Business Process Management

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DIPARTIMENTO
DI INFORMATICA
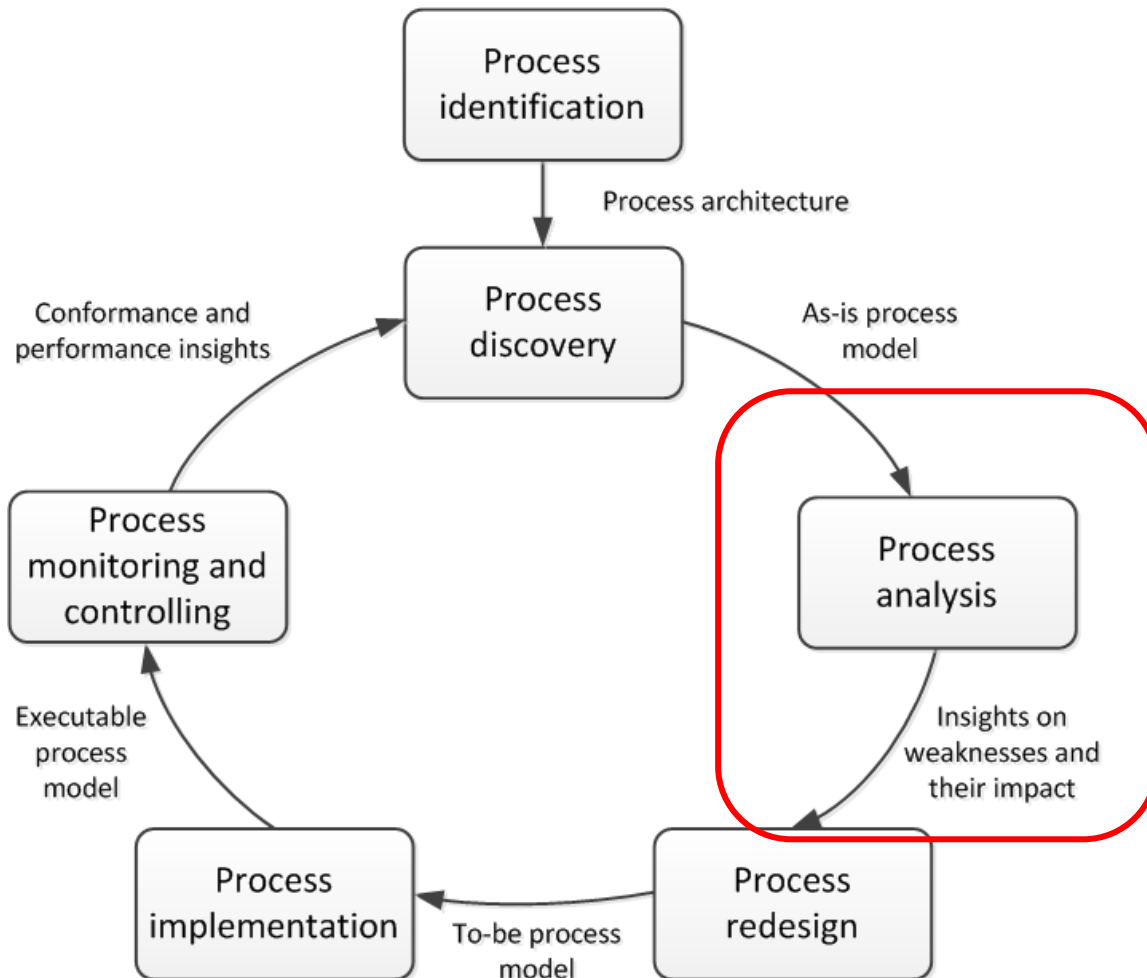
SAPIENZA
UNIVERSITÀ DI ROMA

