ULB

INFO-H420
Management of Data Science and Business Workflows
Part I
4. Qualitative Process Analysis

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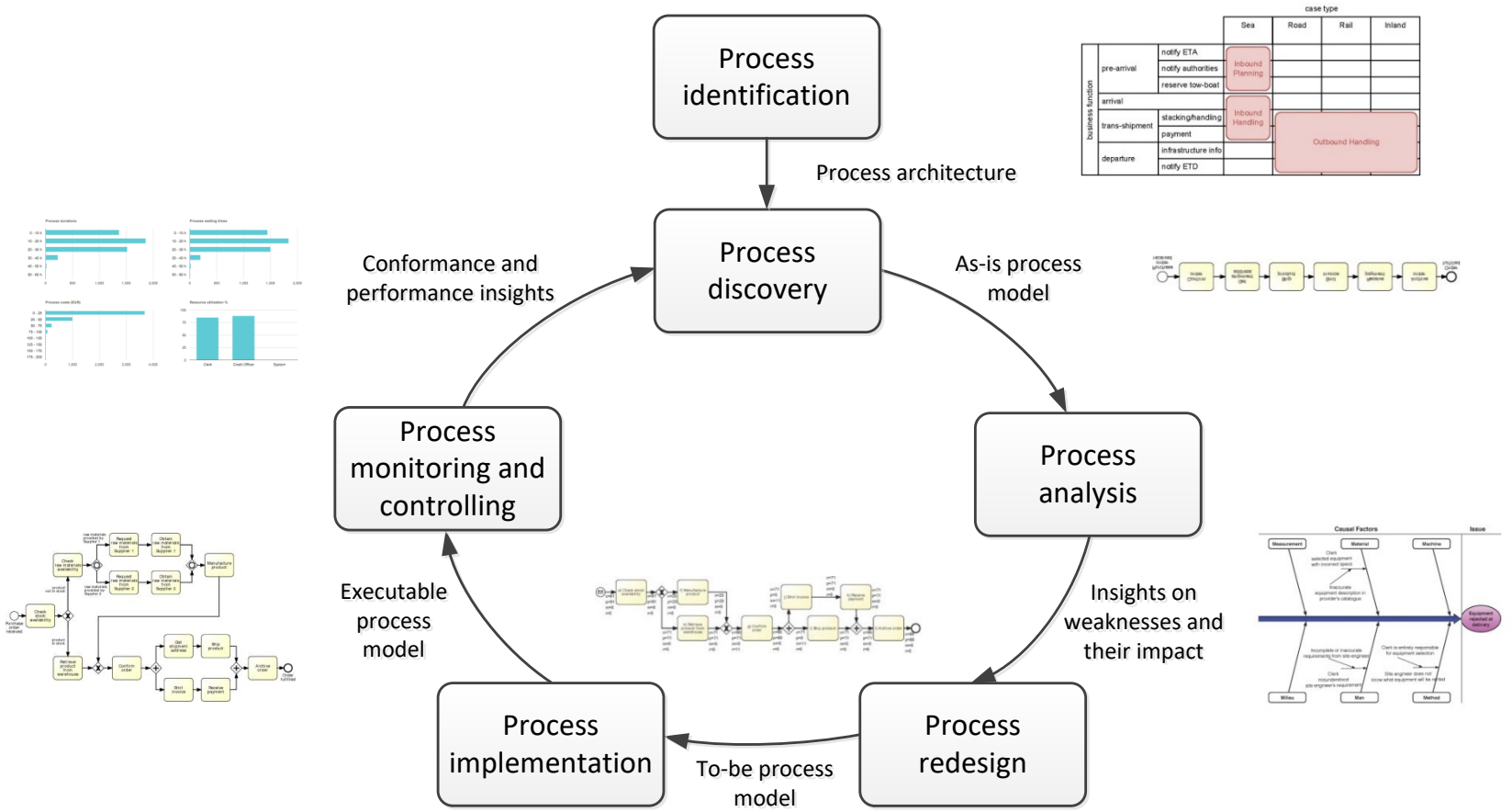
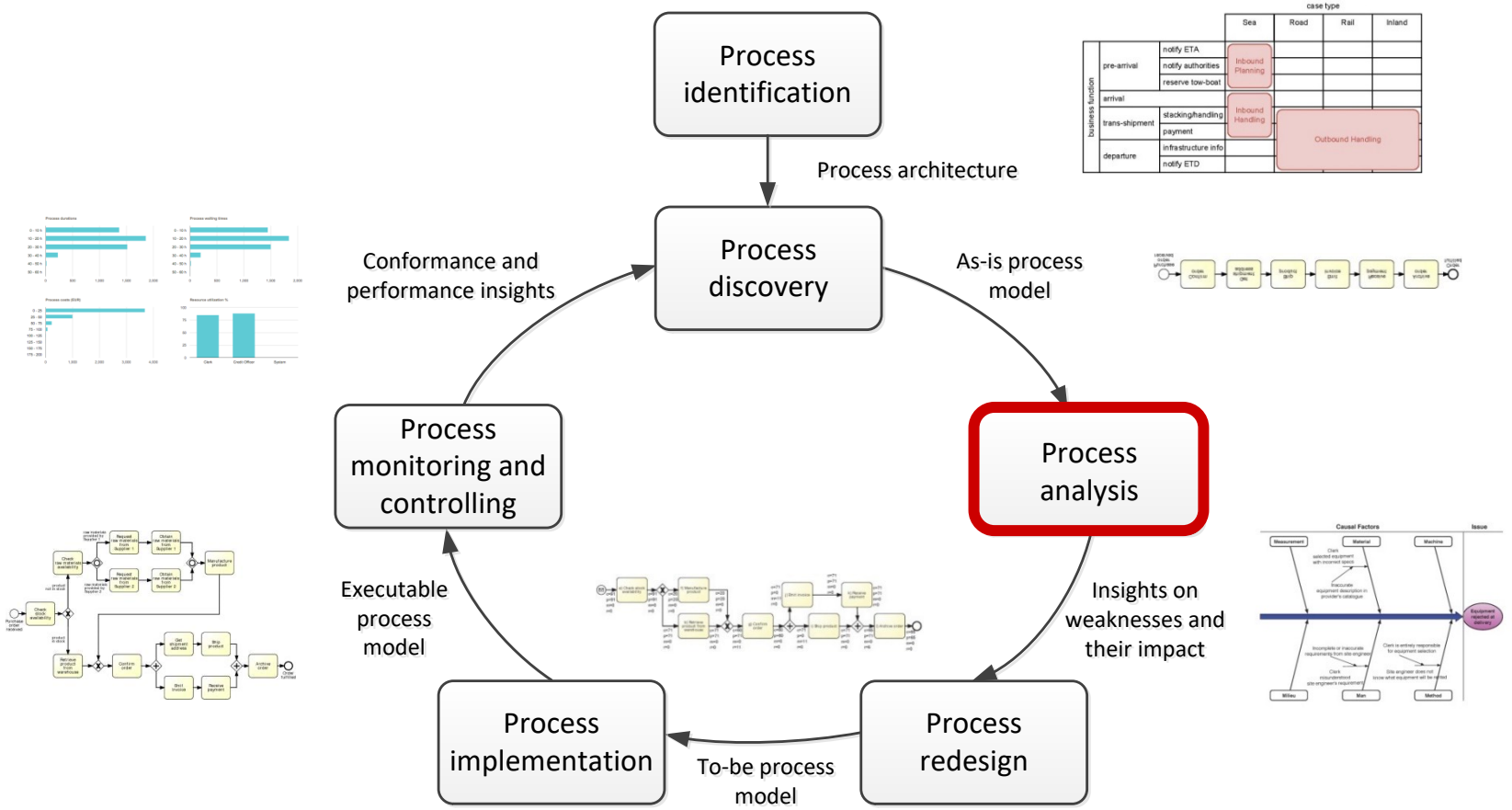
Process Analysis



Process Analysis



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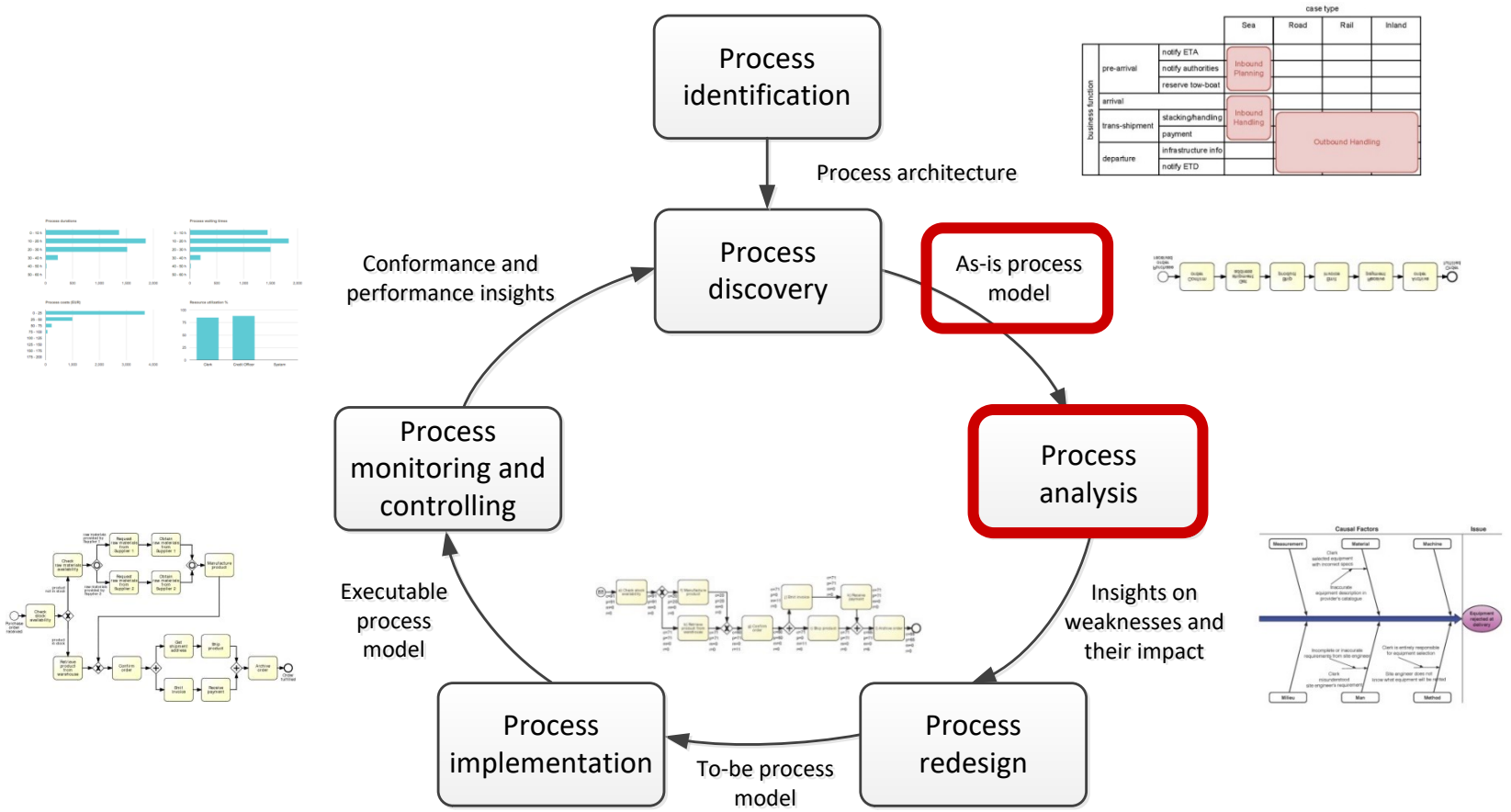

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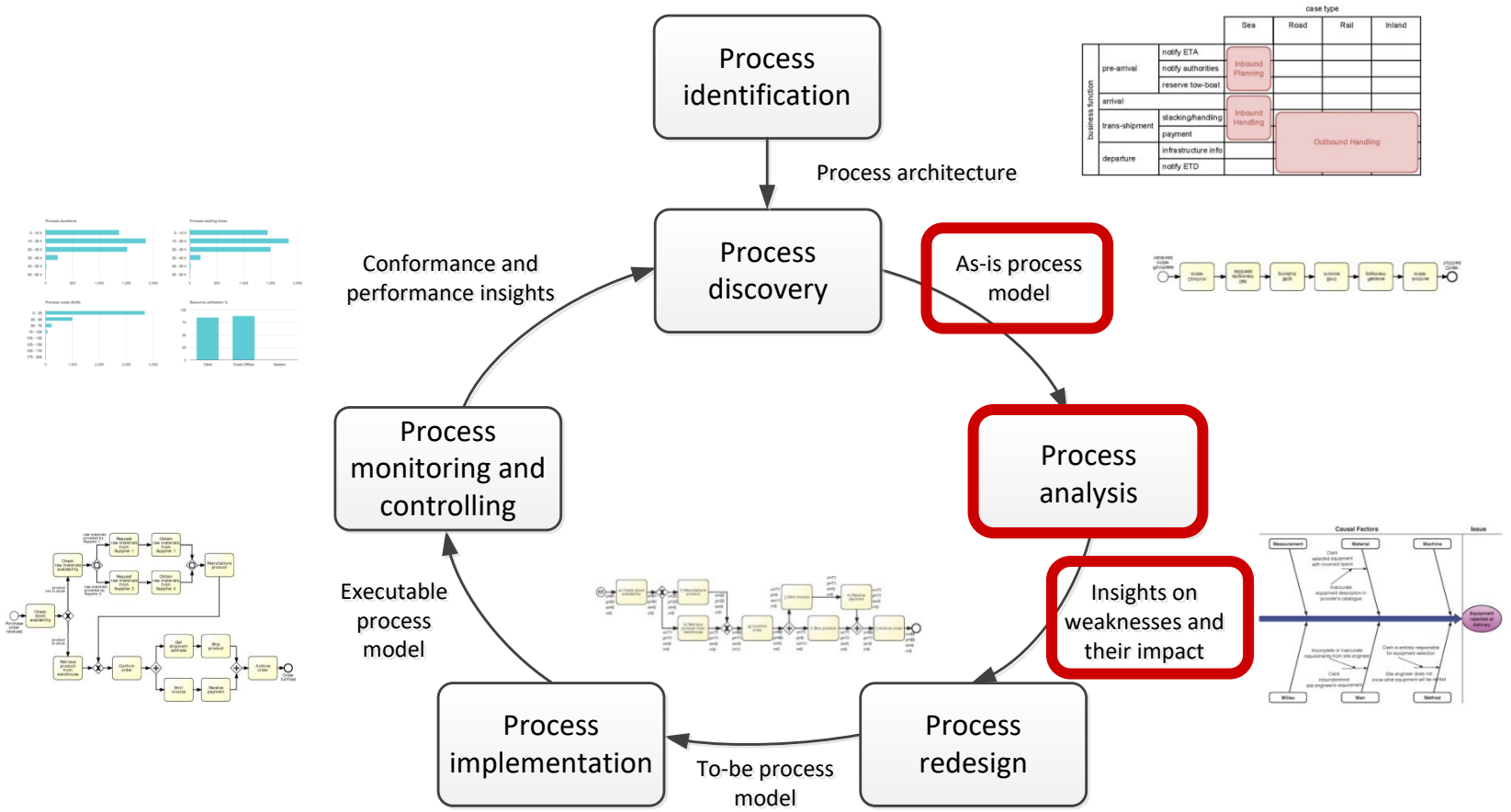


