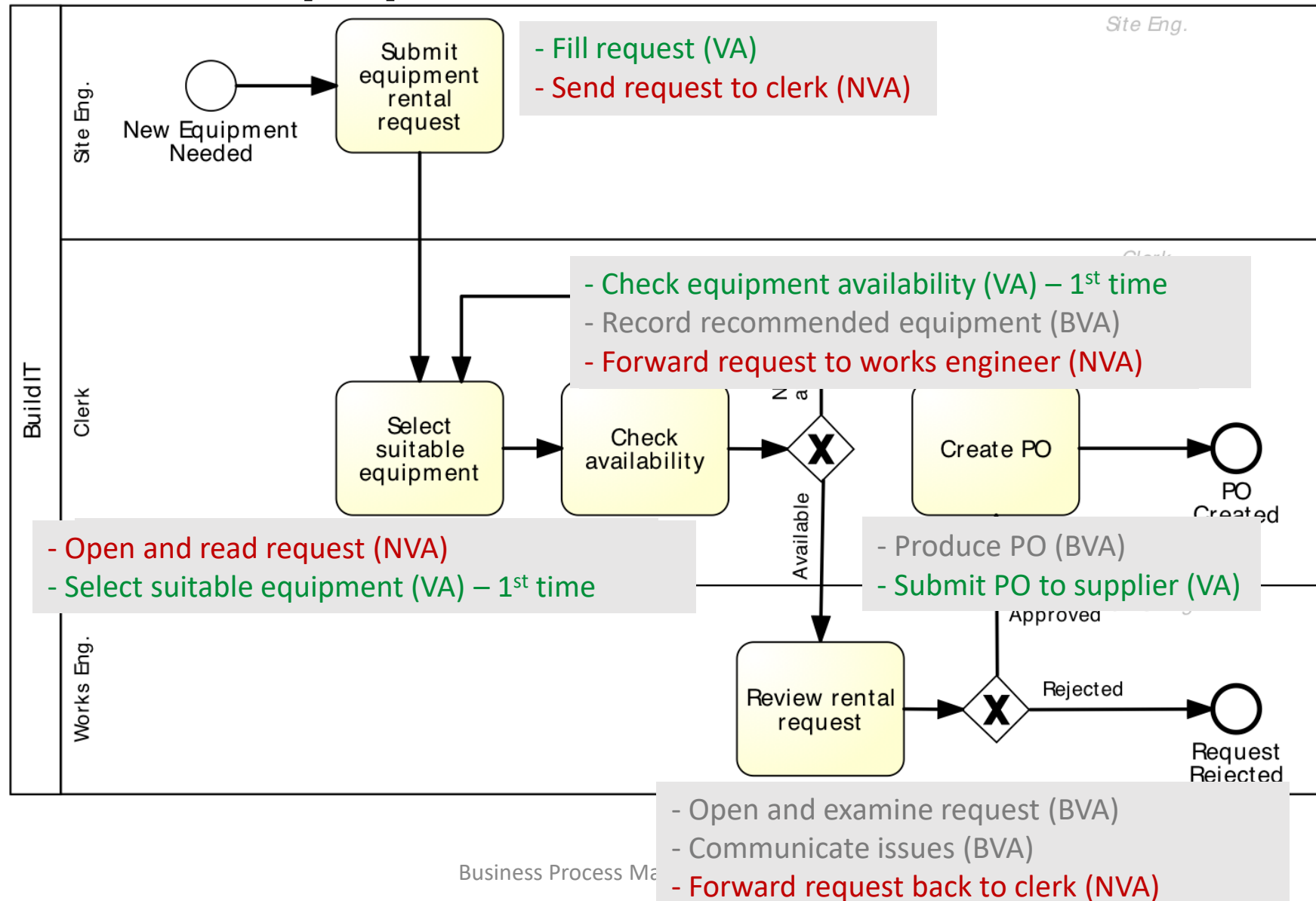Everything else besides VA and BVA. Activities the customer would be unwilling to pay for

Incudes
1. Handovers, context switches
2. Waiting times, delays
3. Rework or defect correction

Examples
- Order-to-cash process: **Forward** PO to warehouse, **Re-send** confirmation, **Receive** rejected products
- University admission process: **Forward** applications to committee, **Receive** admission results from committee

Extract of Equipment Rental Process

- Fill request (VA)
- Send request to clerk (NVA)

- Check equipment availability (VA) – 1st time
- Record recommended equipment (BVA)
- Forward request to works engineer (NVA)

- Open and read request (NVA)
- Select suitable equipment (VA) – 1st time

- Produce PO (BVA)
- Submit PO to supplier (VA)

- Open and examine request (BVA)
- Communicate issues (BVA)
- Forward request back to clerk (NVA)

Equipment Rental Process – VA Analysis

Step	Performer	Classification
Fill request	Site engineer	VA
Send request to clerk	Site engineer	NVA
Open and read request	Clerk	NVA
Select suitable equipment	Clerk	VA
Check equipment availability	Clerk	VA
Record recommended equipment & supplier	Clerk	BVA
Forward request to works engineer	Clerk	NVA
Open and examine request	Works engineer	BVA
Communicate issues	Works engineer	BVA
Forward request back to clerk	Works engineer	NVA
Produce PO	Clerk	BVA
Send PO to supplier	Clerk	VA

Exercise 6.1

Consider the process for university admission (Assignment 2). What steps can you extract from this process? Classify these steps into VA, BVA, and NVA (get at least 3 steps from each category).

Waste analysis

"*All we are doing is looking at the time line, from the moment the customer gives us an order to the point when we collect the cash.*

And we are reducing the time line by reducing the non-value-adding wastes"

Taiichi Ohno, Toyota

Seven sources of waste

Move
- Transportation
- Motion

Hold
- Inventory
- Waiting

Over-do
- Defects
- Over-Processing
- Over-Production

Move

Transportation

Send or receive materials or documents (incl. electronic) taken as input or output by the process activities

Example

University admission process: to apply for admission at a university, students fill in an online form. When a student submits the online form, a PDF document is generated. The student is requested to download it, sign it, and send it by post together with the required documents:

1. Certified copies of degree and academic transcripts

2. Results of language test

3. CV

When the documents arrive at the admissions office, an officer checks their completeness. If a document is missing, an e-mail is sent to the student. The student has to send the missing documents by e-mail or post depending on document type.