Block 7: Qualitative Analysis

Business Process Analysis
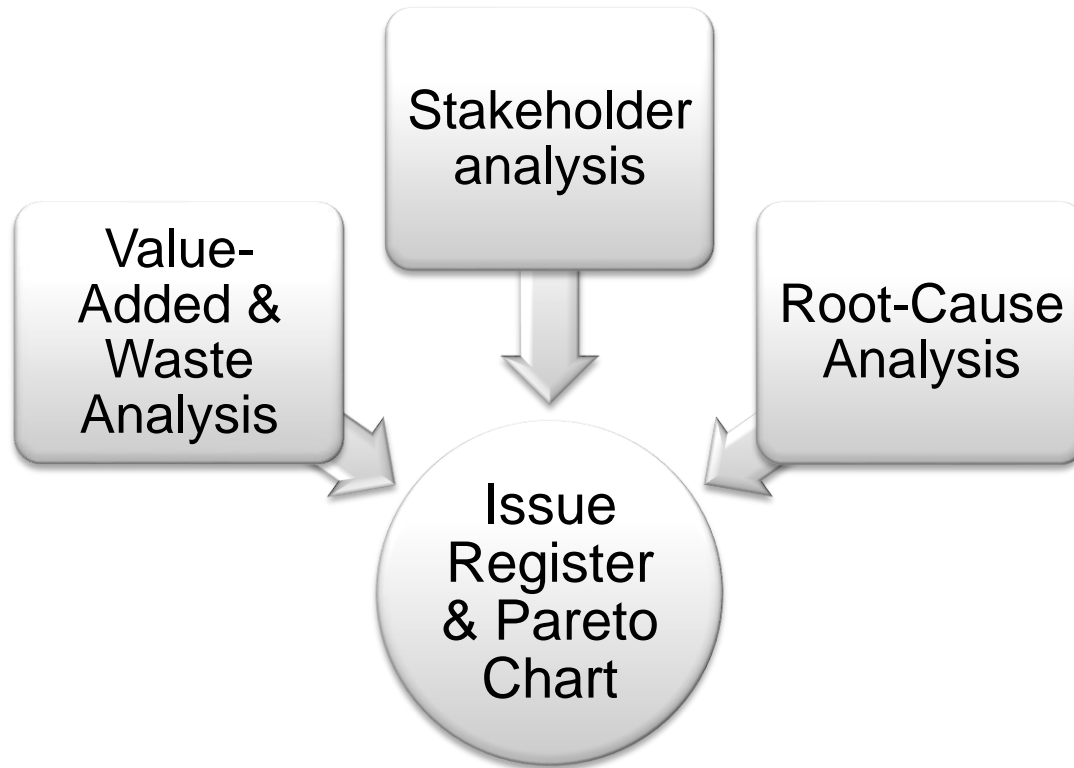
Purposes of Qualitative Analysis

Identify and eliminate waste

- Valued-added analysis

Identify, understand and prioritize issues

- Issue register
- Root-cause analysis (e.g. cause-effect diagrams)
- Pareto analysis

Qualitative Process Analysis: Overview

Value-Added Analysis

1. Decorticate the process into steps
2. Classify each step into:
   - Value-adding (VA): Produces value or satisfaction to the customer.
     - Is the customer willing to pay for this step?
   - Business value-adding (BVA): Necessary or useful for the business to run smoothly, or required due to the regulatory environment, e.g., checks, controls
     - Would the business potentially suffer in the long-term if this step was removed?
   - Non-value-adding (NVA) – everything else including handovers, delays and rework

