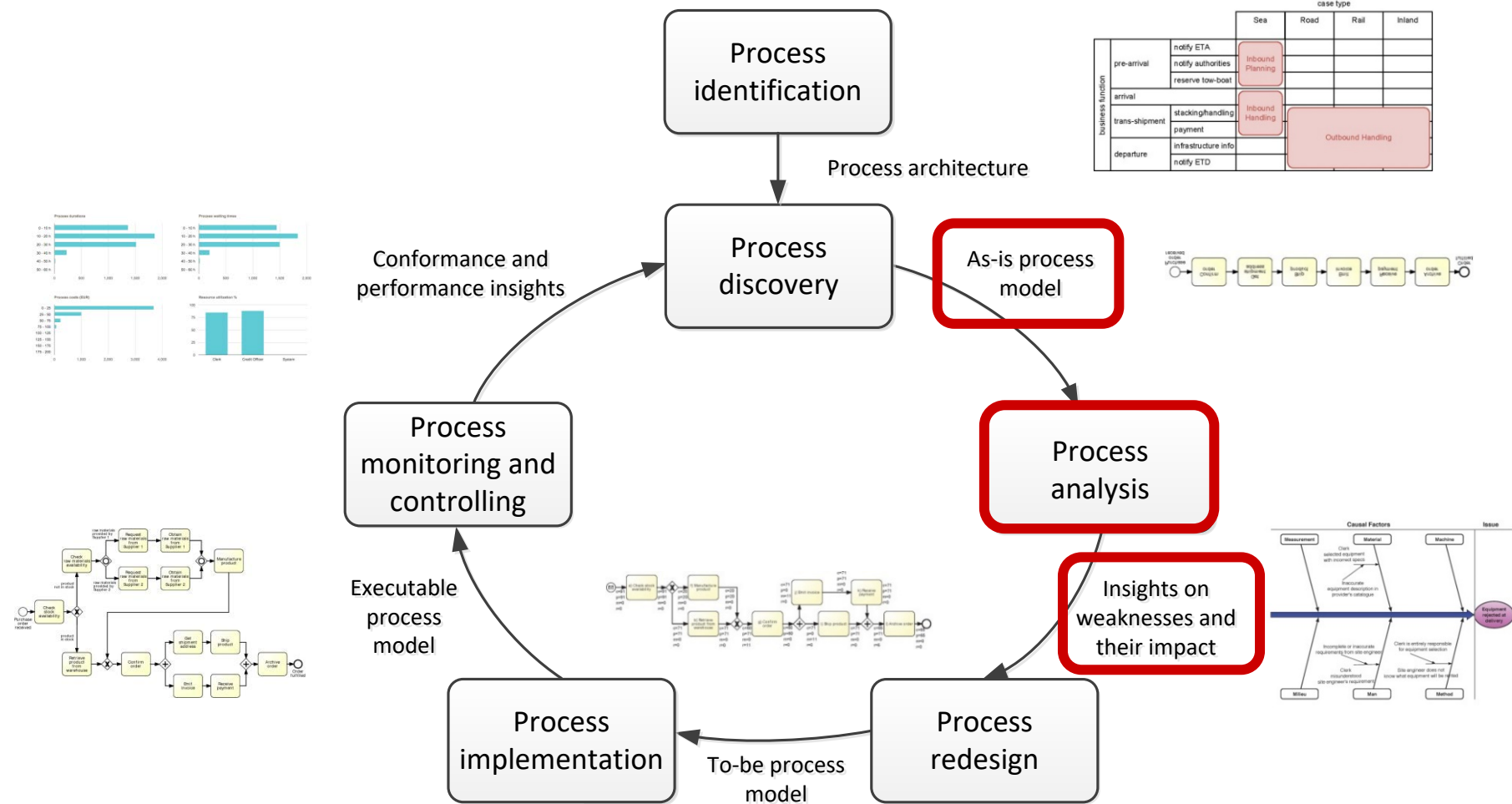


# Business Process Management (4)

# Process Analysis



# Process Analysis Techniques

## Qualitative analysis

- Value-Added & Waste Analysis
- Root-Cause Analysis
- Pareto Analysis
- Issue Register