Process Analysis Techniques

Qualitative analysis

- Value-Added & Waste Analysis
- Issue Register & PICK Charts
- Root-Cause Analysis

Quantitative Analysis

VALUE-ADDED ANALYSIS

Value-added analysis

1. Decorticate the process tasks 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. Classify each step
   - Value-adding (VA)
   - Business value-adding (BVA)
   - Non-value-adding (NVA)

Value-adding steps

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 steps

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 steps

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

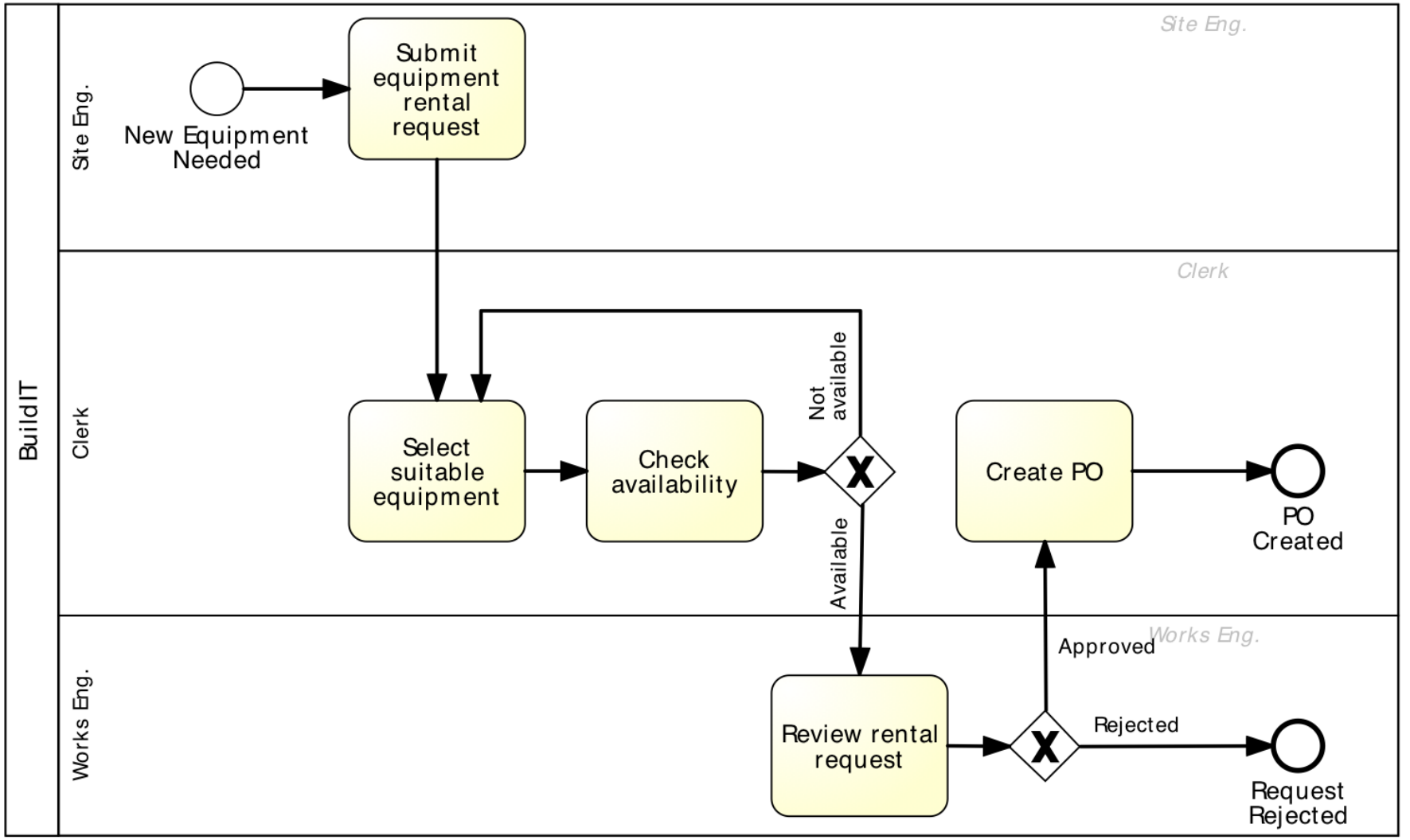
Includes

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



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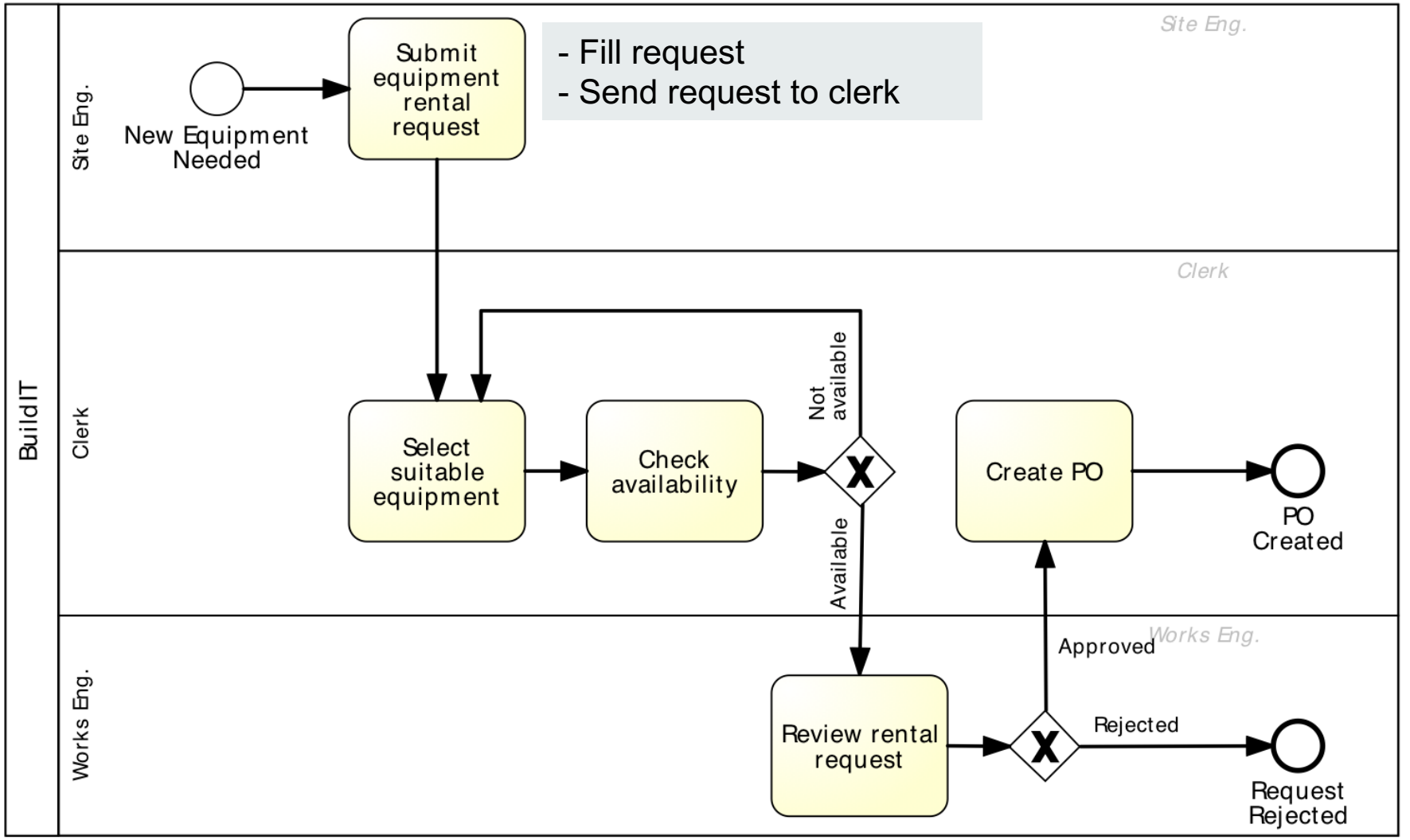

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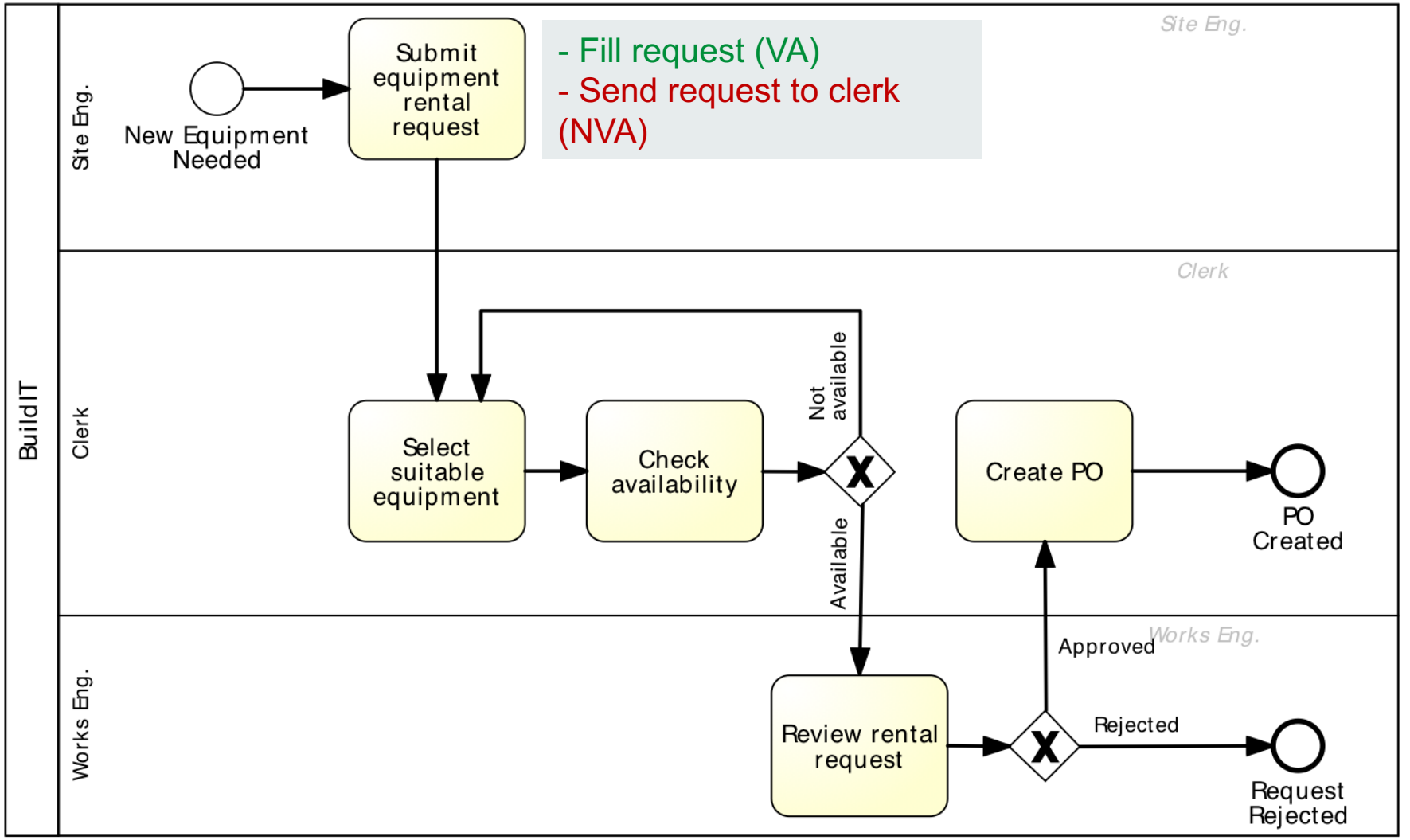