Motion

- Motion of resources internally within the process
- Common in manufacturing processes, less common in service processes

Examples

- Application-to-approval process: a process worker moves around the organization to collect signatures

- Vehicle inspection process: A process worker moves with the inspection forms and the vehicle through different inspection bases in order to undergo different tests. Inspection equipment also needs to be moved around.

- Changing from one application to another in digitized processes

Hold

Inventory

- Materials inventory
- Work-in-process (WIP)

Example

- Vehicle inspection process, when a vehicle does not pass the first inspection, it is sent back for adjustments and left in a pending status. At a given point in time, about 100 vehicles are in the "pending" status across all inspection stations

- University admission process: About 3000 applications are handled concurrently

Waiting

- Task waiting for materials or input data

- Task waiting for a resource

- Resource waiting for work (resource idleness)

Examples

- <u>Vehicle inspection process:</u> A technician at a base of the inspection station waiting for the next vehicle

- <u>Application-to-Approval process</u>: Request waiting for approver

- <u>University admission process</u>: Incomplete application waiting for additional documents; batch of applications waiting for committee to meet

Over-do

Defects

- Correcting or compensating for a defect or error
- Rework loops

Examples

- <u>Travel approval process</u>: Request sent back to requestor for revision
- <u>University admission process</u>: Application sent back to applicant for modification; request needs to be re-assessed later due to incomplete information
- <u>Vehicle inspection process</u>: A vehicle needs to come back to a station due to an omission

Over-processing

- Tasks performed unnecessarily given the outcome of the process
- Unnecessary perfectionism

Examples

- Vehicle inspection: Technicians take time to measure vehicle emissions with higher accuracy than required, only to find that the vehicle clearly does not fulfill the required emission levels

- Travel approval process: 10% of approvals are trivially rejected at the end of the process due to lack of budget

- University admission process: Officers spend time verifying the authenticity of degrees, transcripts and language test results. In 1% of cases, these verifications uncover issues. Verified applications are sent to the admissions committee. The admission committee accepts 20% of the applications it receives

Over-production

- Unnecessary process instances are performed, producing outcomes that do not add value upon completion

Examples

- <u>Quote-to-cash process</u>: In 50% of cases, issued quotes do not lead to an order

- <u>Travel approval process</u>: In 5% of cases, travel requests are approved but the travel is cancelled

- <u>University admission process</u>: About 3000 applications are submitted, but only 600 are considered eligible after assessment

Equipment rental process: wastes
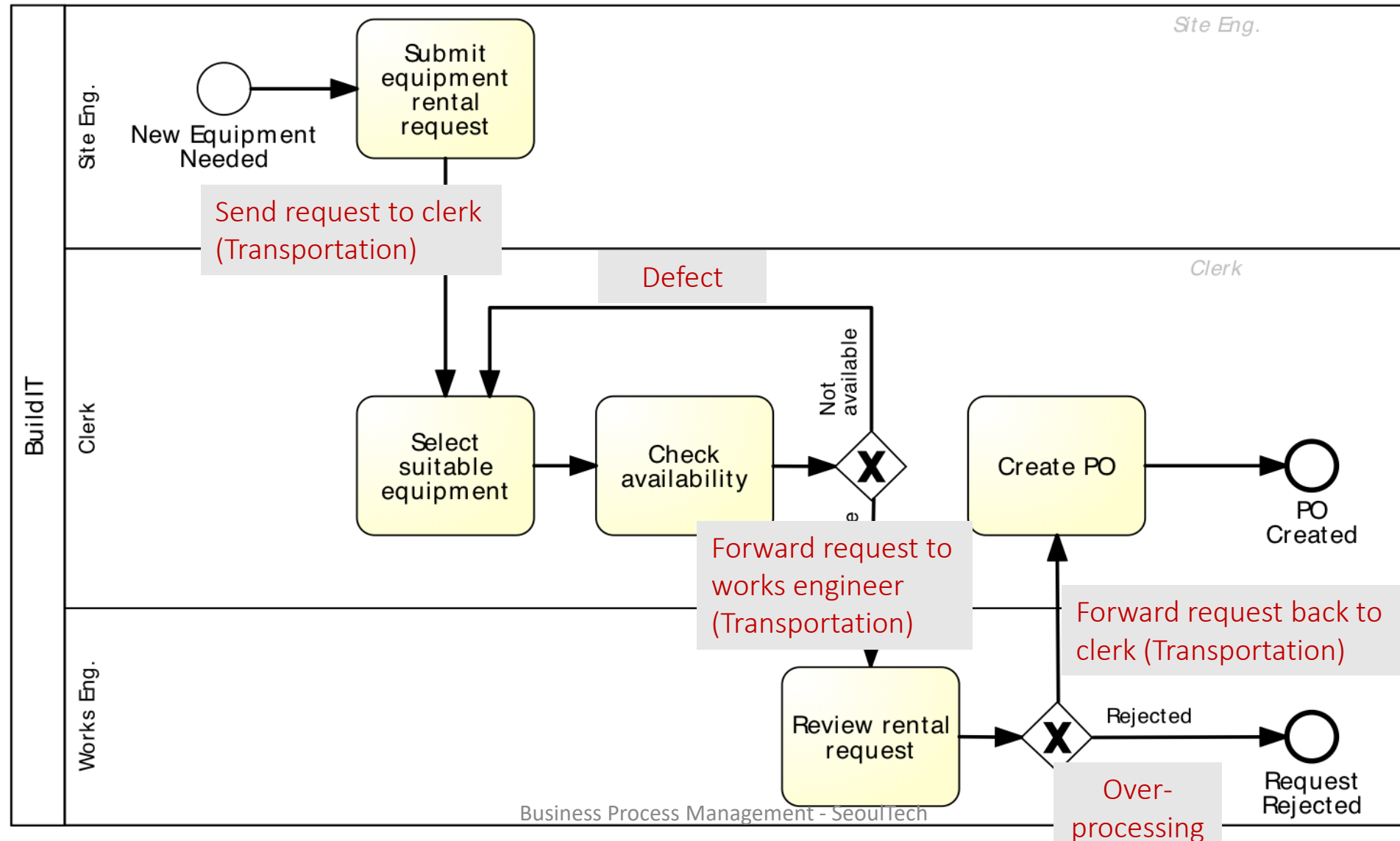
Equipment rental process: wastes