## Quantitative Analysis





Fundamentals of

# Business Process Management

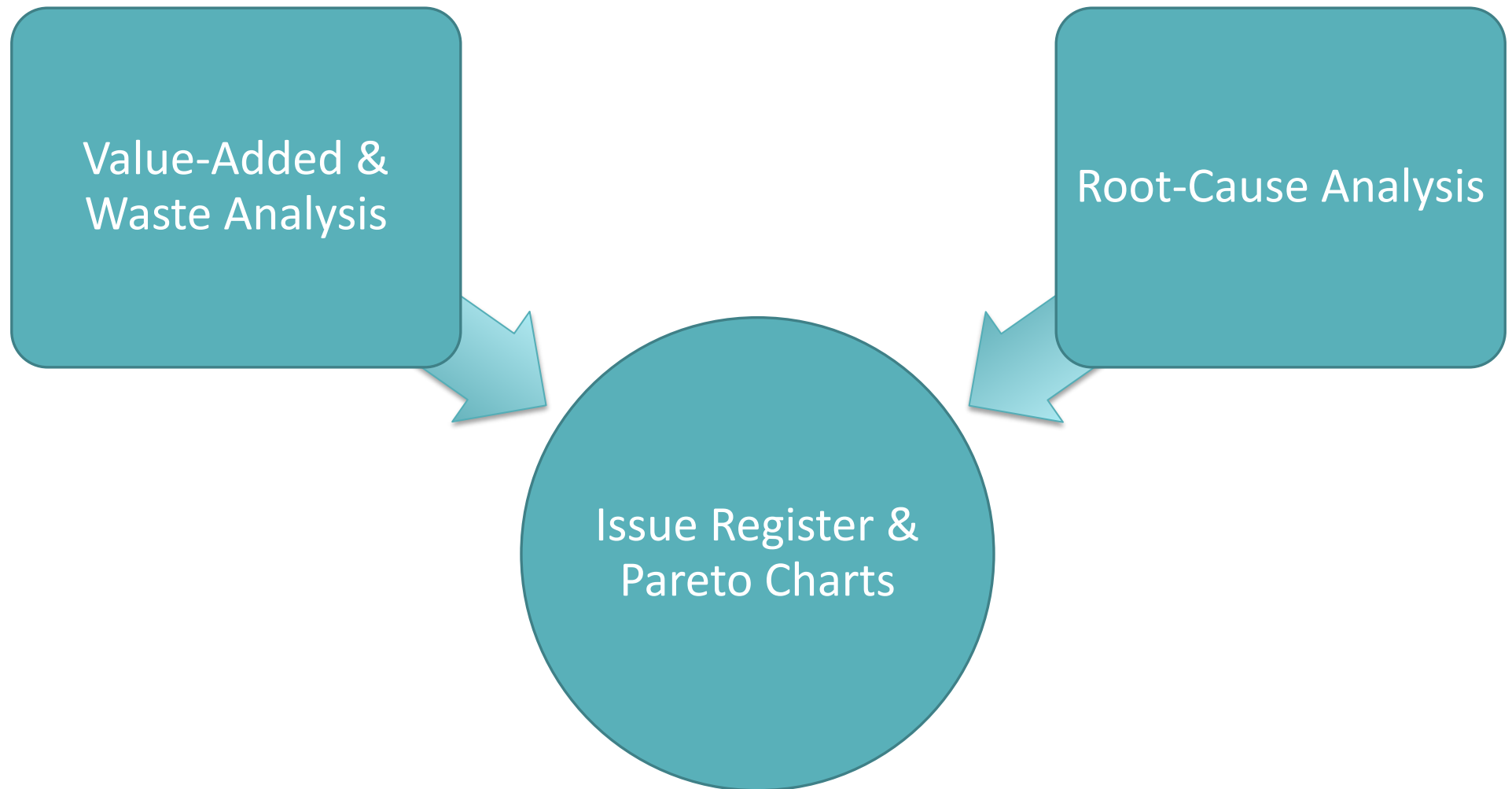
Marlon Dumas · Marcello La Rosa  
Jan Mendling · Hajo A. Reijers

*Second Edition*

 Springer

1. Introduction
2. Process Identification
3. Essential Process Modeling
4. Advanced Process Modeling
5. Process Discovery
- 6. Qualitative Process Analysis**
7. Quantitative Process Analysis
8. Process Redesign
9. Process-Aware Inf. Systems
10. Process Implementation
11. Process Monitoring
12. BPM as an Enterprise Capability

# Qualitative analysis



# Value-added analysis

## 1. Decorticate 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. Classify each step

- Value-adding (VA)
- Business value-adding (BVA)
- Non-value-adding (NVA)