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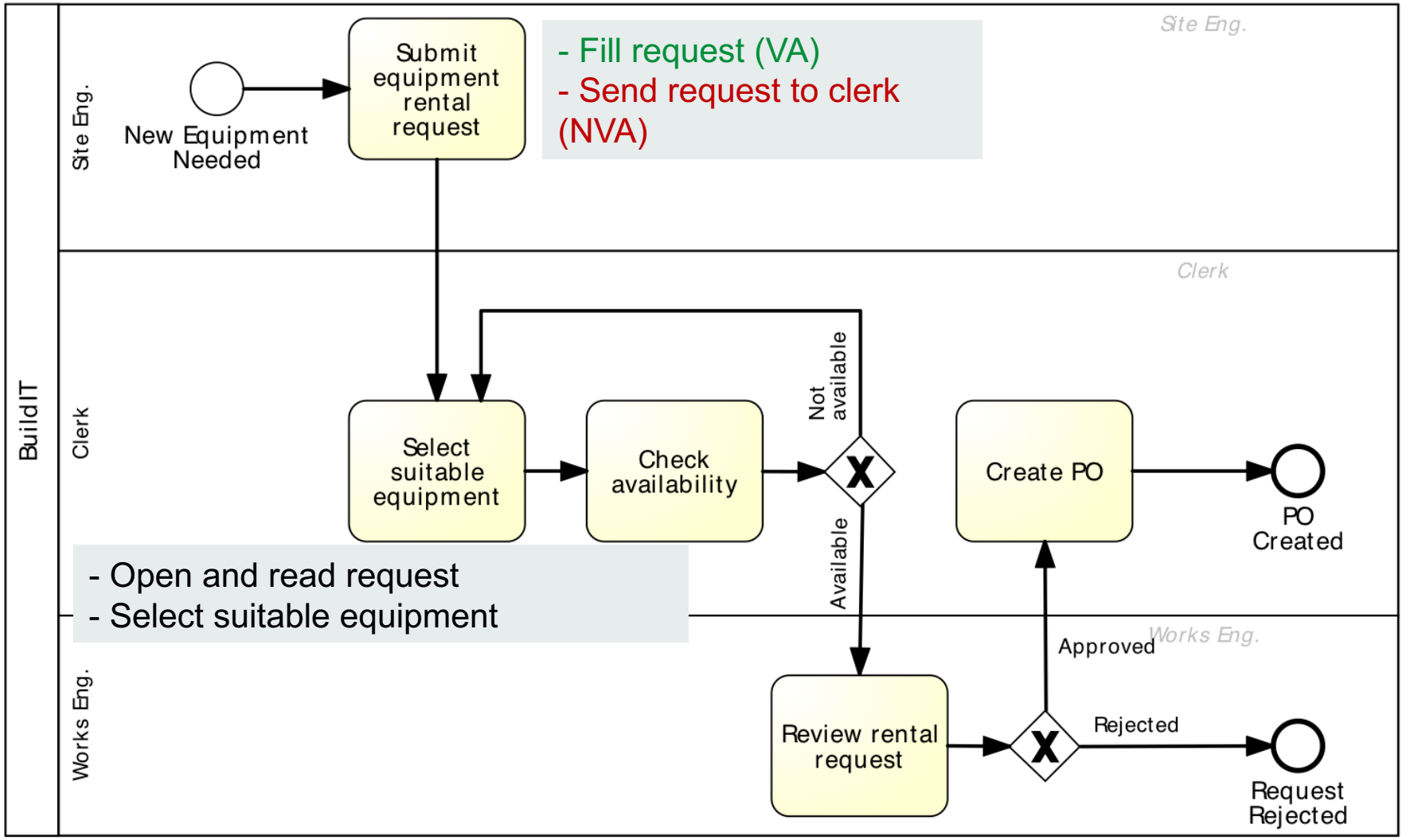

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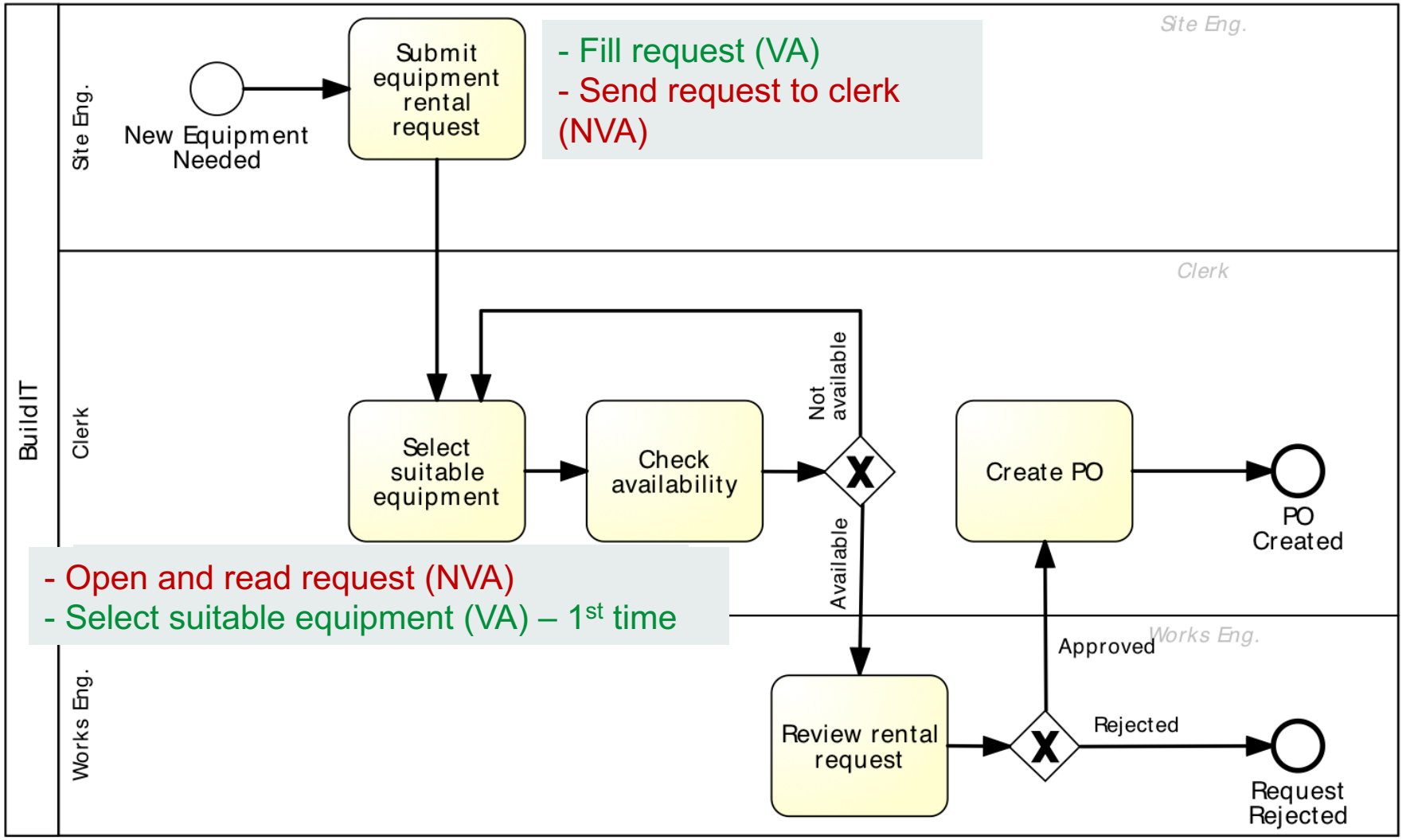

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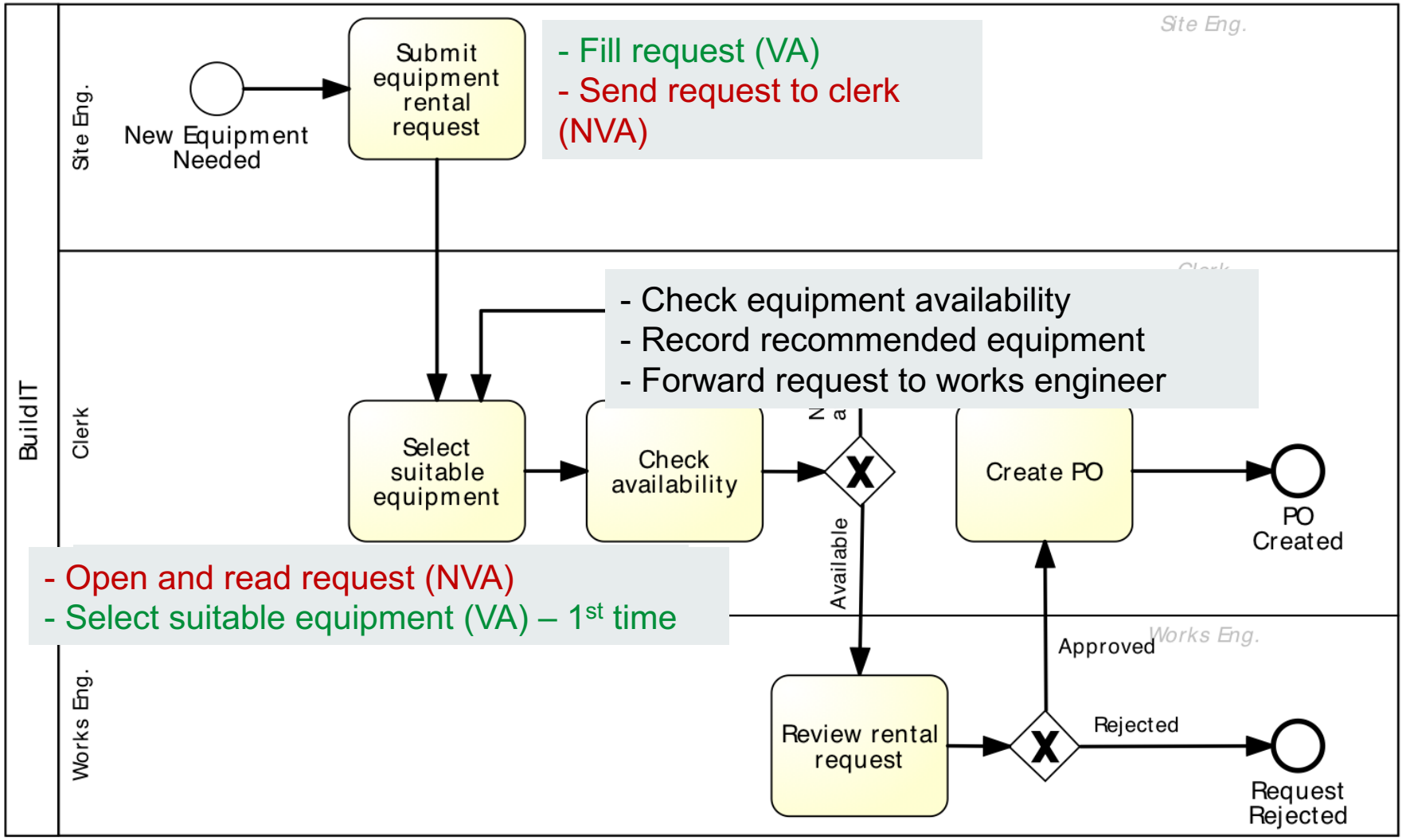

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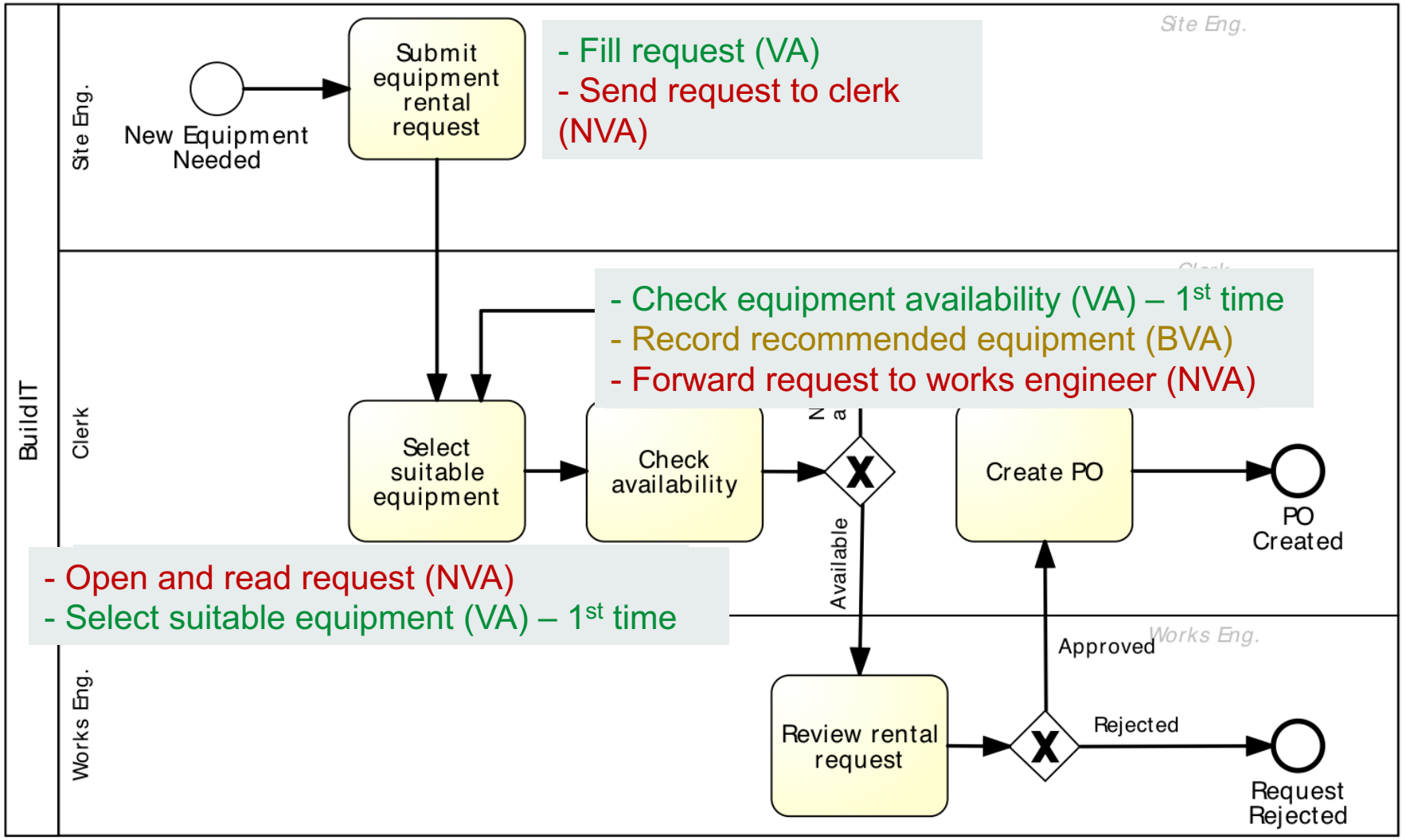