Transportation

- Site engineer sends request to clerk
- Clerk forwards to works engineer
- Works engineer sends back to clerk

Inventory

- Equipment kept longer than needed

Waiting

- Waiting for Clerk to process the rental request
- Waiting for availability of works engineer to approve

Equipment rental process: wastes

Defect

- Selected equipment not available, alternative equipment sought
- Incorrect equipment delivered and returned to supplier

Over-processing

- Clerk finds available equipment and rental request is rejected by works engineer
- Rental requests being approved and then canceled by site engineer because no longer needed

Over-production

- Equipment being rented and not used at all by site engineer

Exercise 6.2

Identify at least 3 wastes in the university admission process (Assignment 2) and classify them according to the seven types of waste (each identified waste should belong to different classification type). Consider the following additional information.

Each year, the university receives in total 3,000 online applications

- 20% of applications are rejected initially due to deficiencies in the online application form (e.g., missing documents). In half of the cases, the applicant manages to fix the identified issues and the application passes the administrative check after the second try.

- 10% of applications are rejected because the hard copy is not received on time.

- 2% rejected due to invalid English language test.

- 5% rejected due to plagiarized motivation letter.

- 5% rejected due to poorly written motivation letters.

- 15% rejected due to low GPA.

- 20% of applicants are offered a place but decline it.

- 20% of applicants are declared admissible but do not receive an offer due to lack of study places

Issue register

Purpose: to maintain, organize and prioritize perceived weaknesses of the process (issues)

Sources of issues:

- Input to the BPM project
- Collected via <u>stakeholder analysis</u>, including questionnaires or interviews/focus groups with:
  - Customers
  - Process participants (workers, covering each major role in the process)
  - Process owner / managers
  - Subcontractors, business partners
- Collected as part of ongoing process improvement actions
- Collected during process discovery (modelling)
- Value-added/waste analysis

Issue register structure

Can take the form of a table with:

- Issue identifier

- Short name

- Description (short description of the issue (1-3 sentences)

- Assumptions

- Impact:
  - Qualitative (impact on customer satisfaction, employee satisfaction, long-term supplier relationships, etc.)
  - Quantitative (time loss, revenue loss, avoidable costs, etc.)

- Possible improvement actions

Larger process improvement projects may require *issue trackers*

Issue example

Issue name

- Equipment kept longer than needed

Description

- Site engineers keep rented equipment longer than needed by asking for deadline extensions to the supplier

Data and hypotheses

- 3000 pieces of equipment rented per year
  In 10% of cases, equipment is kept two days more than needed
  Average rental cost is 100 per day

Quantitative impact

- $0.1 \times 3000 \times 2 \times 100 = 60{,}000$ per year

Issue Register Example

Equipment rental process

| Name	Explanation	Data / Hypotheses	Qualitative Impact	Quantitative Impact
Equipment kept longer than needed	Site engineers keep equipment longer than needed via deadline extensions	3000 pieces of equipment rented p.a. In 10% of cases, equipment kept two days longer than needed. Rental cost is 100 per day		0.1 × 3000 × 2 × EUR 100 = EUR 60000 p.a.
Wrong equipment delivered	Site engineers reject delivered equipment due to non-conformance to their specifications	3000 pieces of equipment rented p.a. 5% of them are rejected due to an internal mistake For each equipment rejected due to an internal mistake, BuildIT is billed EUR 100.	Disrupted schedules. Employees stress and frustration	3000 × 0.05 × EUR 100 = EUR 15000 p.a.
Late payment fees	Late payment fees incurred because invoices are not paid by their due date	3000 pieces of equipment rented p.a. Average rental time is 4 days. Rental cost is EUR 100 per day. Each rental leads to one invoice. About 10% of invoices are paid late. Penalty for late payment is 2%.	Poor reputation with suppliers	0.1 × 3000 × 4 × EUR 100 × 0.02 = EUR 2400 p.a.