Value-adding activities

- Produces 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**: Confirm delivery date, Deliver products
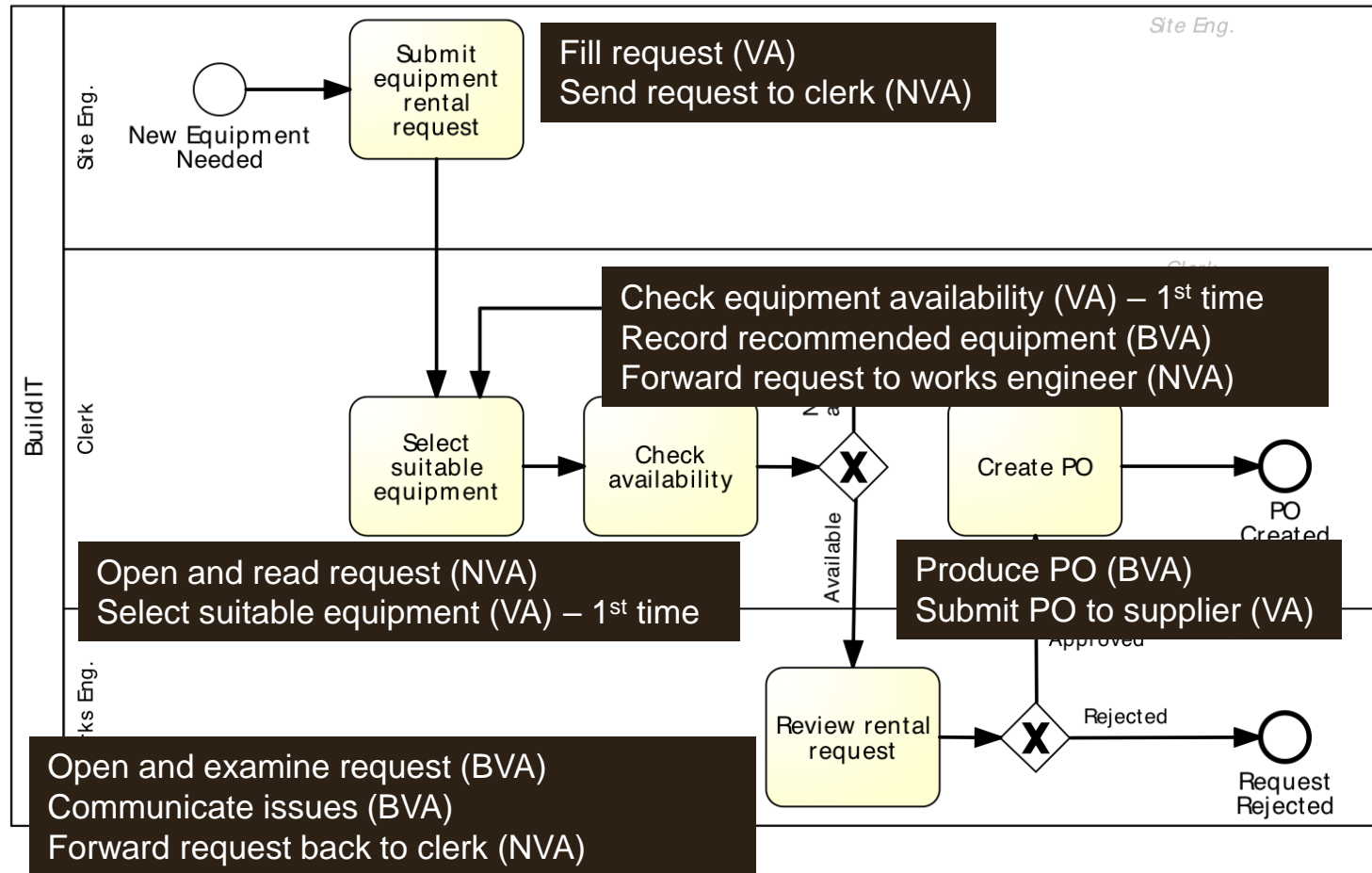 - **University admission**: Assess application, Notify outcome

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**: <u>Check</u> purchase order, <u>Check</u> customer's credit worthiness, Issue invoice, Collect payment, Collect customer feedback
  - **University admission**: <u>Verify</u> completeness of application, <u>Check</u> validity of degrees, <u>Check</u> validity of language test results

Non-value-adding activities

- Everything else besides VA and BVA

- Incudes:
  - Handovers, context switches
  - Waiting times, delays
  - Rework or defect correction

- Examples
  - **Order-to-cash**: <u>Forward</u> PO to warehouse, <u>Re-send</u> confirmation, <u>Receive</u> rejected products
  - **University admission**: <u>Forward</u> applications to committee, <u>Receive</u> 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)

Example – Equipment Rental Process

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	VA
Forward request to works engineer	Clerk	VA
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	BVA

Admission Process

Consider the following process for the admission of graduate students at a university. In order to apply for admission, students first fill in an online form. Online applications are recorded in an information system to which all staff members involved in the admissions process have access to. After a student has submitted the online form, a PDF document is generated and the student is requested to download it, sign it, and send it by post together with the required documents, which include: 1. Certified copies of previous degree and academic transcripts. 2. Results of English language test. 3. Curriculum vitae.

When these documents are received by the admissions office, an officer checks the completeness of the documents. If any document is missing, an e-mail is sent to the student. The student has to send the missing documents by post. Assuming the application is complete, the admissions office sends the certified copies of the degrees to an academic recognition agency, which checks the degrees and gives an assessment of their validity and equivalence in terms local education standards. This agency requires that all documents be sent to it by post, and all documents must be certified copies of the originals. The agency sends back its assessment to the university by post as well. Assuming the degree verification is successful, the English language test results are then checked online by an officer at the admissions office. If the validity of the English language test results cannot be verified, the application is rejected (such notifications of rejection are sent by e-mail). Once all documents of a given student have been validated, the admission office forwards these documents by internal mail to the corresponding academic committee responsible for deciding whether to offer admission or not. The committee makes its decision based on the academic transcripts and the CV. The committee meets once every 2 to 3 weeks and examines all applications that are ready for academic assessment at the time of the meeting.