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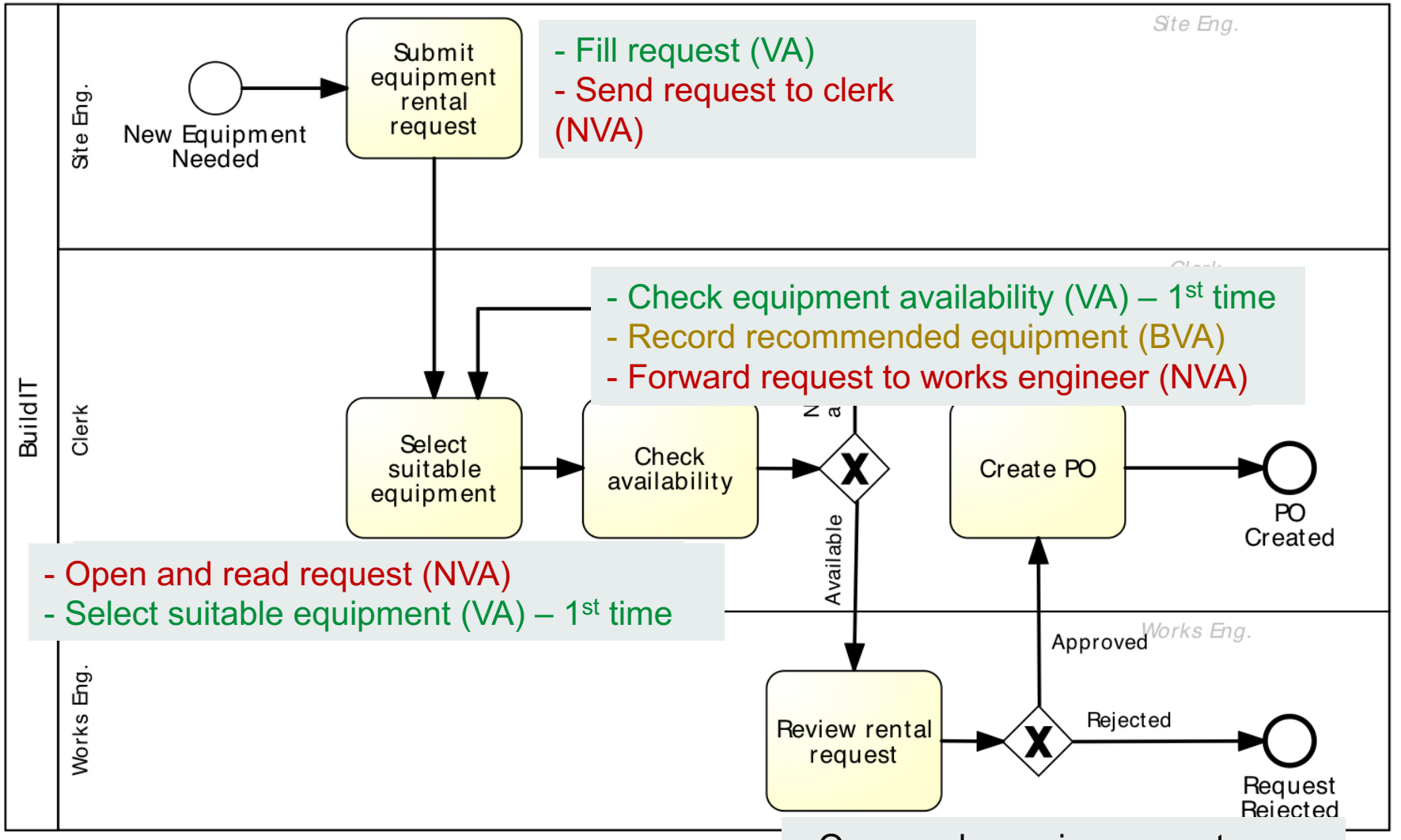

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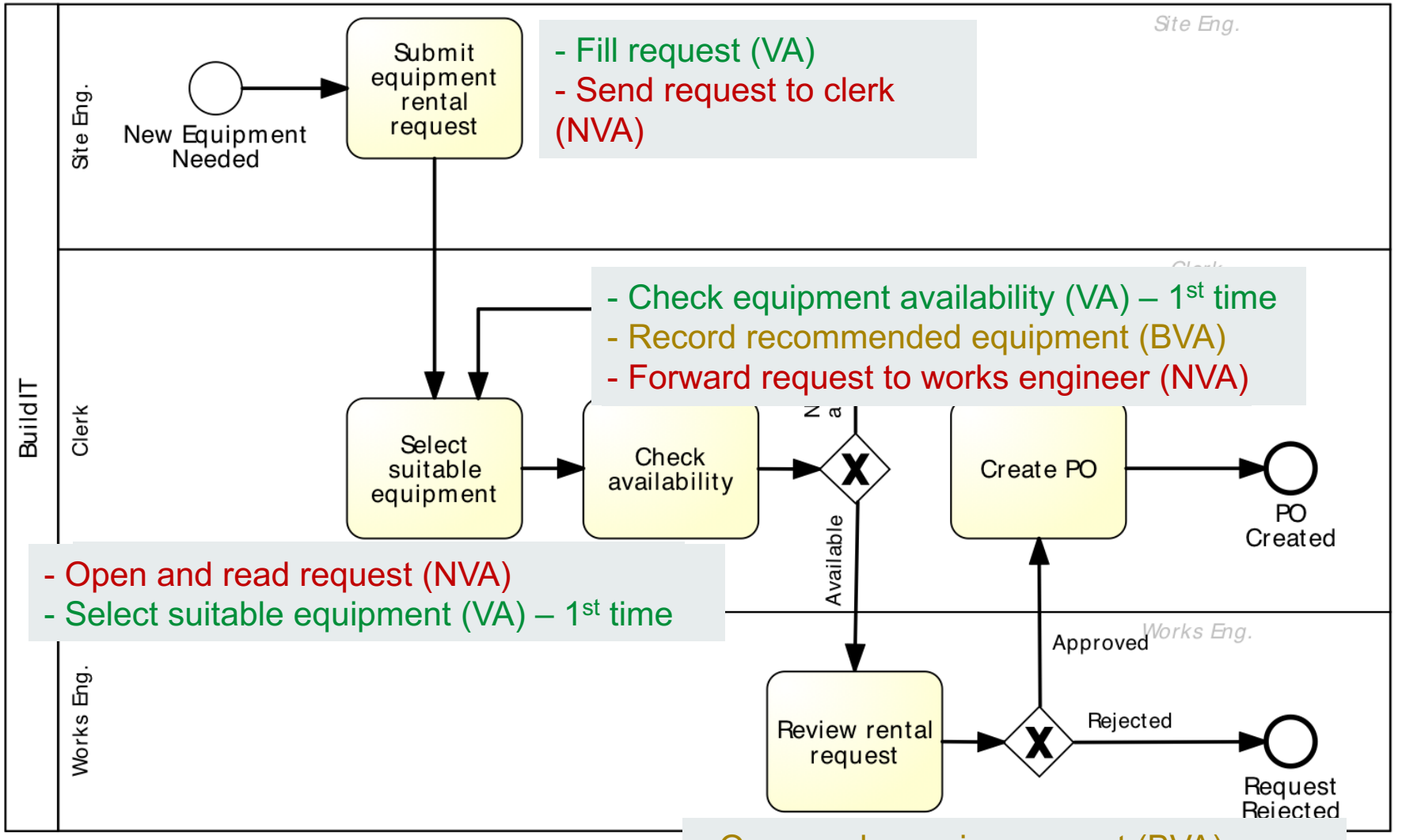

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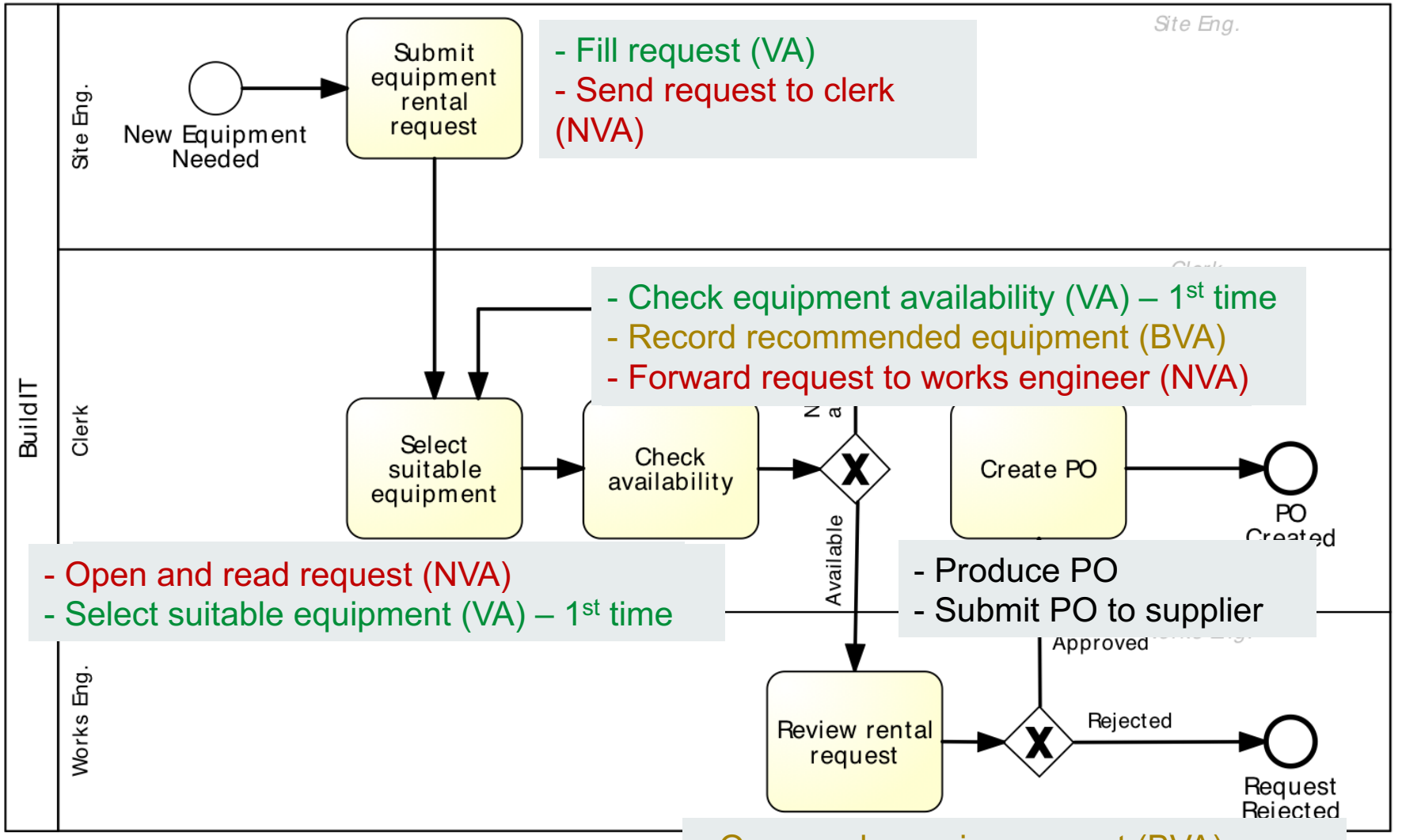