Maximize

# Value-adding activities

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



Minimize

# Business value-adding activities

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





Remove

# Non-value-adding activities

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

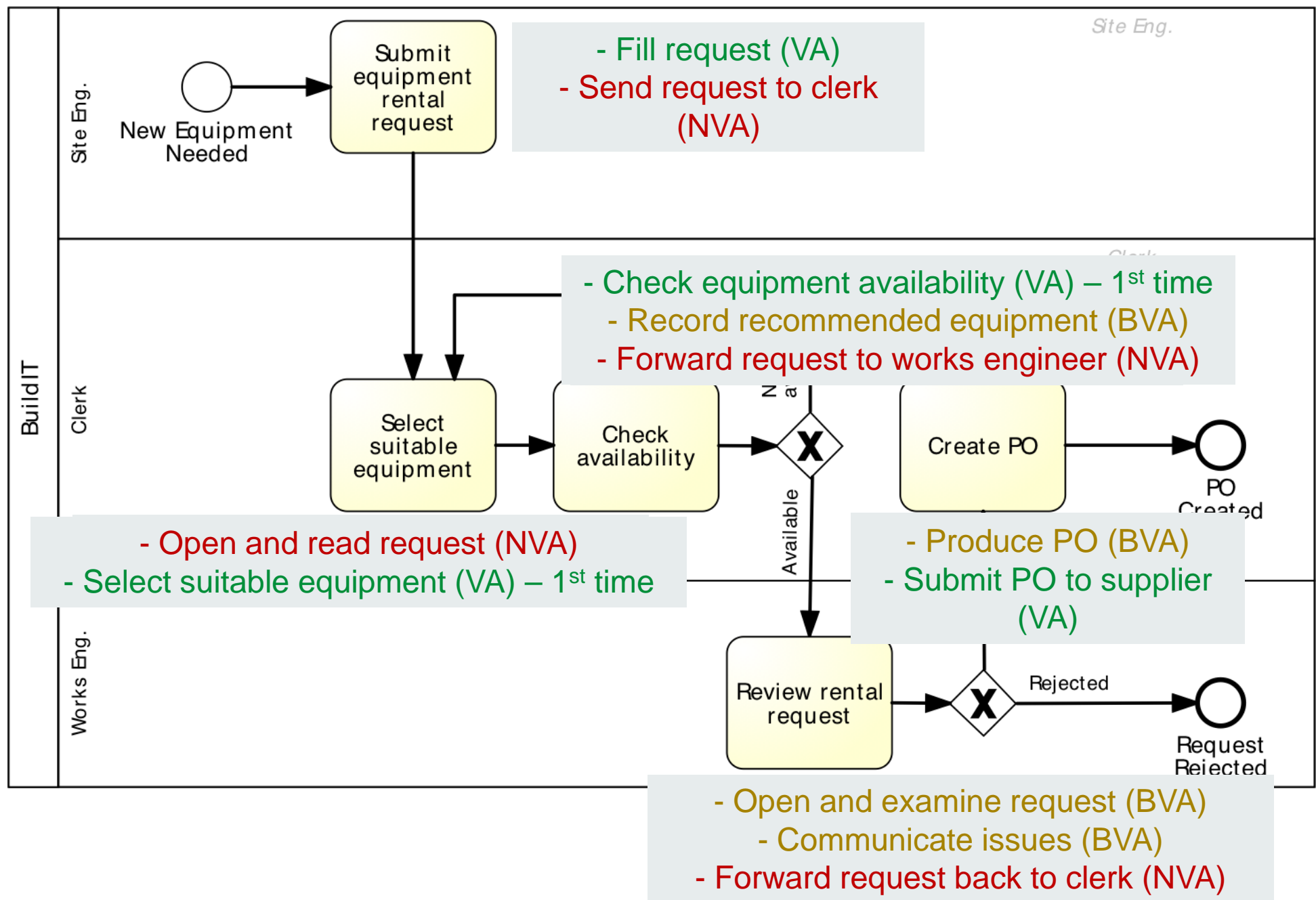
## Includes

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



# 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

*“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



# 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

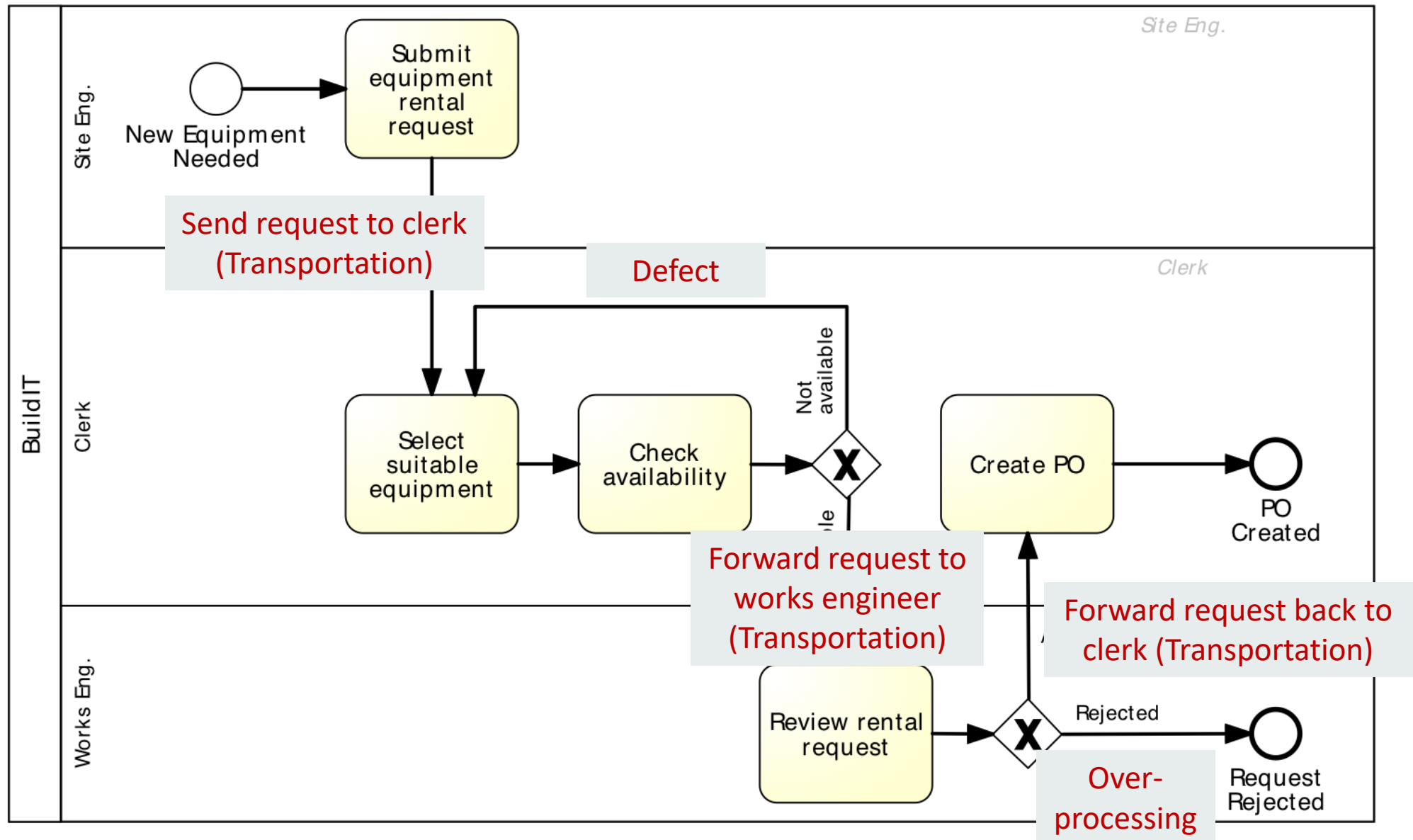
# Over-production

- 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

## 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

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
- Assumptions
- 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