Pareto Chart

- Useful to prioritize a collection of issues

- Bar chart where the height of the bar denotes the impact of each issue

- Bars sorted by impact

- Superposed curve of cumulative percentage impact
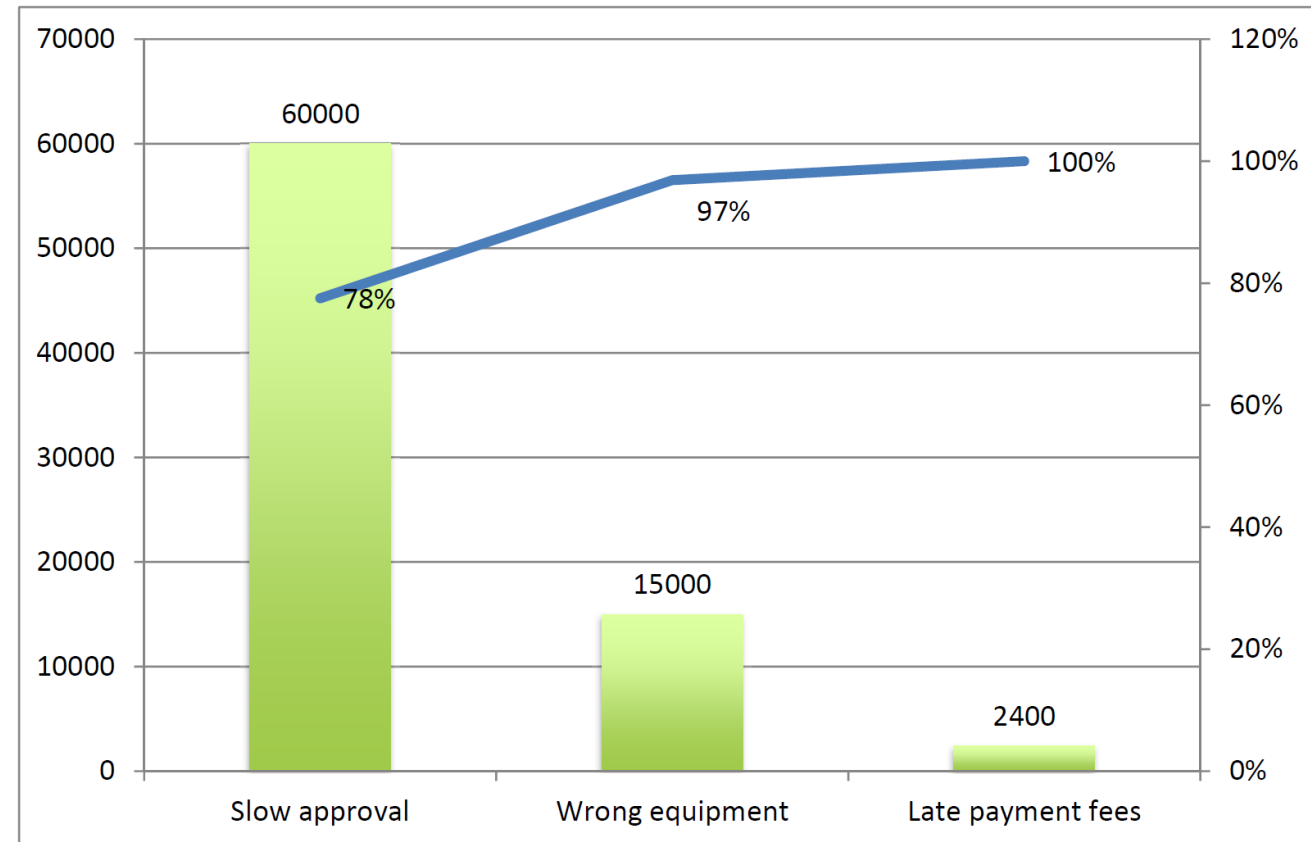
Issue Prioritization: PICK Chart
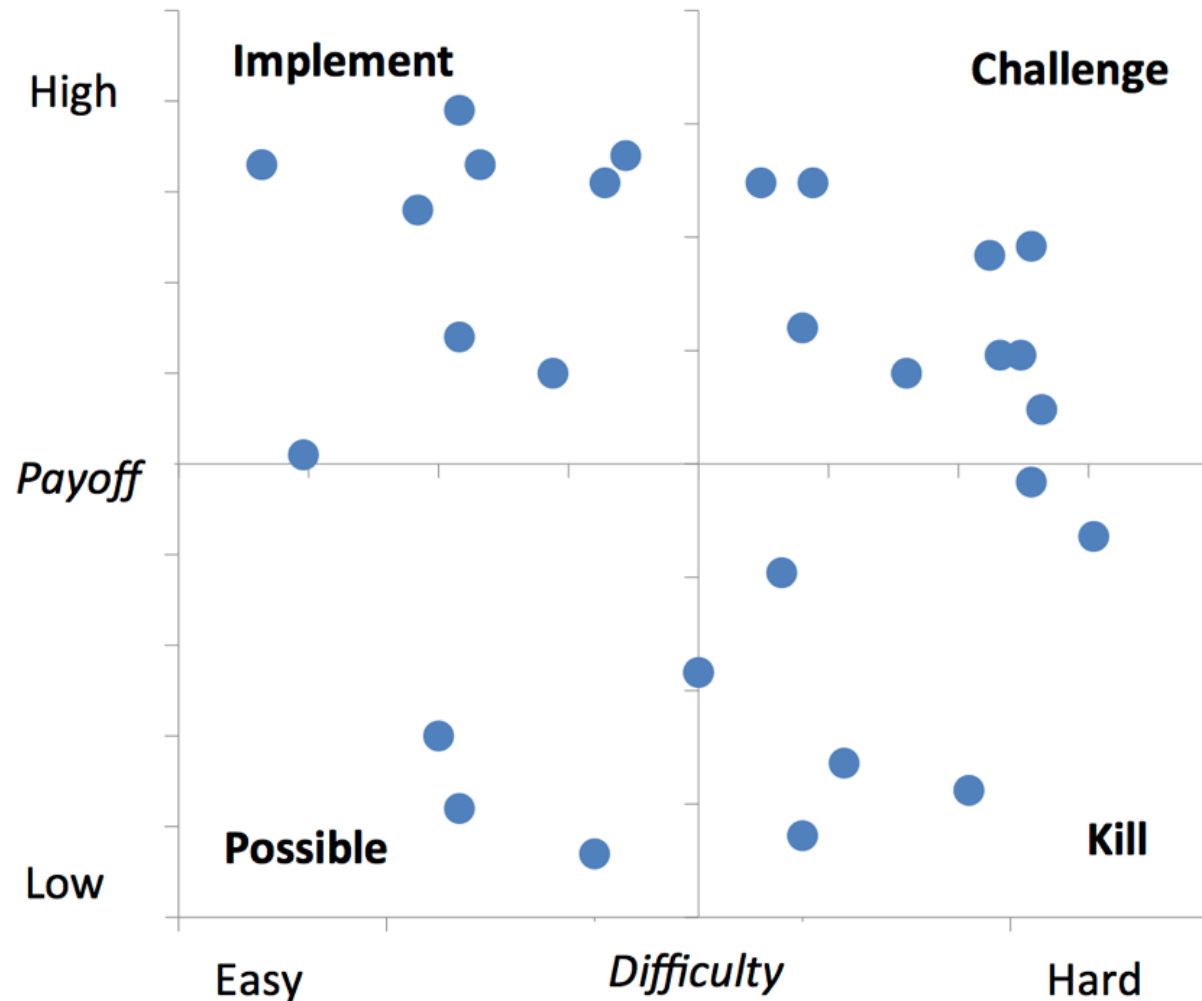
- tool used for organizing process improvement ideas and categorizing them
  - **Possible**: issues that can be addressed if there are sufficient resources to do so.
  - **Implement**: issues that should definitely be implemented as a matter of priority.
  - **Challenge:** issues that should be addressed but require significant amount of effort.
  - **Kill**: issues that are probably not worth addressing or at least not to their full extent.