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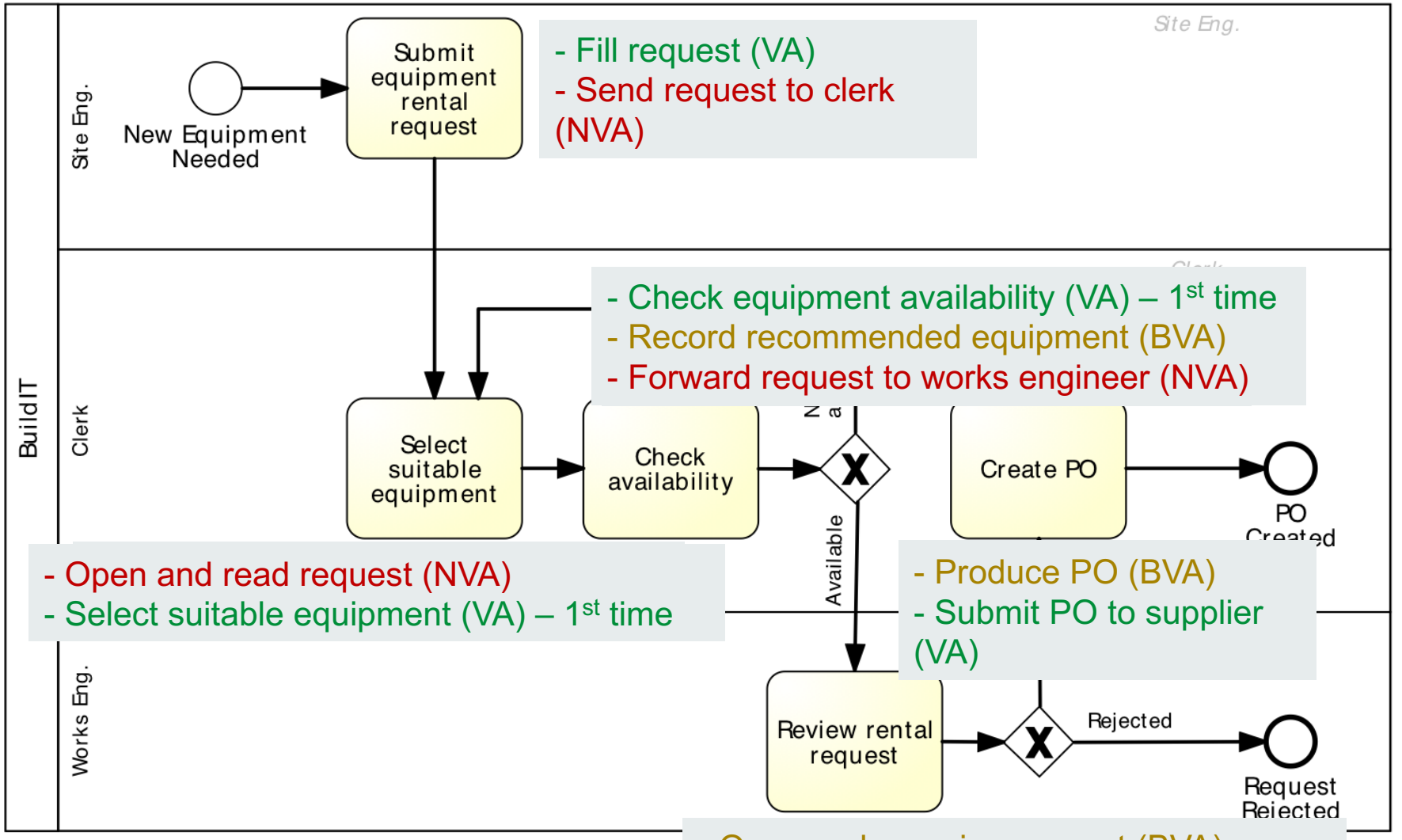
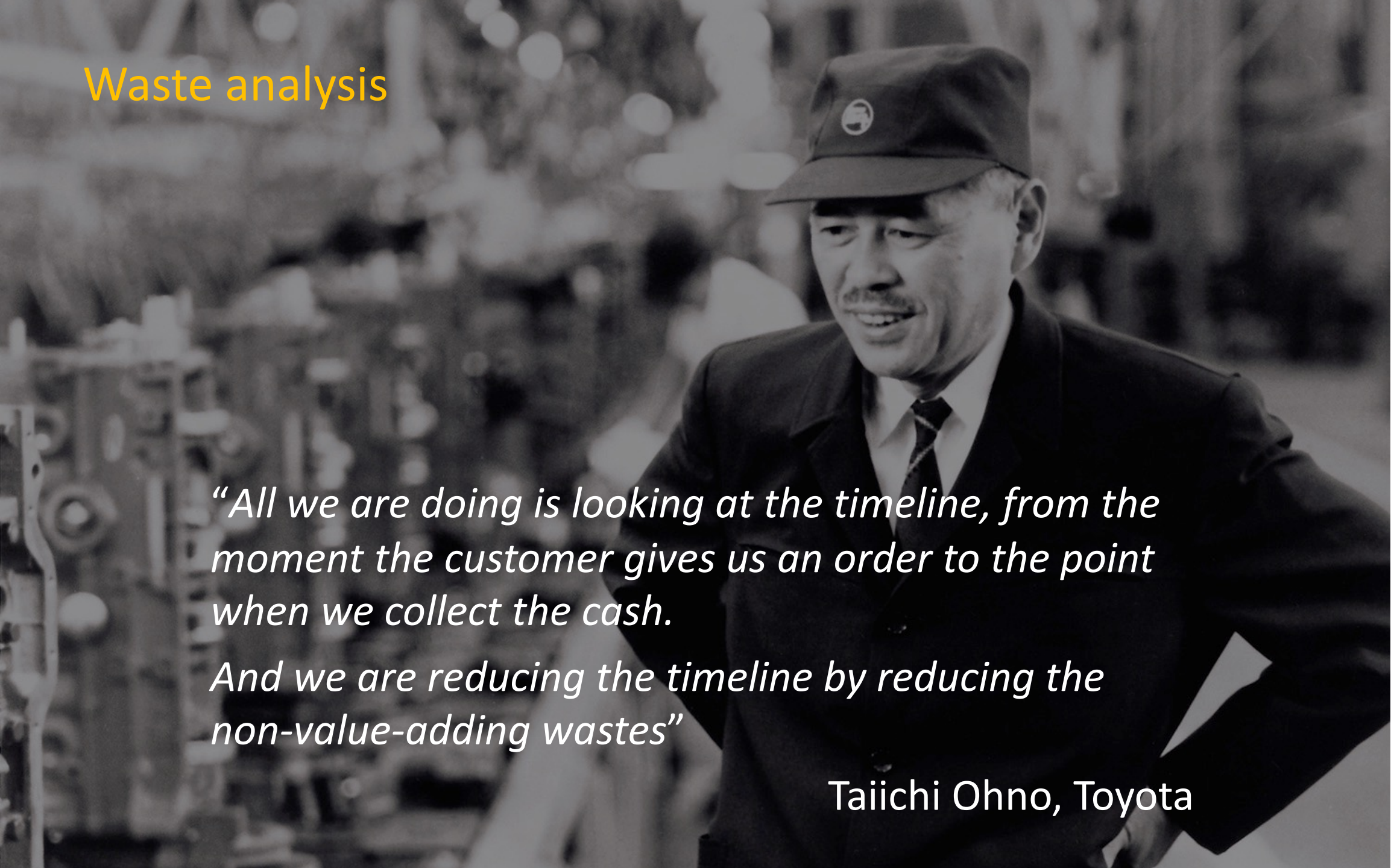


Equipment Rental Process – VA Analysis

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

WASTE ANALYSIS

Waste analysis



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

And we are reducing the timeline 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

Hold

Inventory

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

Example

- University admission process: About 3000 applications are handled concurrently
- 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

Waiting

- Task waiting for materials or input data
- Task waiting for a resource
- Resource waiting for work (resource idleness)

Examples

- Application-to-Approval process: Request waiting for approver
- University admission process: Incomplete application waiting for additional documents; batch of applications waiting for committee to meet
- Vehicle inspection process: A technician at a base of the inspection station waiting for the next vehicle

Over-do

Defects

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

Examples

- Travel approval process: Request sent back to requestor for revision
- University admission process: Application sent back to applicant for modification; request needs to be re-assessed later due to incomplete information
- Vehicle inspection process: 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

- 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
- Vehicle inspection process: 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

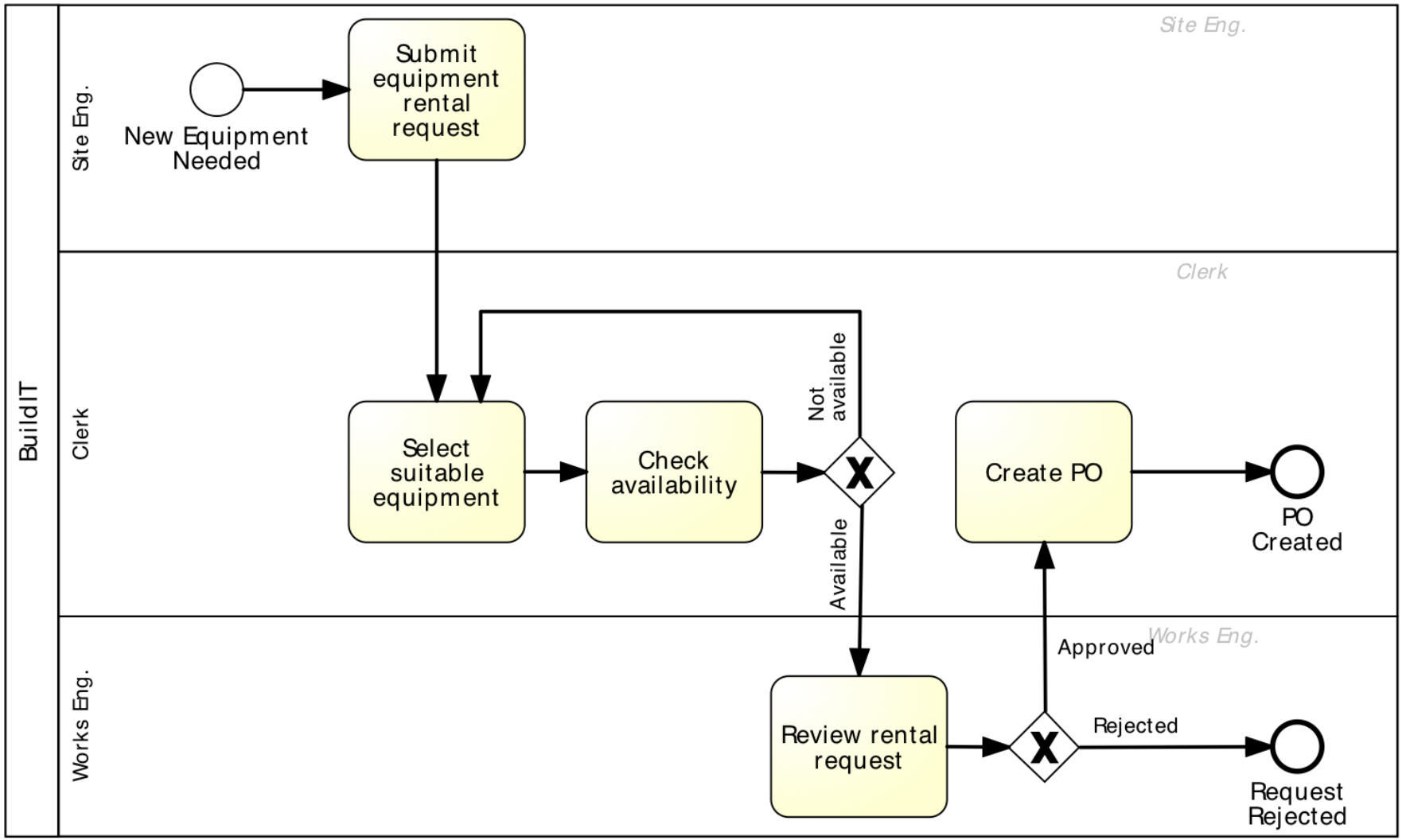
Over-production

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

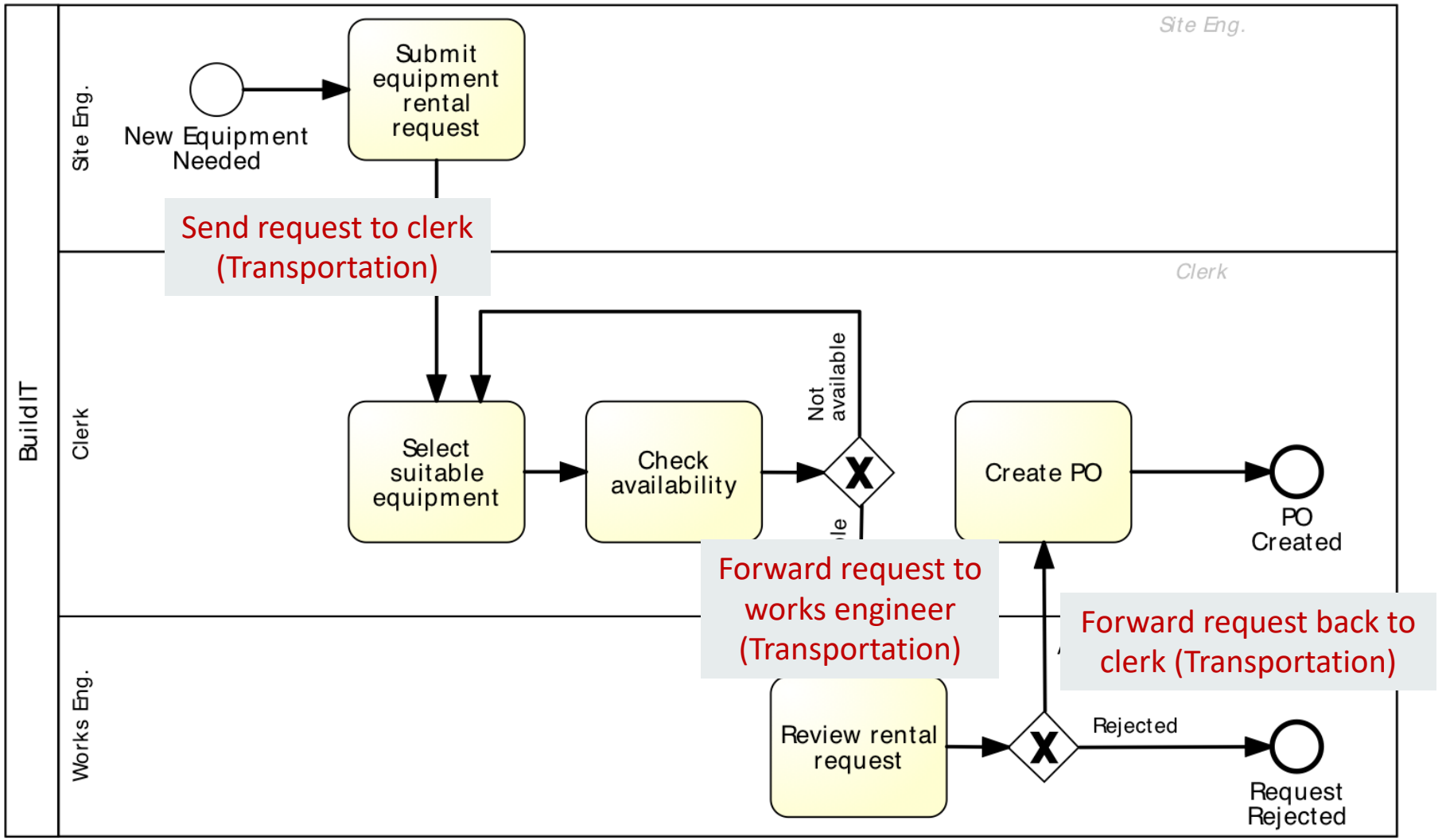
Examples

- Quote-to-cash process: In 50% of cases, issued quotes do not lead to an order
- Travel approval process: In 5% of cases, travel requests are approved but the travel is cancelled
- University admission process: About 3000 applications are submitted, but only 600 are considered eligible after assessment