- $0.1 \times 3000 \times 2 \times 100 = 60,000$  p.a

# Issue Register Example

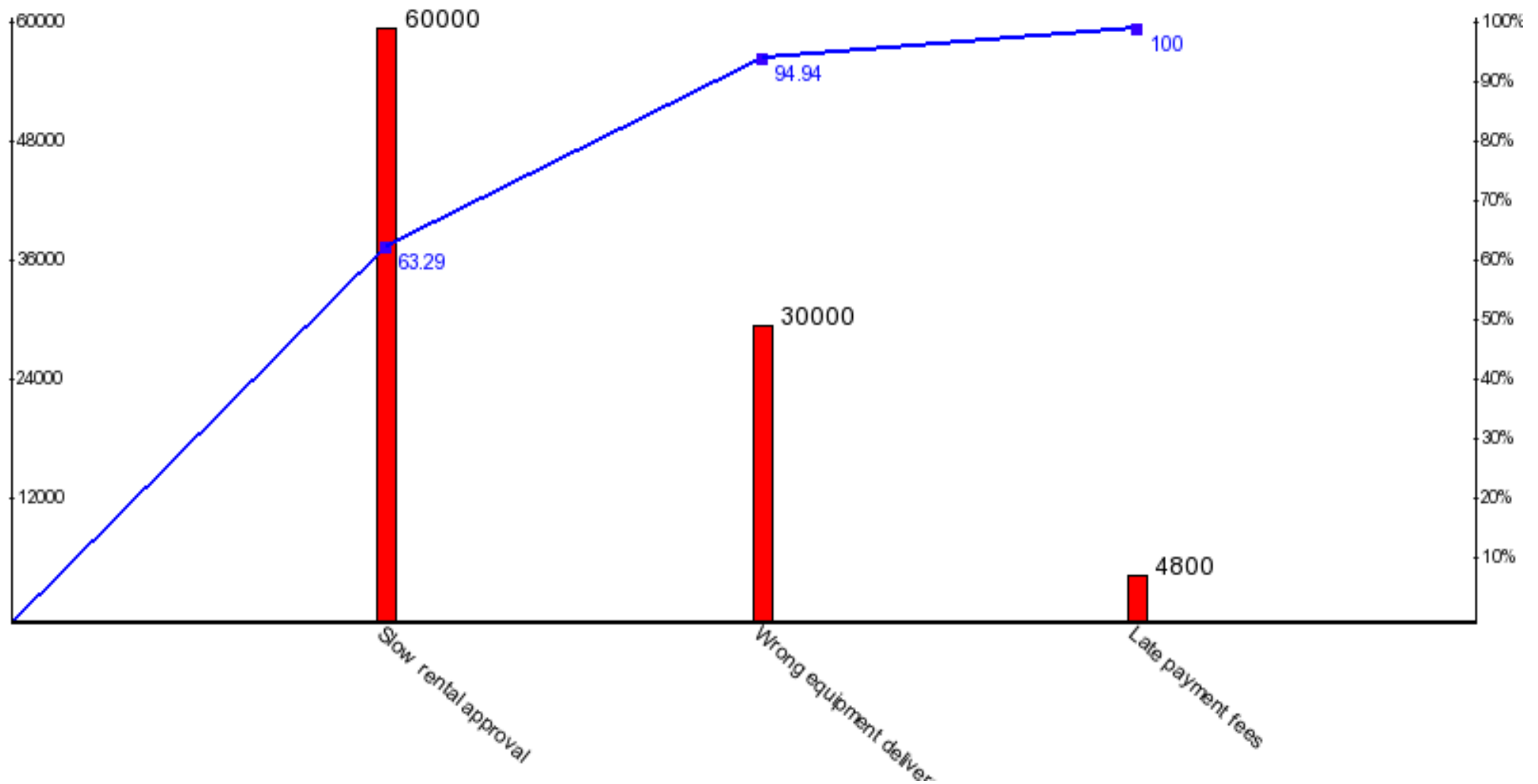
## Equipment rental process

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		$0.1 \times 3000 \times 2 \times \text{EUR } 100 = \text{EUR } 60000$ 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	$3000 \times 0.05 \times \text{EUR } 100 = \text{EUR } 15000$ 