Root-cause analysis

Factors

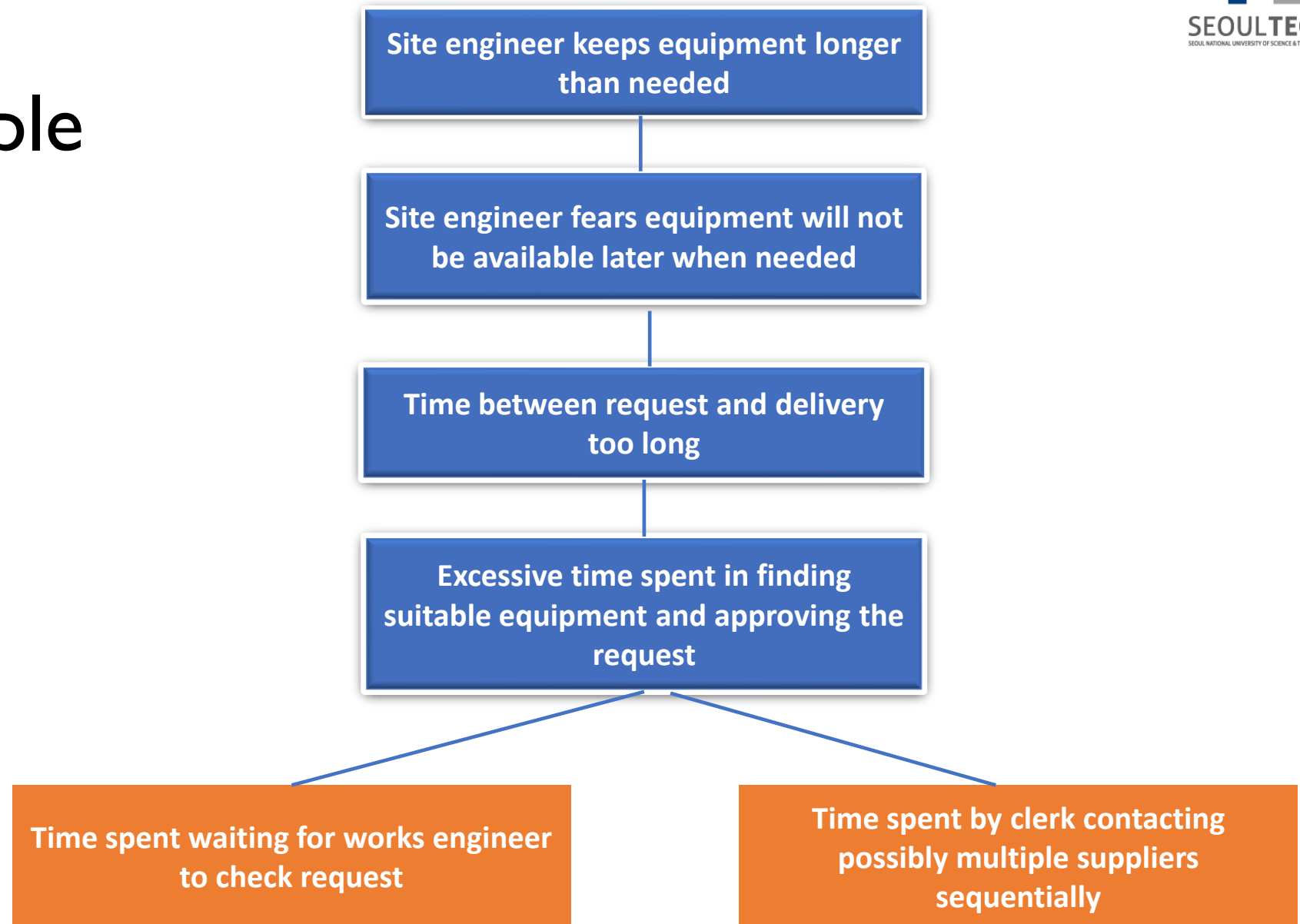Why-why diagram
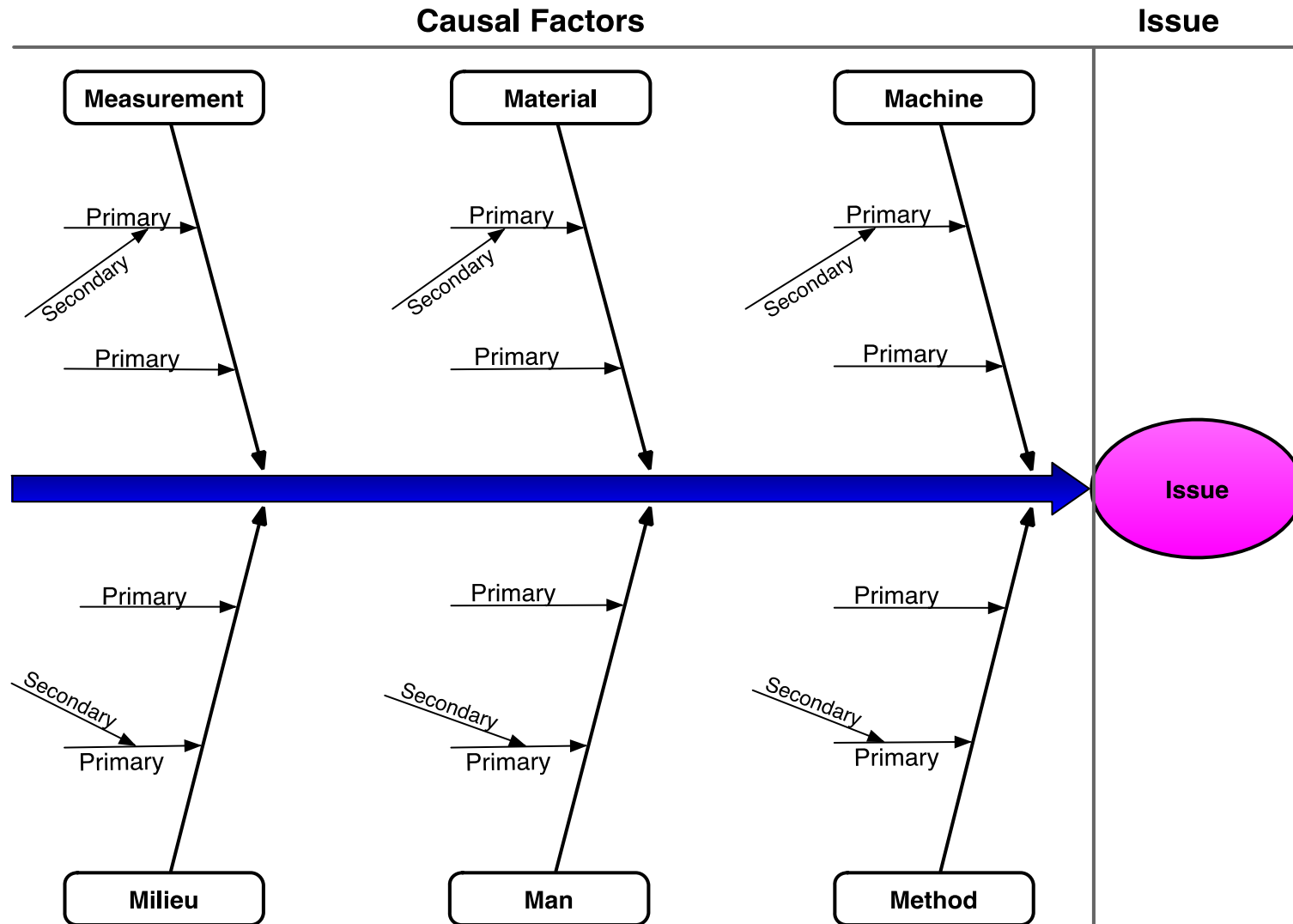
Issue