At the end of the committee meeting, the chair of the committee notifies the admissions office of the selection outcomes. This notification includes a list of admitted and rejected candidates. A few days later, the admission office notifies the outcome to each candidate via e-mail. Additionally, successful candidates are sent a confirmation letter by post.

Eliminating Waste

"*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
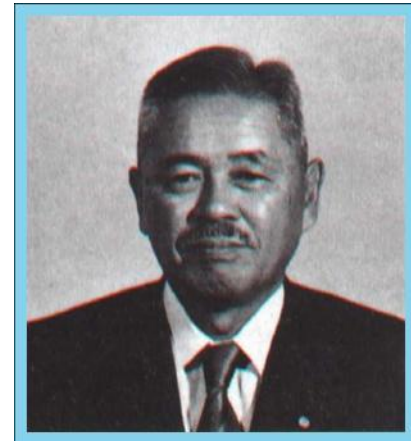
7+1 Sources of Waste

1. Unnecessary Transportation *(send, receive)*
2. Inventory *(large work-in-process)*
3. Motion *(drop-off, pick-up, go to)*
4. Waiting *(waiting time between tasks)*
5. Over-Processing *(performing what is not yet needed or might not be needed)*
6. Over-Production *(unnecessary cases)*
7. Defects *(rework to fix defects)*
8. Resource underutilization (idle resources)

Source: Seven Wastes defined by Taiichi Ohno

8th waste coined by Ben Chavis, Jr.

Seven sources of waste

Move
- Unnecessary Transportation
- Motion

Hold
- Inventory
- Waiting (and idleness)

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

Move

Unnecessary transportation

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

Example:

- 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 to 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 business processes

Examples

- **Vehicle inspection**: a process worker moves with the inspection forms from one inspection base to another; in some cases inspection equipment also needs to be moved around
- **Approval**: a process worker moves around the organization to collect signatures

Hold

Inventory

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

Examples

- **Vehicle inspection**: 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**: About 3000 applications are handled concurrently

Waiting

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

Examples

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

Over-do

Defects

- Correcting or compensating for a defect
- Rework loops

Examples

- Vehicle inspection: A vehicle needs to come back to a station due to an omission

- Travel approval: Request sent back to requestor for revision

- University admission: Application sent back to applicant for modification; request needs to be re-assessed later due to incomplete information

Over-processing

- Tasks performed unnecessarily given the process outcome
- 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 levels
- **Travel approval**: 10% of approvals are trivially rejected at the end of the process due to lack of budget
- **University admission**: Officers spend time verifying authenticity of degrees, transcripts and language test results. In 1% of cases, these verifications uncover issues. Verified applications are sent to the committee. The committee accepts 20% of the applications it receives

Over-production

- Unnecessary process instances are performed, with outcomes which do not add value upon completion

Examples

- **Order-to-cash**: In 50% of cases, issued quotes do not lead to an order

- **Travel approval**: In 5% of cases, travel requests are approved but the travel is cancelled

- **University admission**: 3000 applications submitted, only 800 considered eligible after assessment