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	$0.1 \times 3000 \times 4 \times \text{EUR } 100 \times 0.02 = \text{EUR } 2400$ p.a.

# Pareto chart

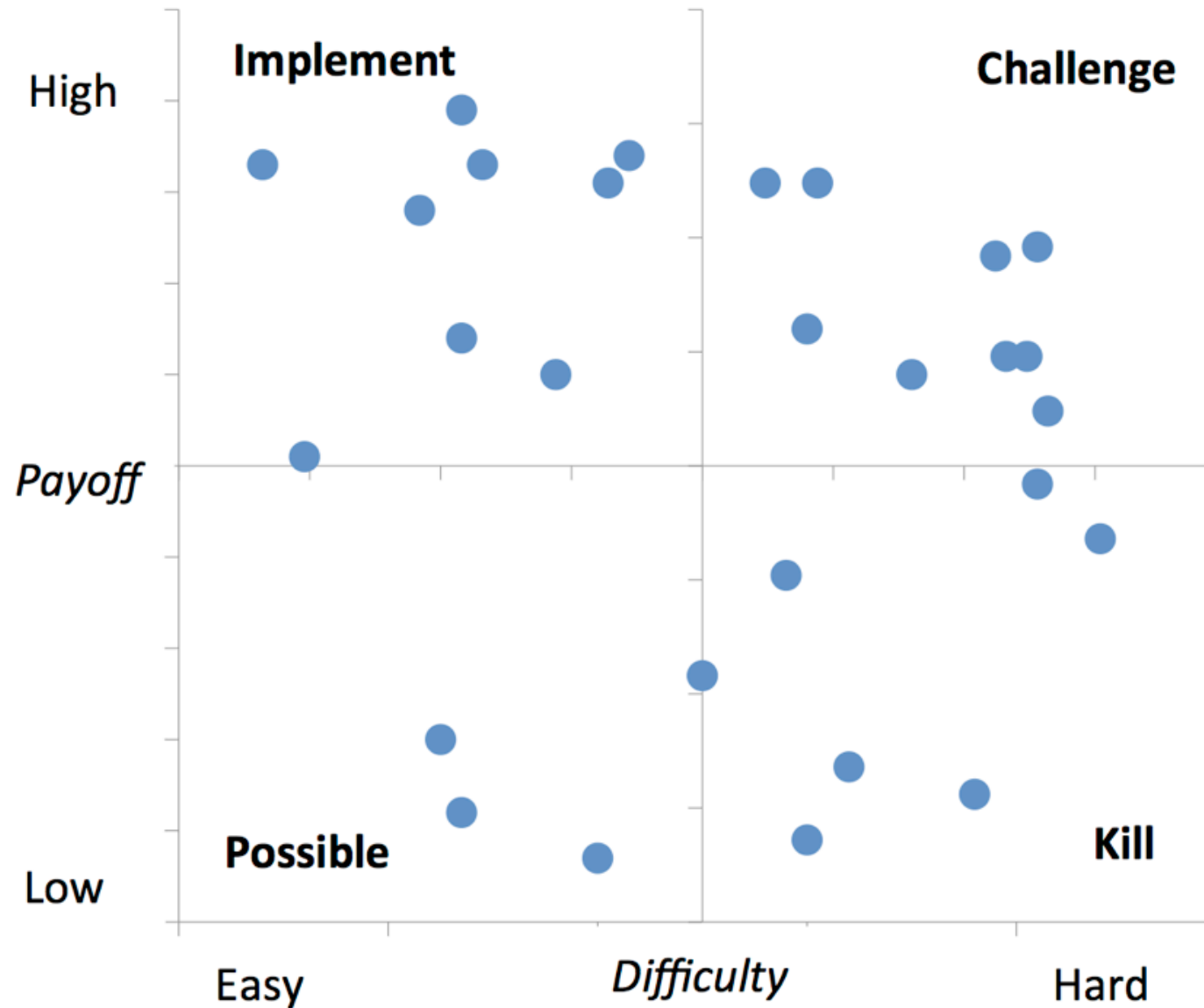
- Useful to prioritize a collection of issues
- Bar chart where the height of the bar denotes the impact of each issue
- Bars sorted by impact
- Superposed curve of cumulative percentage impact