Equipment rental process: wastes



Equipment rental process: wastes



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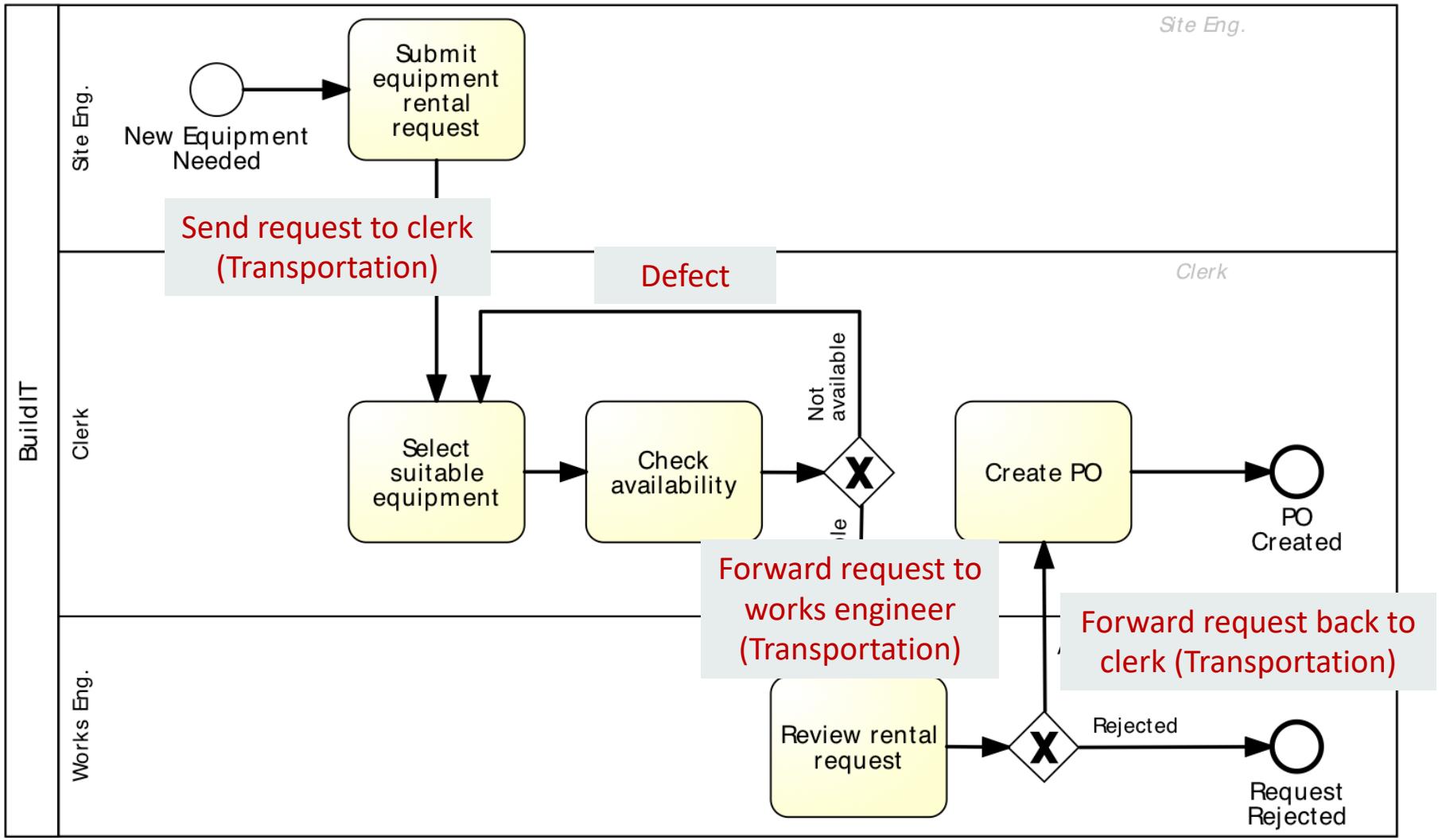

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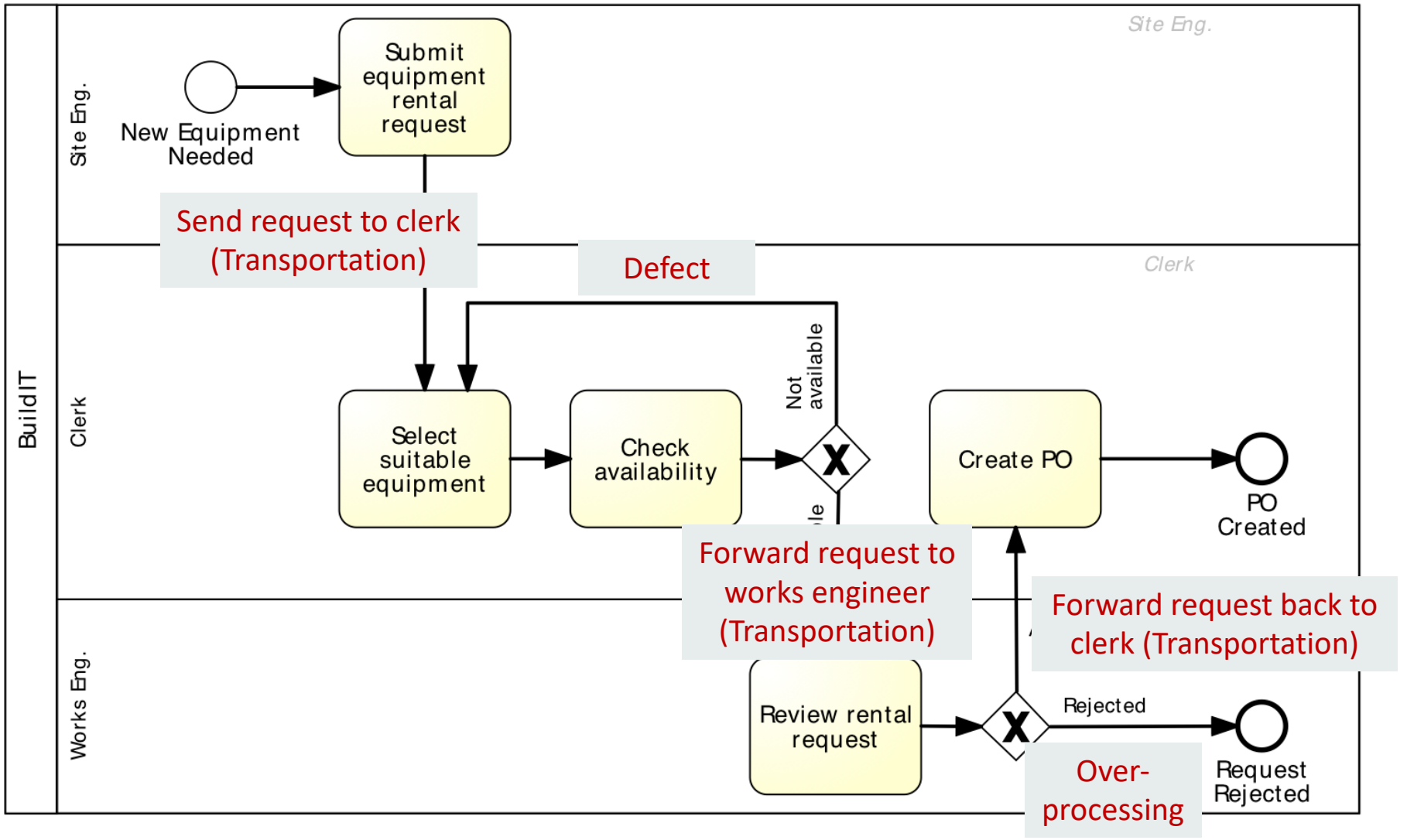


Equipment rental process: wastes

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 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
- Equipment returned by site engineer because is incorrect

ISSUE REGISTER

Issue register

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

Sources of issues:

- Input to the BPM project
- Collected during process discovery (e.g. during modelling workshops)
- Collected via *stakeholder analysis*
  - Customers
  - Process participants (workers)
  - Process owner / managers
  - Subcontractors, business partners

Issue register structure

Can take the form of a table with:

- Issue identifier
- Short name
- Description
- Data and Hypotheses
- Impact: Qualitative and Quantitative
- 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 p.a.
  In 10% of cases, equipment is kept two days more than needed
  Average rental cost is 100 per day

Quantitative impact

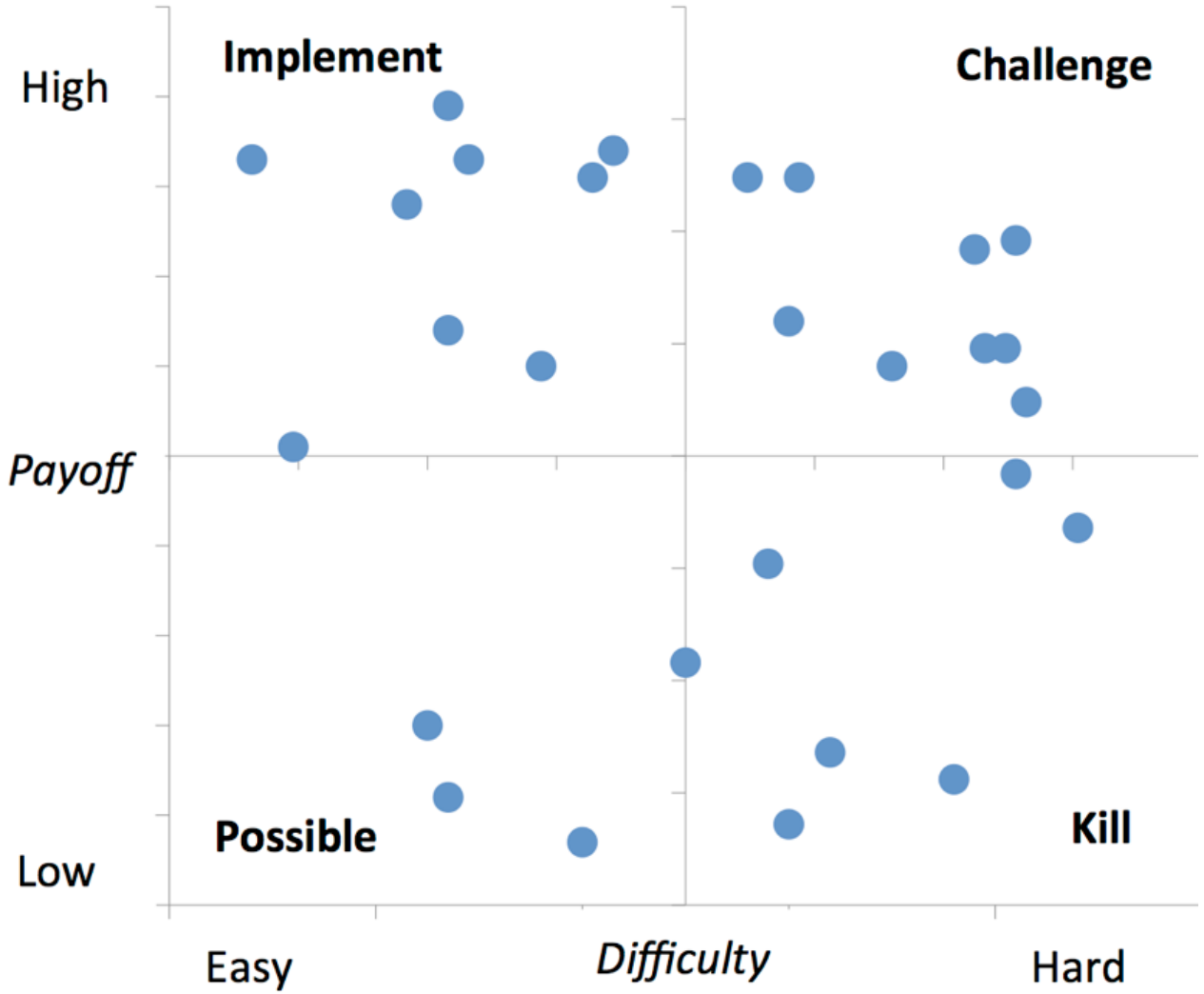
- 0.1 × 3000 × 2 × 100 = 60,000 p.a

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.