Equipment rental process: wastes
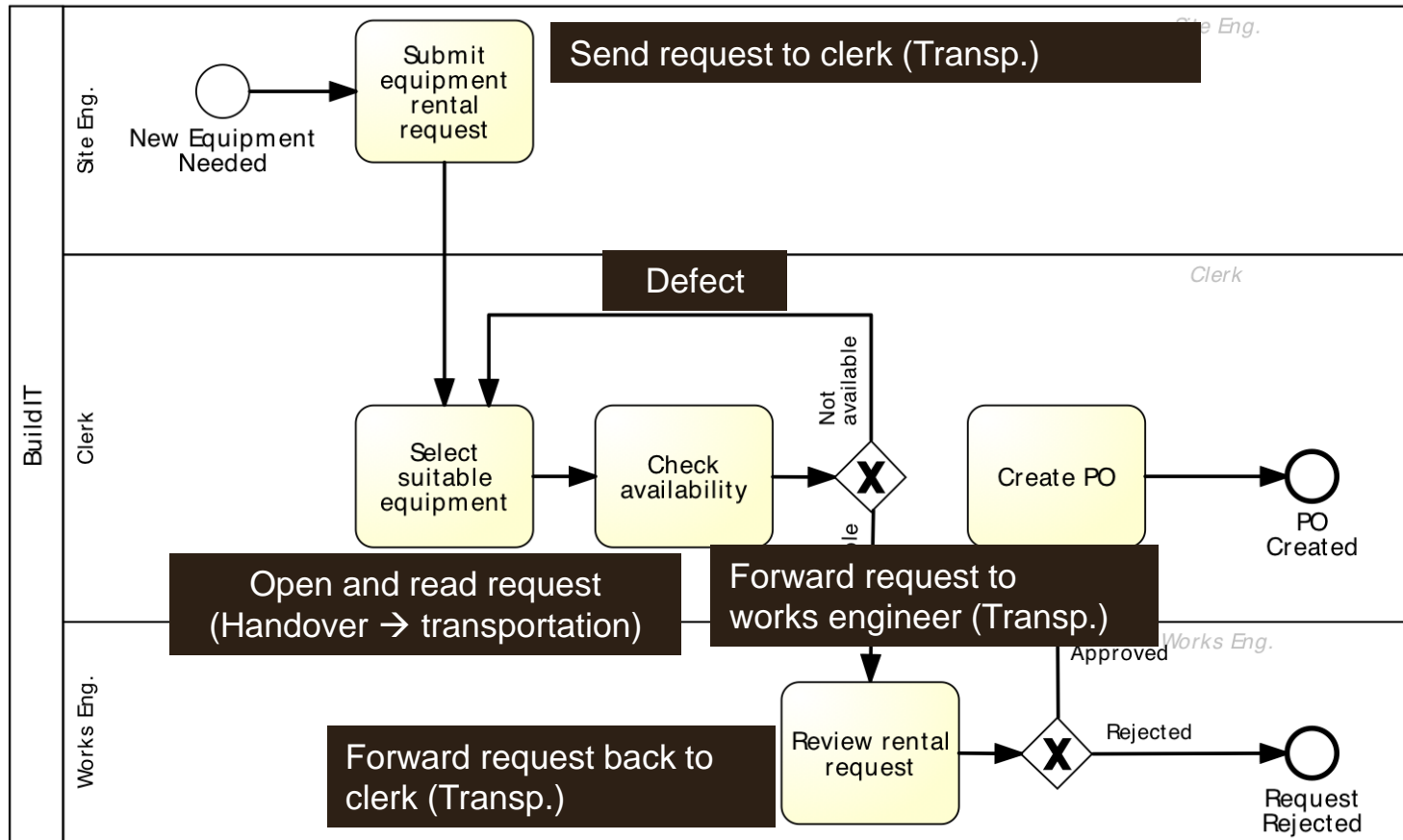
Equipment rental process: wastes

Transportation

- Site engineer sends request to clerk
- Clerk forwards to works engineer
- Works engineer send 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 because equipment not needed
- Rental requests being approved and then canceled by site engineer

Over-production

- Equipment being rented and not used at all

Identifying and documenting process issues

- Stakeholder analysis: allows us to collect issues from complementary perspectives

- Issue register: allows us to document issues and their impact in a structured manner

- Pareto analysis and PICK charts: allow us to select a subset of issues for further analysis and redesign

Stakeholder Analysis

Gathering data from multiple sources by interviewing stakeholders of different types and reconciling their viewpoints

In BPM, stakeholder analysis is commonly used to gather information

about issues that affect the performance of the process from different perspectives.

There are typically five categories of stakeholders:

- Customer(s) of the process.

- Process participants.

- External parties (e.g., suppliers, sub-contractors) involved in the process.

- Process owner and operational managers supervising participants.

- Sponsor of the process improvement effort and other executive managers who have a stake in the performance of the process.

Typical Stakeholder Concerns

- Customers are often concerned about slow cycle time, defects, lack of transparency, or lack of traceability (inability to observe current process status)

- Process participants might be rather concerned about:
  - High resource utilization, working under stress.
  - Defects arising from handoffs in the process and wastes.

- External parties (e.g. suppliers and sub-contractors) are generally concerned about having a steady or growing stream of work from the process, being able to plan their work ahead, and being able to meet contractual requirements.

- Process owner usually concerned with performance, be it high cycle times or high processing times. Also concerned about common defects and wastes, and compliance with internal policy and external regulations.

- Sponsor and other high-level managers are generally concerned with the strategic alignment of the process and the contribution of the process to key performance indicators. Also concerned about the ability of the process to adapt to evolving customer expectations, competition, and market conditions.