Cause-effect diagram
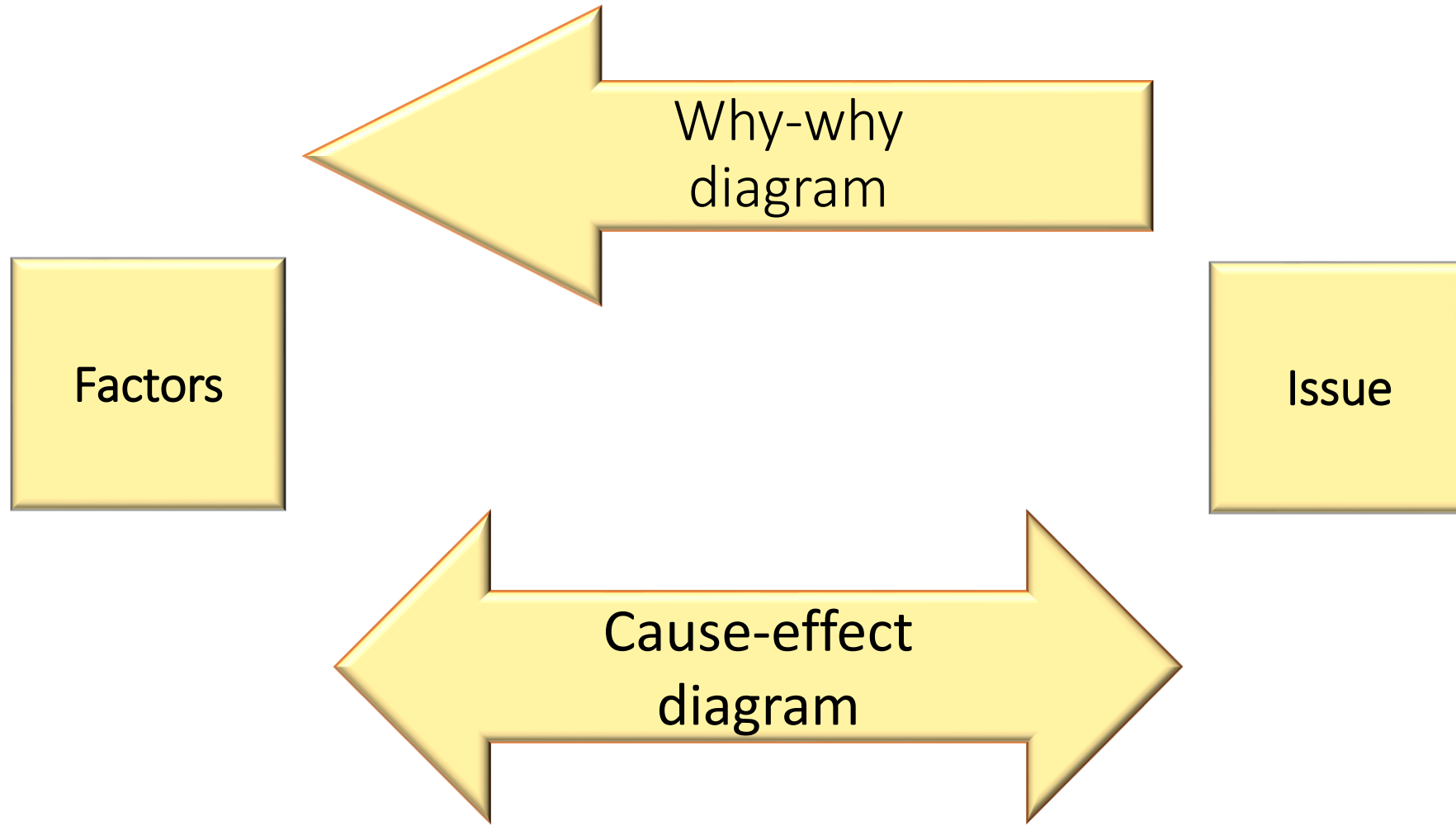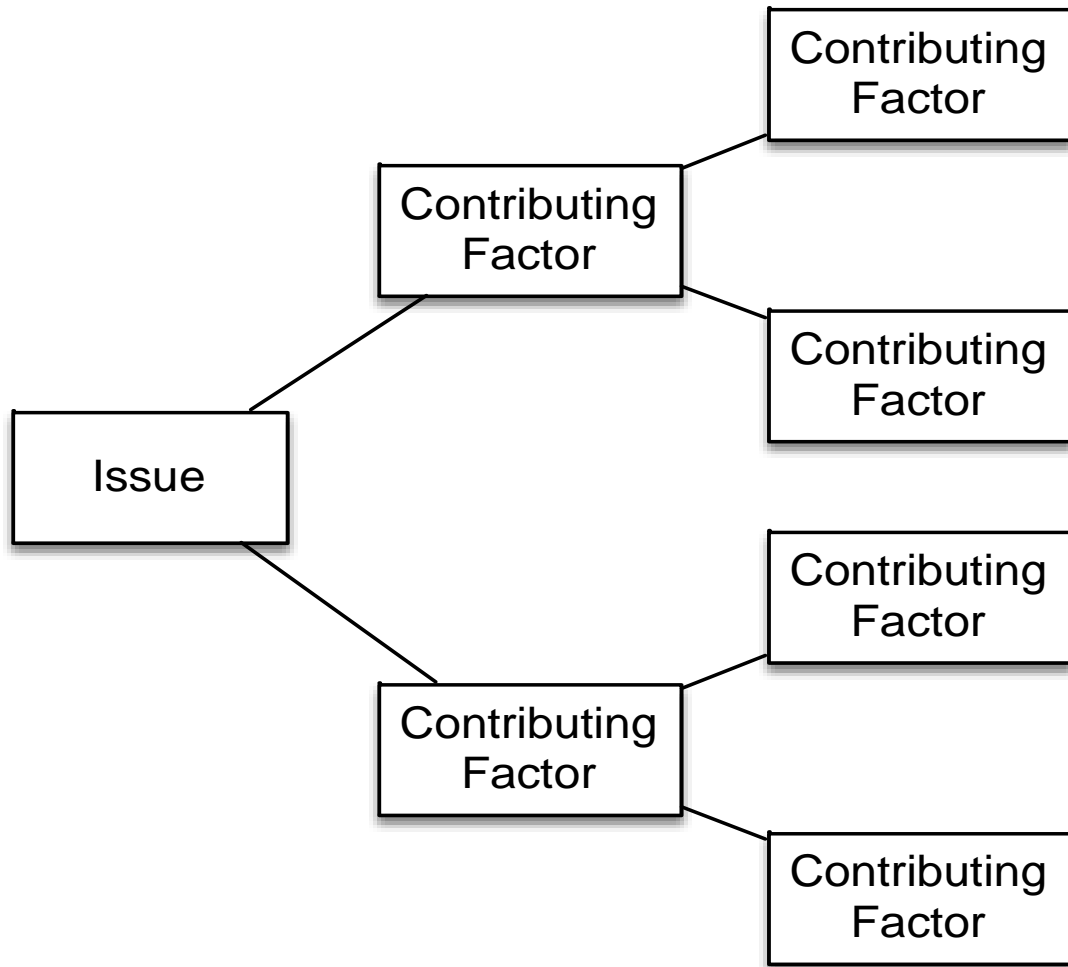
Why-why diagram