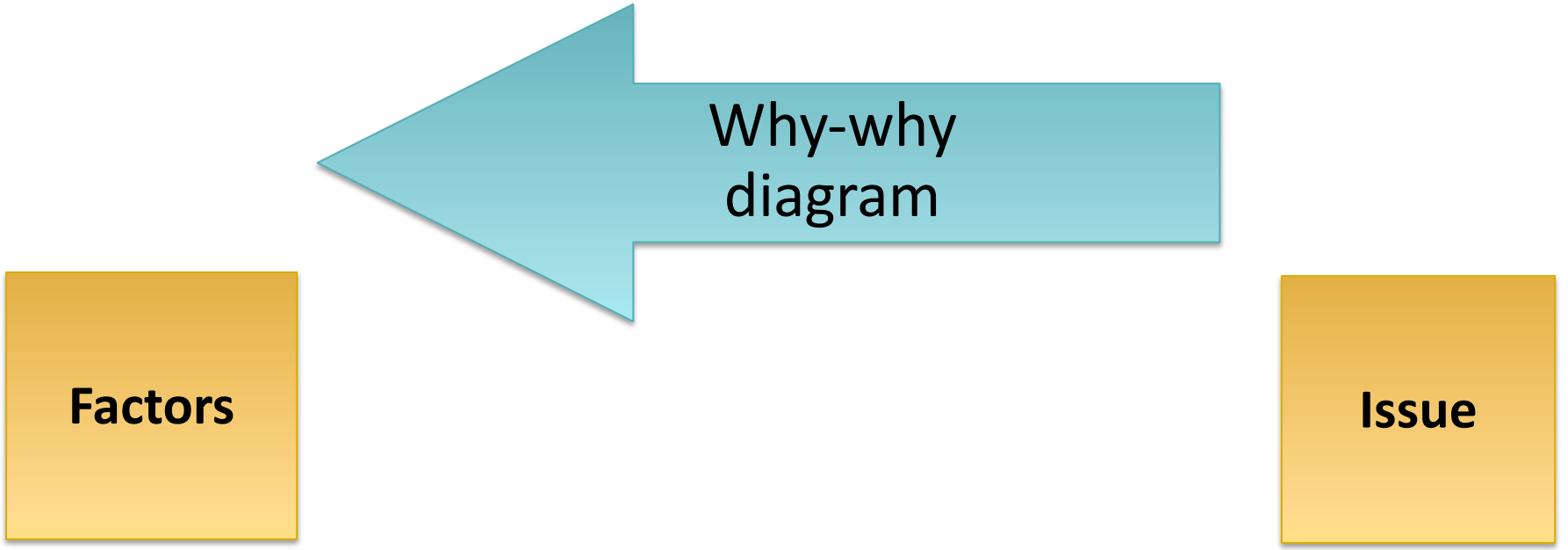
Issue Prioritization: PICK Chart



ROOT CAUSE ANALYSIS

Root-cause analysis

Root-cause analysis



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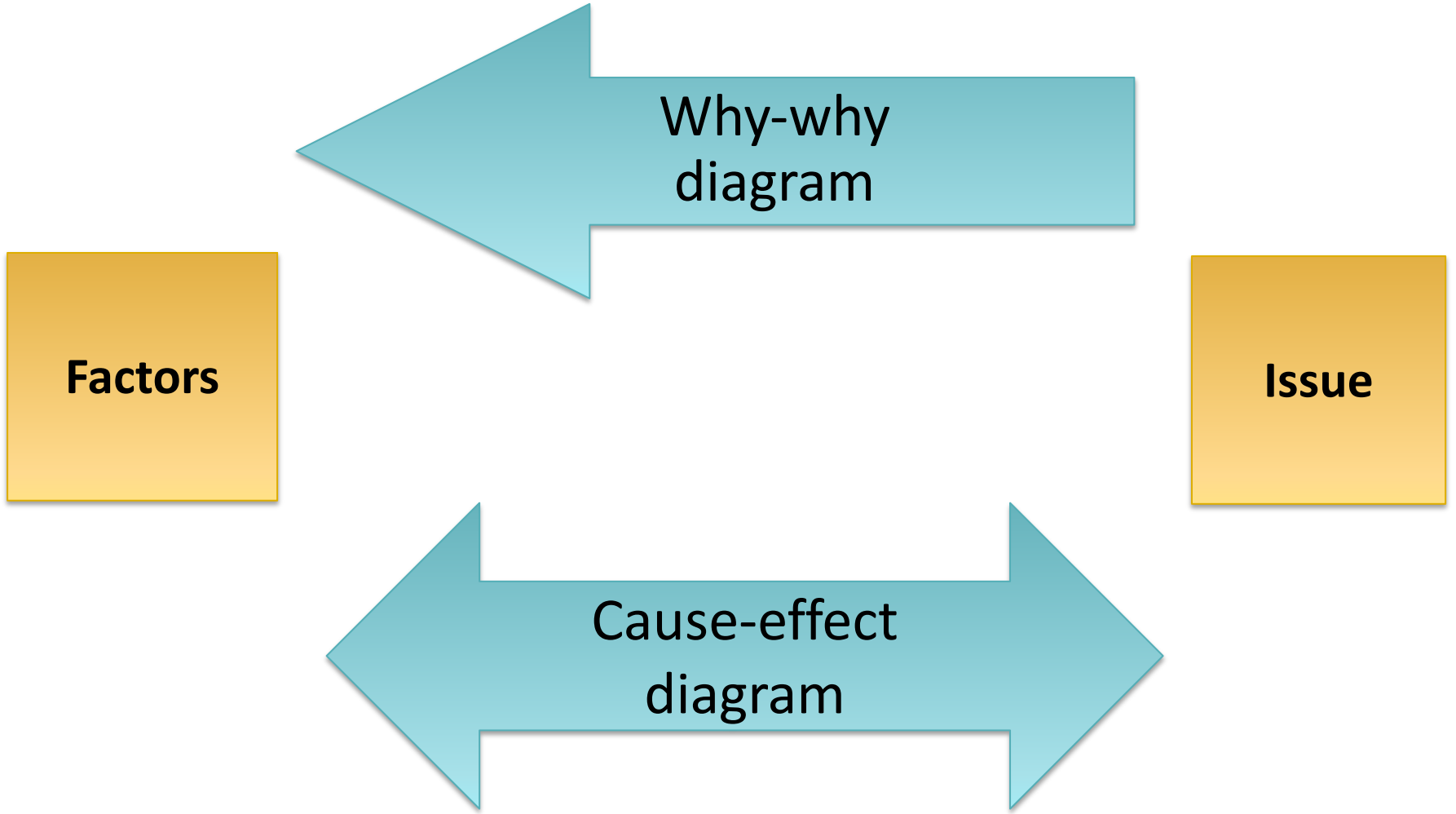
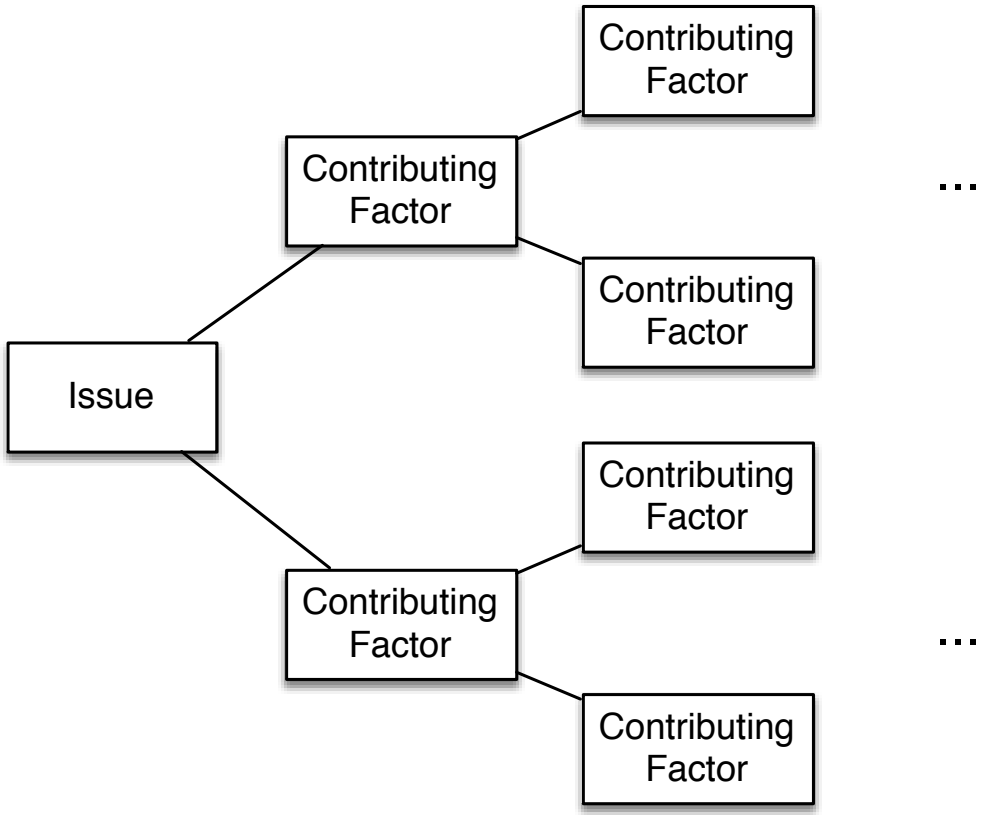


Why-why diagram

Five levels of nesting - “Five Why’s”

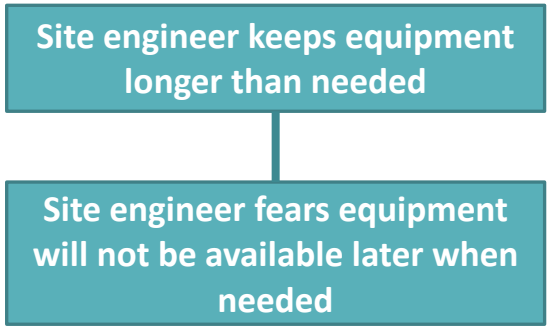


Why-why diagram example

Why-why diagram example

Site engineer keeps equipment longer than needed

Why-why diagram example



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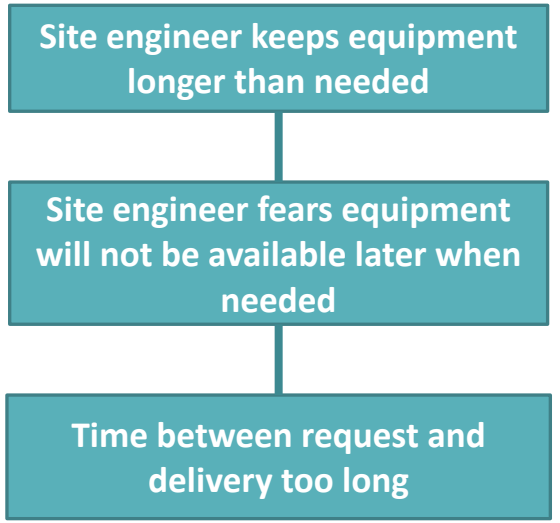

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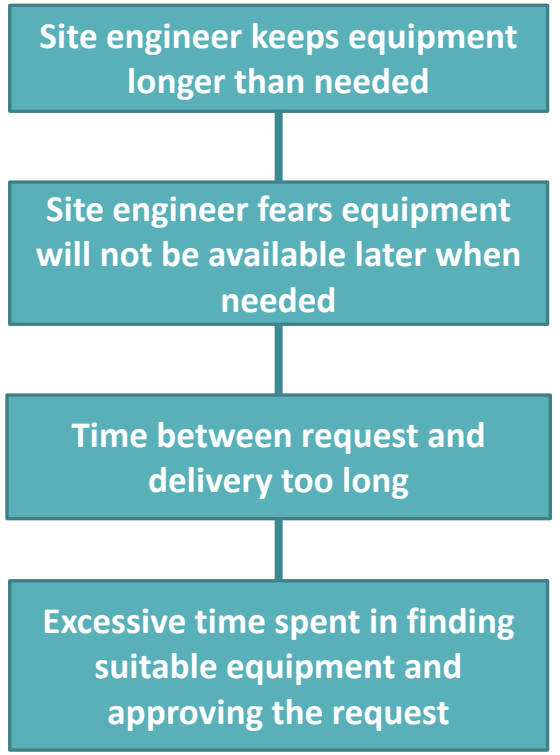