# Pareto chart example

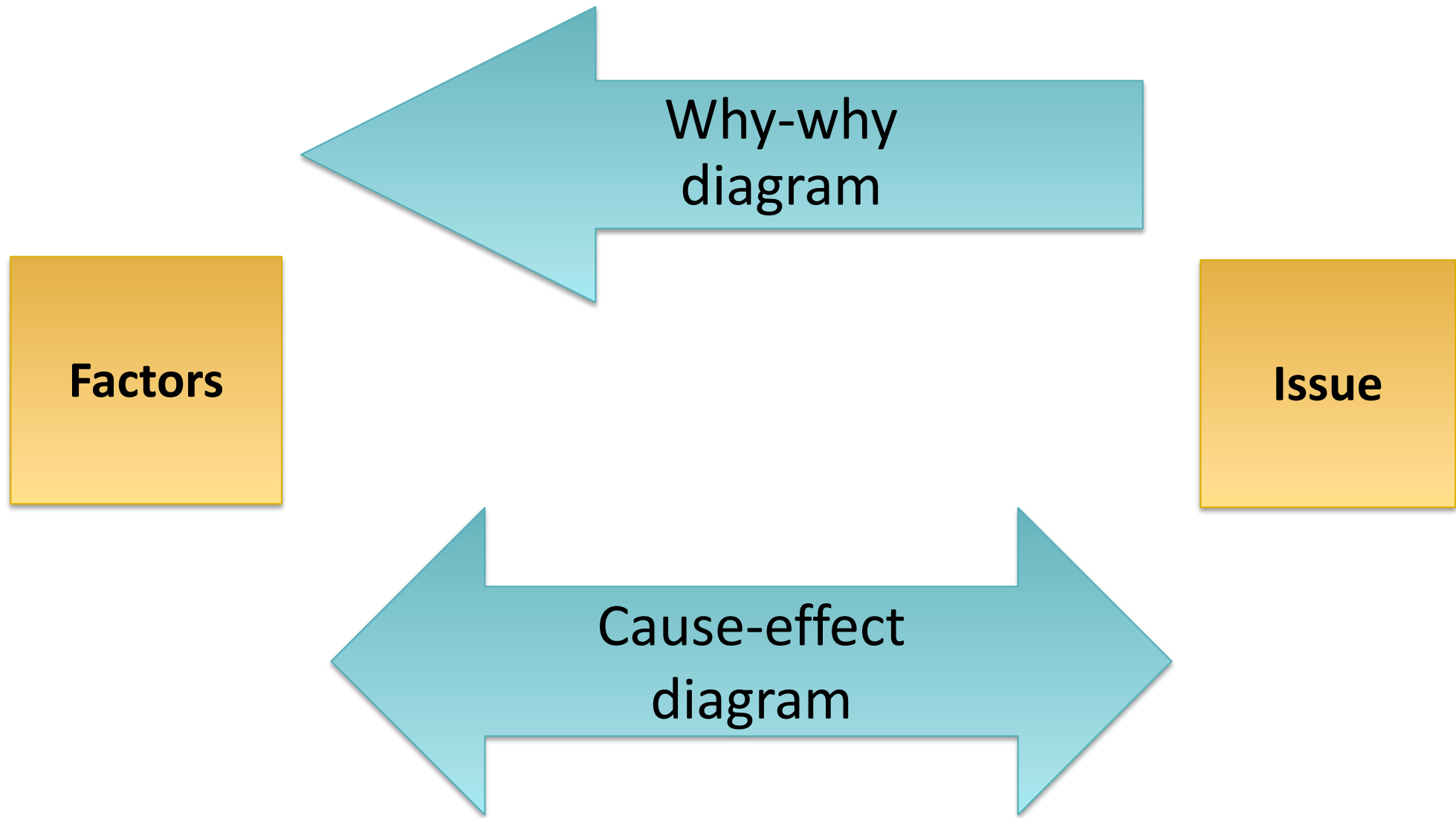




# Two-Dimensional Prioritization: PICK Chart

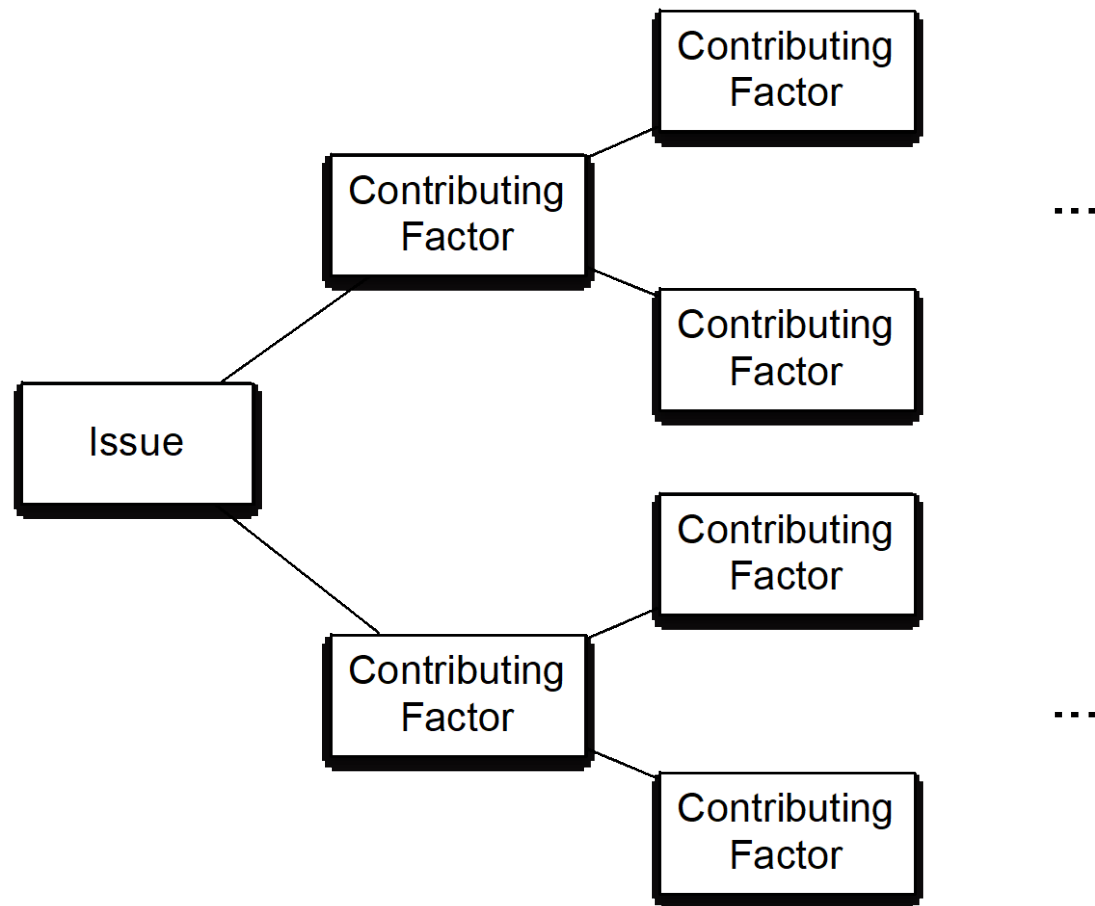