- Why-why diagrams (also known as tree diagrams) constitute another technique to analyze the cause of negative effects, such as issues in a business process
- They capture the series of cause-to-effect relations that lead to a given effect
- The folklore has it that we need to go down 5 levels on average to get to the bottom of the problem

Why-why diagram example

Why?

Site engineer keeps equipment longer than needed

Site engineer fears equipment will not be available later when needed

Time between request and delivery too long

Excessive time spent in finding suitable equipment and approving the request

Time spent waiting for works engineer to check request

Time spent by clerk contacting possibly multiple suppliers sequentially

Cause-effect (Fishbone) diagram
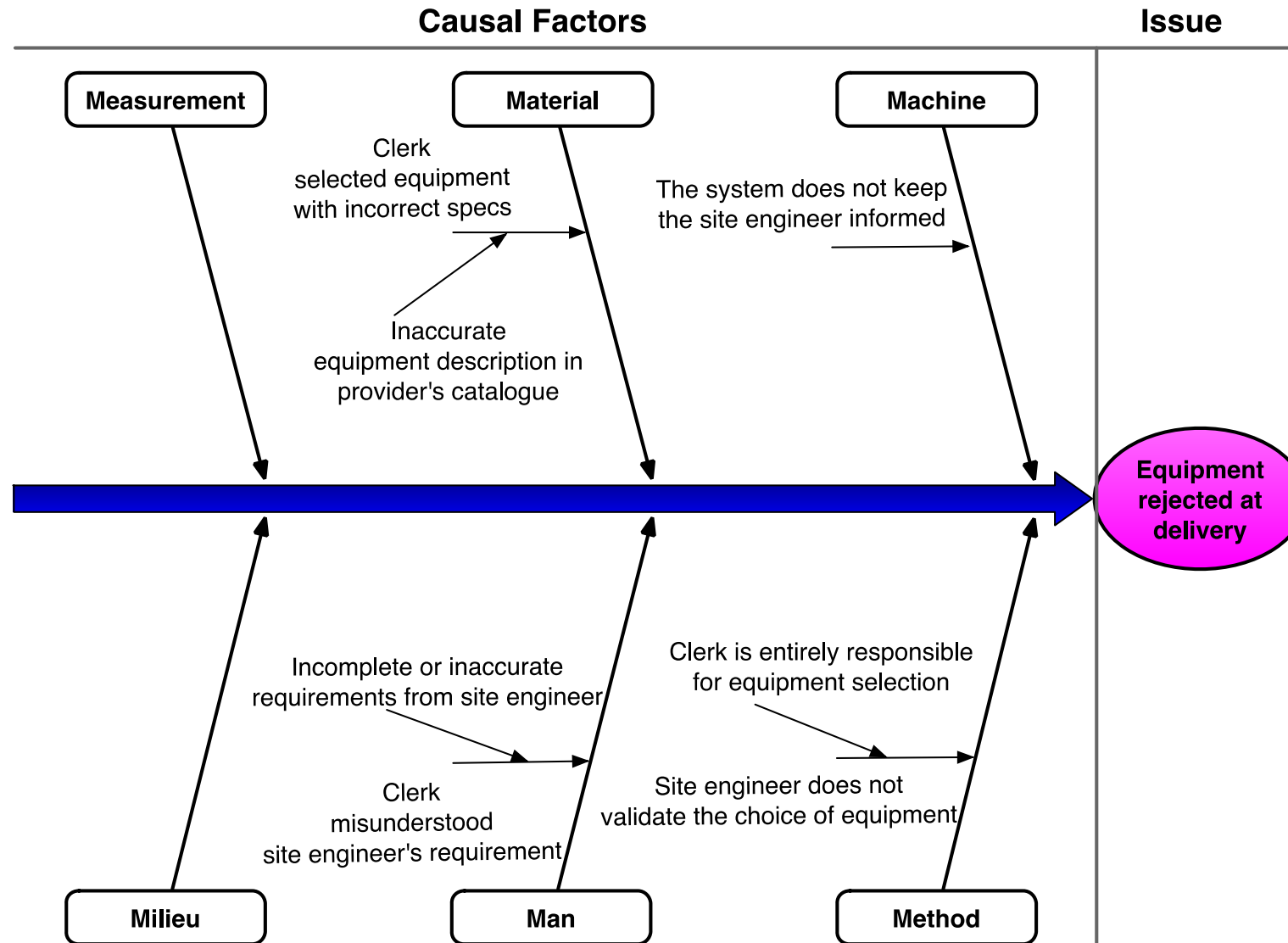
Categories of causes: Six Ms

1. **Machine:** factors stemming from technology used
   - Lack of suitable functionality in the supporting software applications
   - Poor User Interface (UI) design
   - Lack of integration between systems

2. **Method:** factors stemming from the way the process is designed, understood or performed
   - Unclear assignments of responsibilities
   - Unclear instructions
   - Insufficient training
   - Lack of timely communication

3. **Material:** factors stemming from input materials or data
   - Missing, incorrect or outdated data

Categories of causes: Six Ms

4. **Man:** factors stemming from wrong assessments or incorrect performance of steps attributable to:
   - Lack of training and clear instructions
   - Lack of motivation
   - Too high demands towards process workers

5. **Measurement:** factors stemming from reliance on:
   - Inaccurate estimations
   - Miscalculations

6. **Milieu:** factors outside the scope of the process