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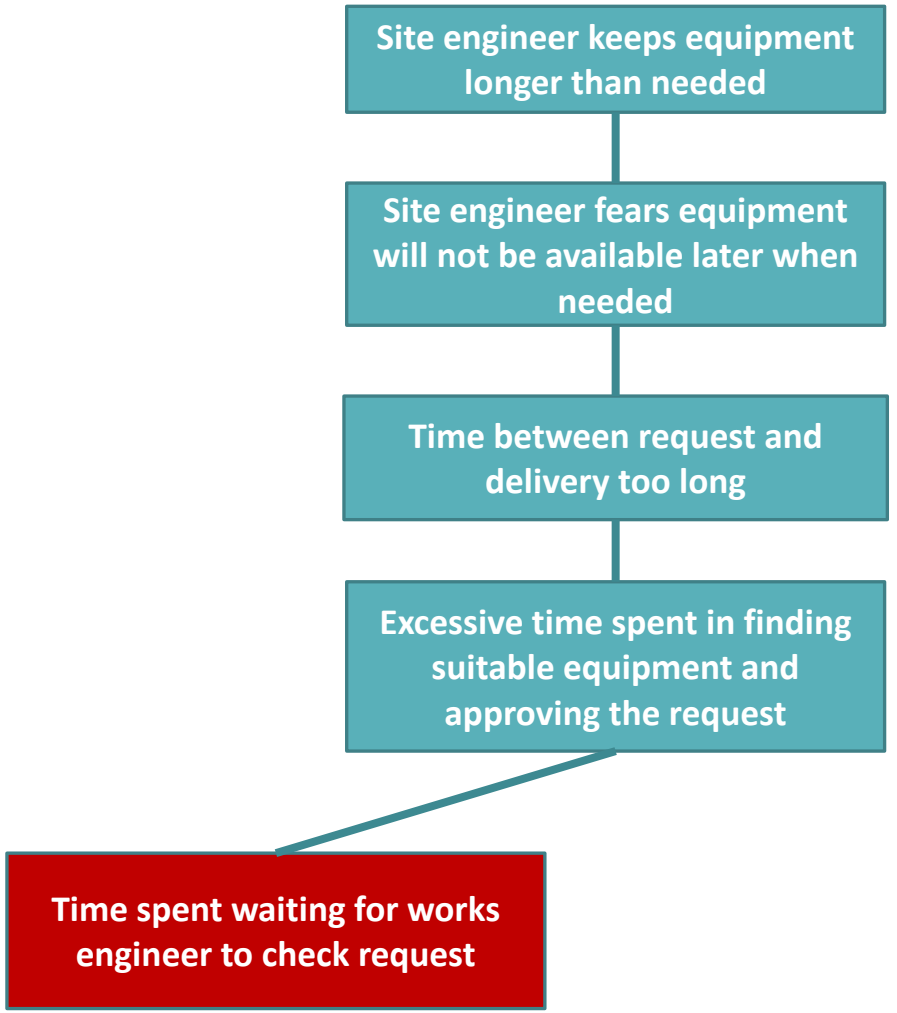

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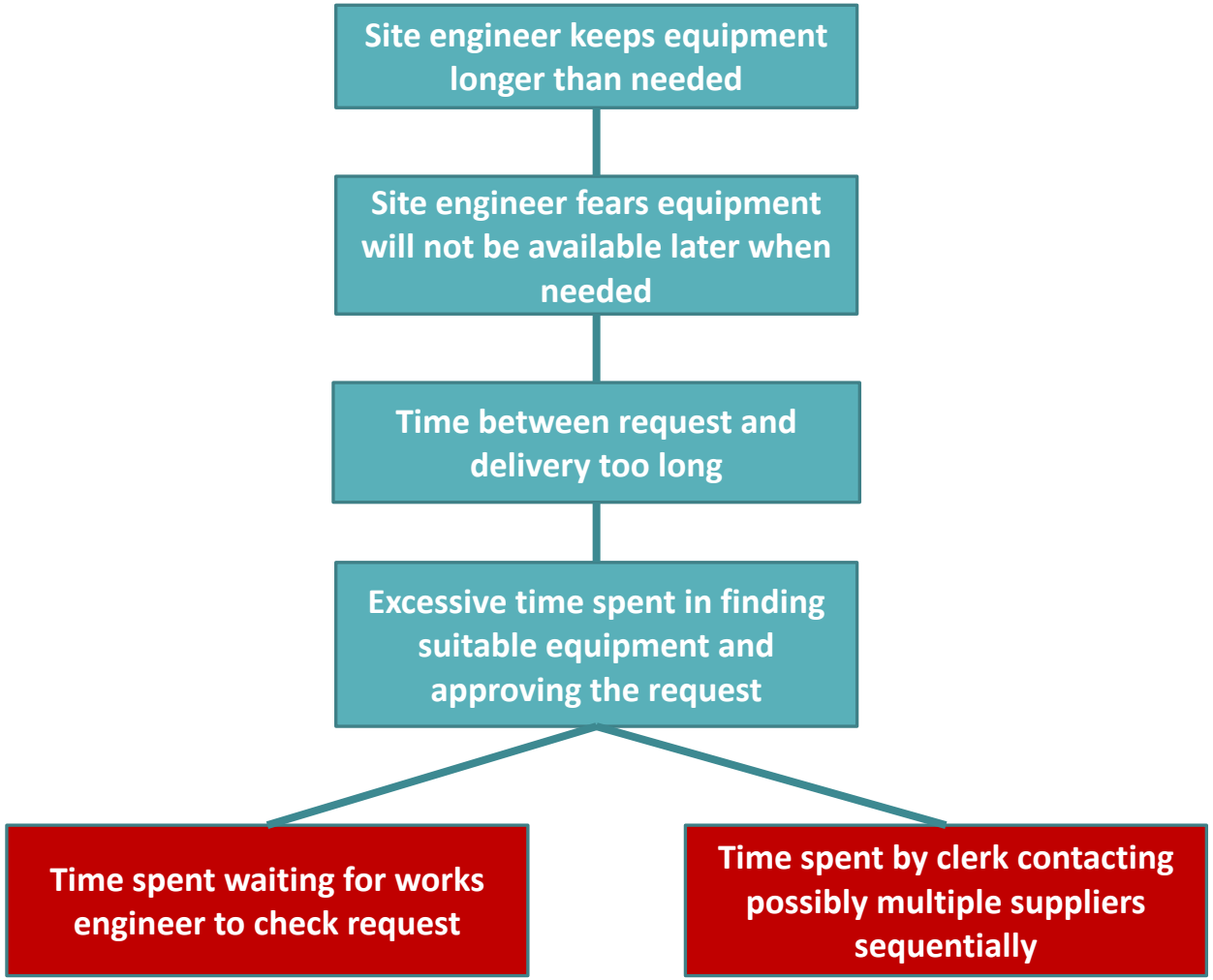
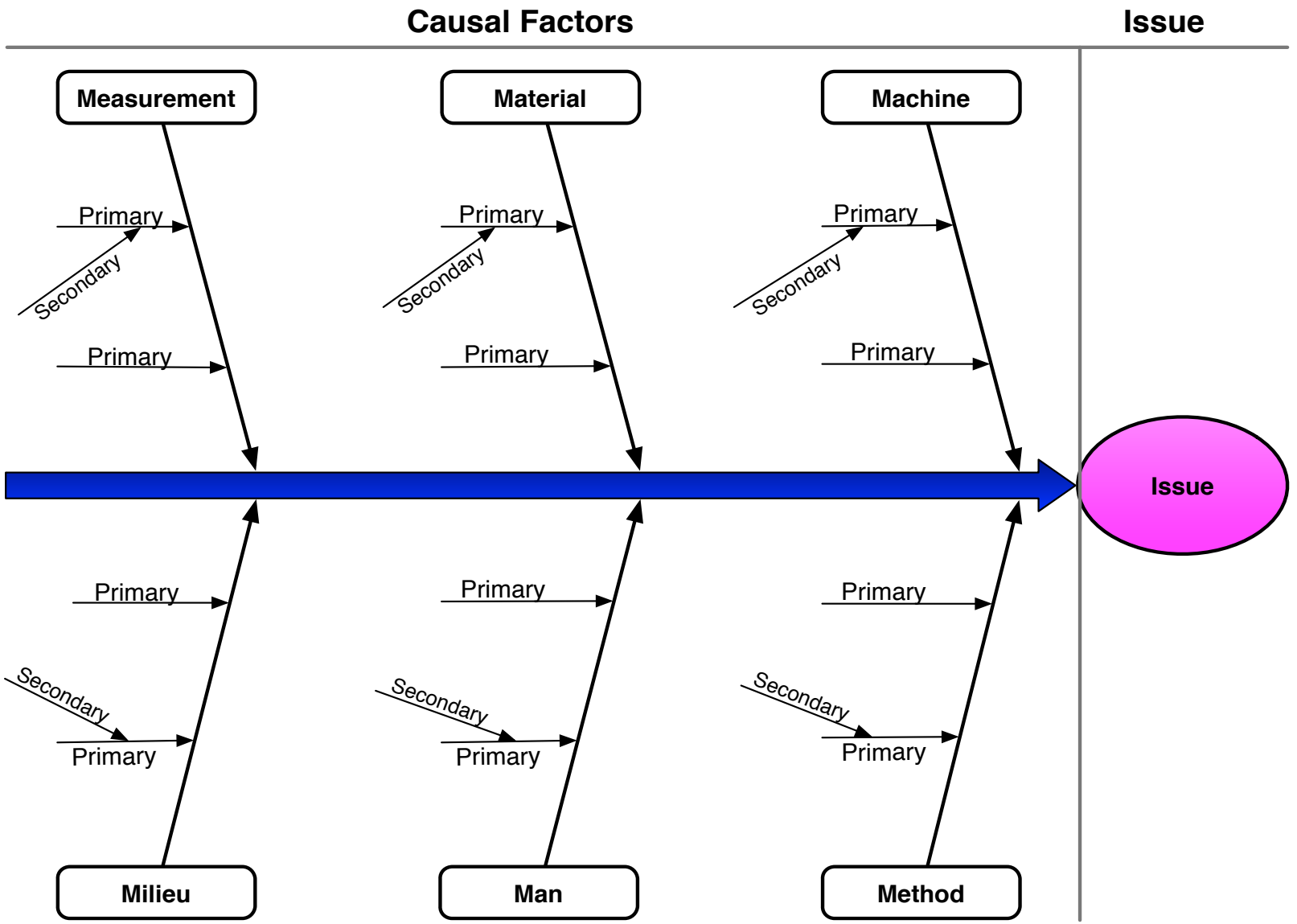


Cause-effect (Fishbone) diagram



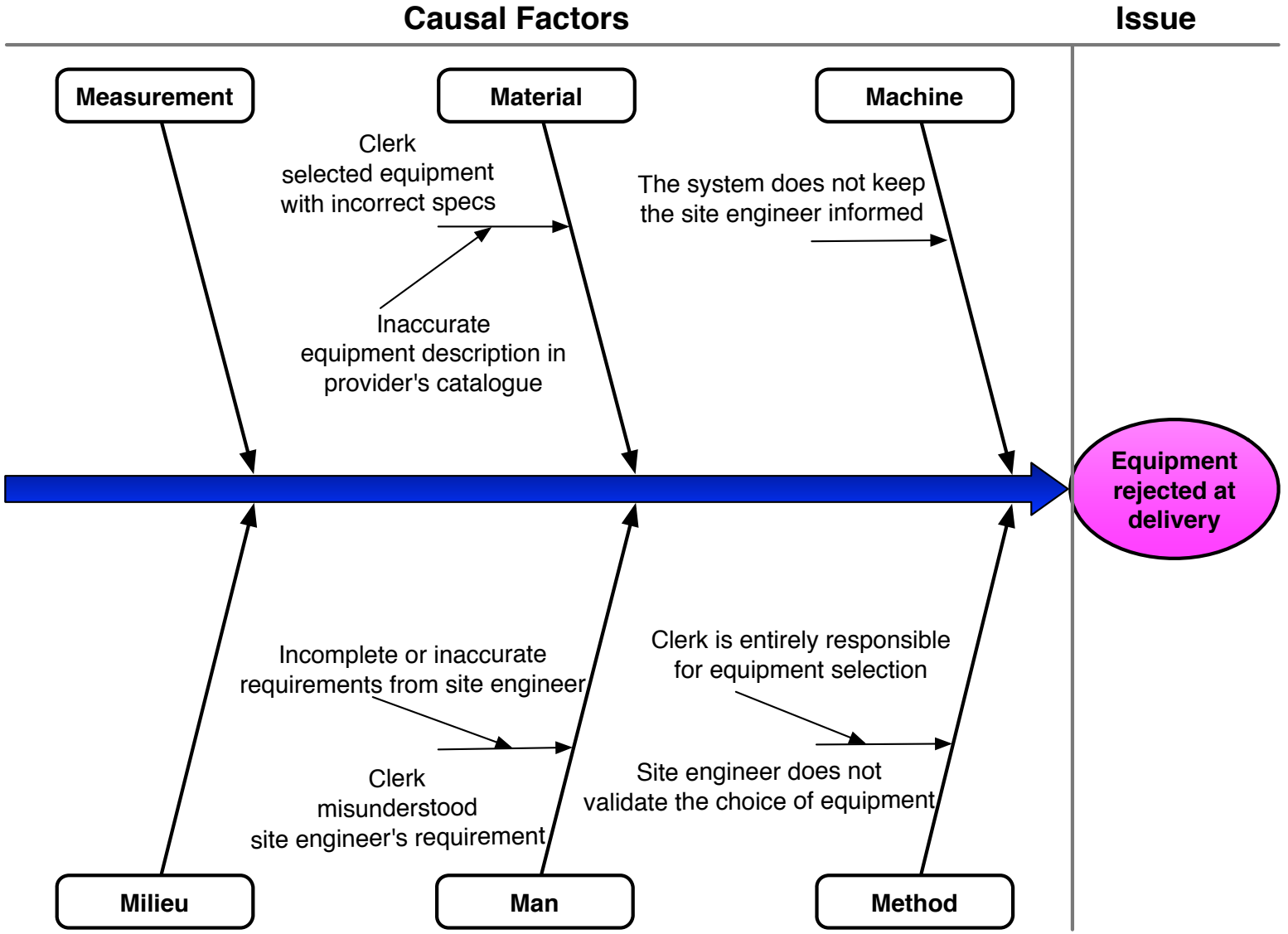
Categories of causes: Six Ms

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



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

Acknowledgements

- All material comes from Marlon Dumas, Marcello La Rosa, Jan Mendling, Hajo A. Reijers, authors of the “Fundamentals of Business Process Management” book.