# Root-cause analysis

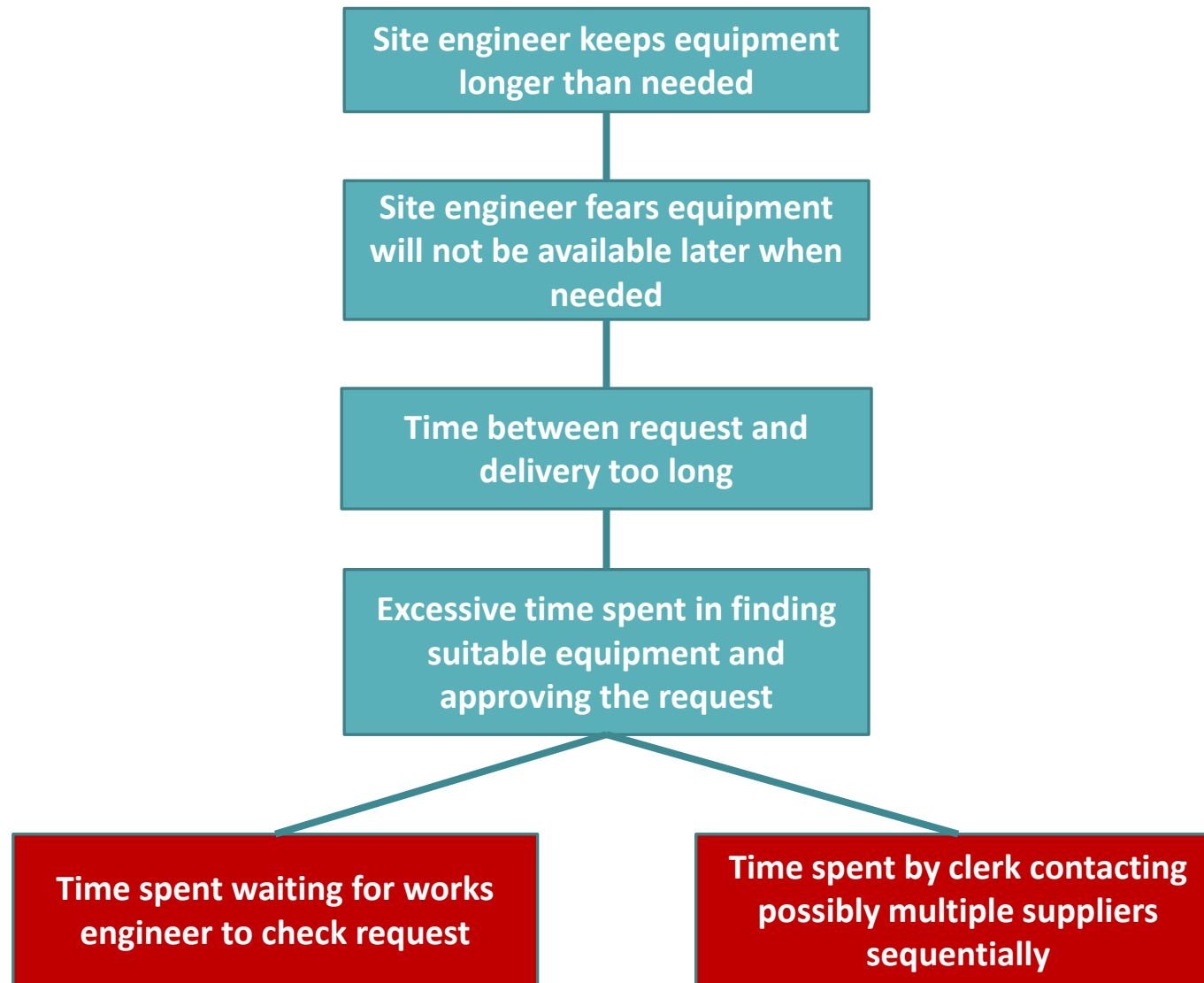


# Why-why diagram

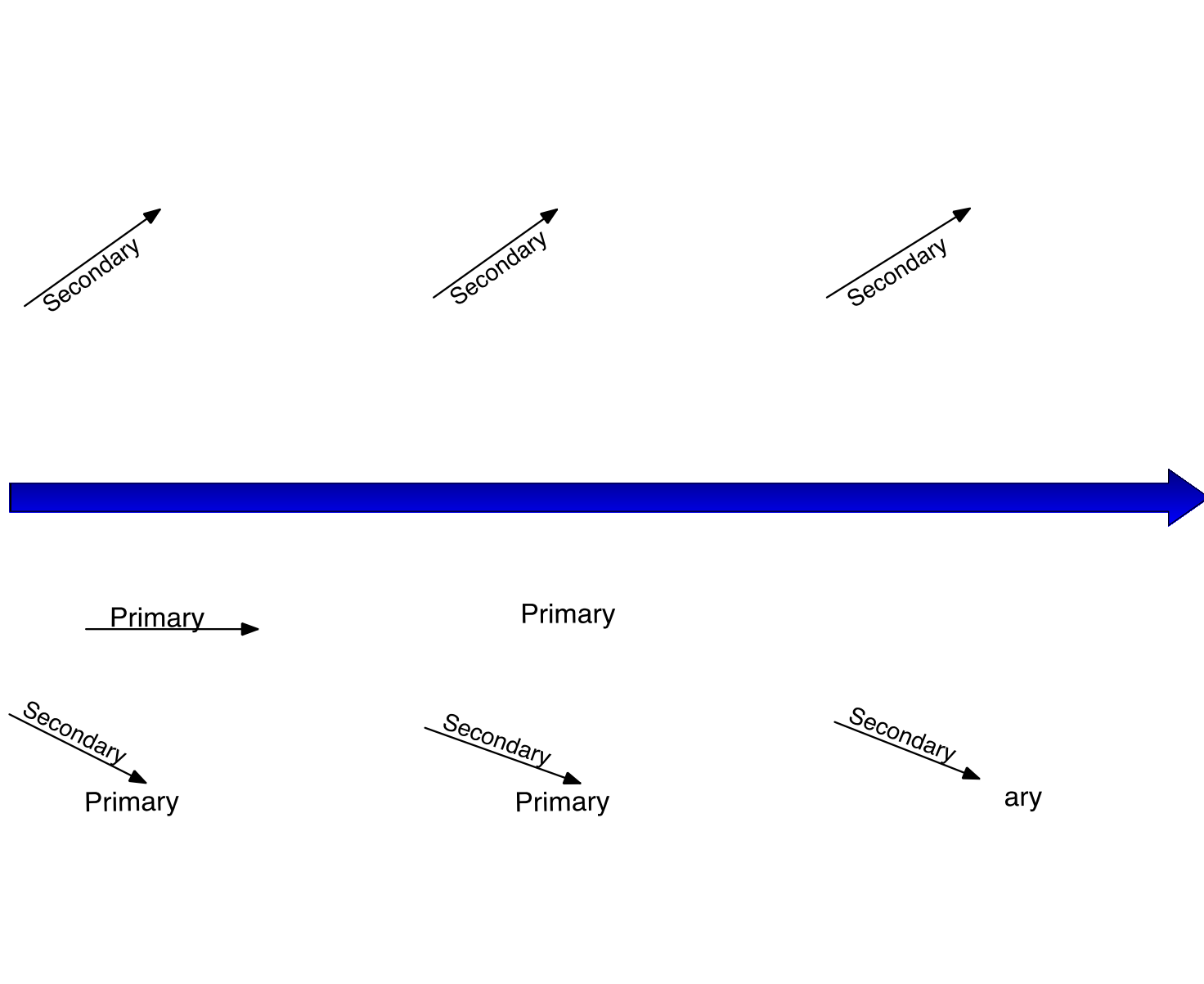
Five levels of nesting - “Five Why’s”



# Why-why diagram example



# 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

the site engineer informed<sup>p</sup>





# 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

# Questions