   - Delays caused because of unresponsive external actors
   - Sudden increases of workload due to special circumstances

Cause-effect diagram example

Causal Factors **Issue**

Measurement | Material | Machine

Clerk selected equipment with incorrect specs

The system does not keep the site engineer informed

Inaccurate equipment description in provider's catalogue

Equipment rejected at delivery

Incomplete or inaccurate requirements from site engineer

Clerk is entirely responsible for equipment selection

Clerk misunderstood site engineer's requirement

Site engineer does not validate the choice of equipment

Milieu | Man | Method

Exercise 6.7

As discussed in Exercise 6.4 (page 232), one of the main issues of the university admission process is that students have to wait too long to know the outcome of their application. It often happens that by the time a student is admitted, the student has decided to go to another university instead. Analyze the possible causes of this issue using a why-why diagram.

Summary

1. Segregate value-adding, business value-adding and non-value-adding steps

2. Identify waste

3. Collect and systematically organize issues, assess their impact

4. Analyze root causes of issues

Next Week

Quantitative Process Analysis
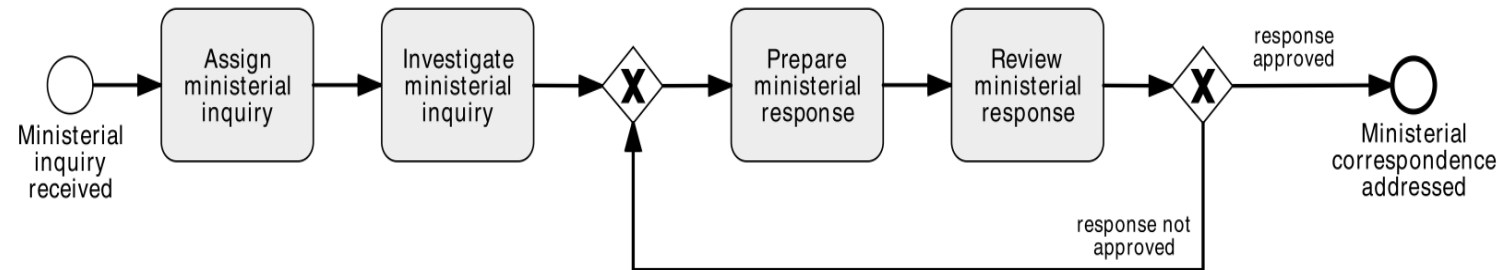
Activity	Cycle time	Processing time
Register ministerial enquiry	2 days	30 mins
Investigate ministerial enquiry	8 days	12 hours
Prepare ministerial response	4 days	4 hours
Review ministerial response	4 days	2 hour

Acknowledgements

- The content notes for this lecture feature content borrowed with or without modification from the following sources:
    - "Source: M. Dumas, M. La Rosa, J. Mendling and H. Reijers, *Fundamentals of Business Process Management*, 2nd edition, Springer, 2018".
    - Chapter 6