Issue register

- Purpose: to maintain, organize and prioritize perceived weaknesses of the process (issues)
- Sources of issues:
  - Input to a process modelling project
  - 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
  - Assumptions
  - Impact: Qualitative and Quantitative
  - Possible improvement actions

- Larger process improvement projects may require issue trackers

Example of an issue documentation

Issue name

- Equipment kept longer than needed

Description

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

Assumptions

- 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

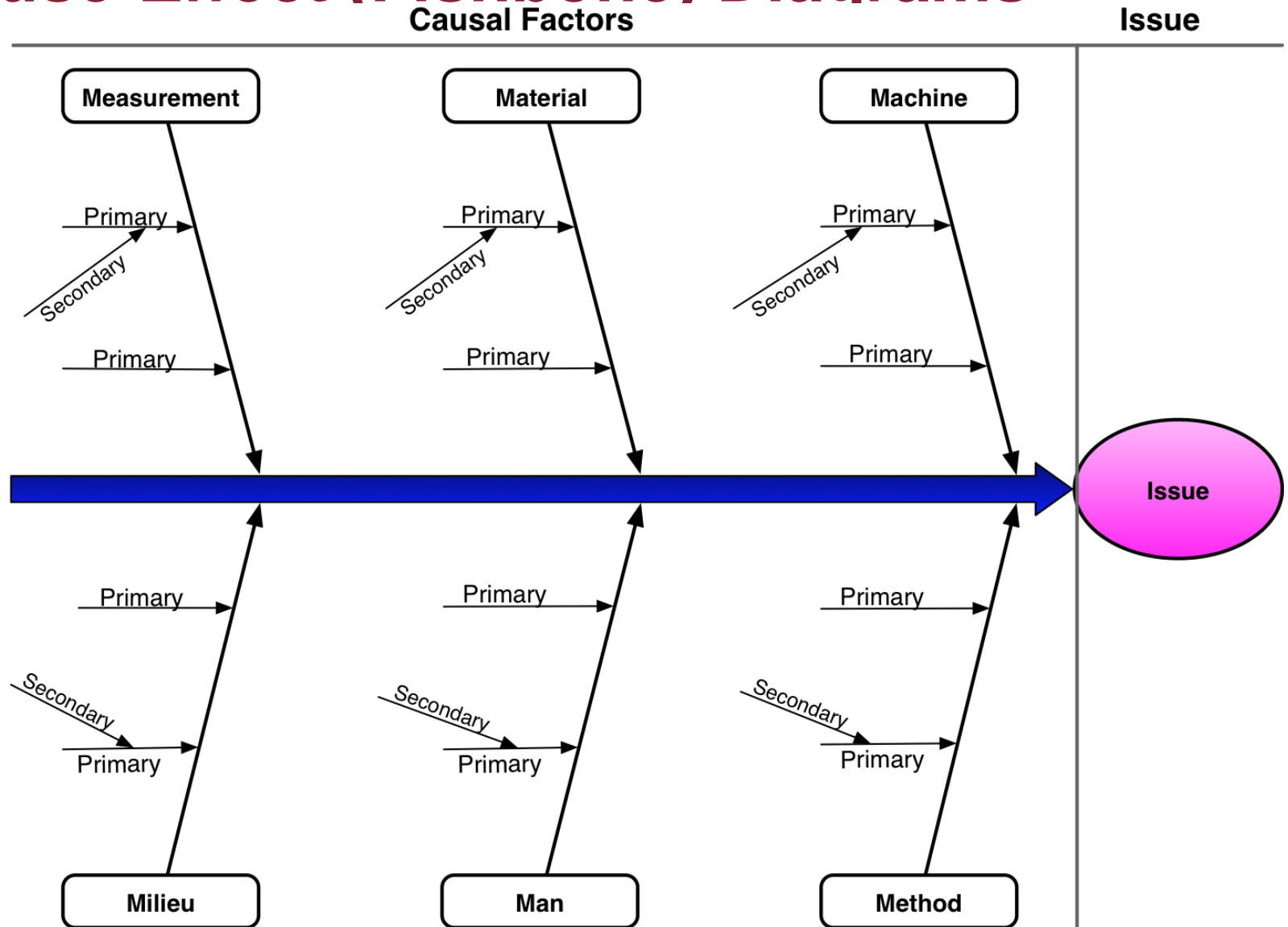| Name	Explanation	Assumptions	Qualitative Impact	Quantitative Impact
Equipment kept longer than needed	Site engineers keep equipment longer than needed via deadline extensions	3000 pieces of equipment rented p.a. In 10% of cases, equipment kept two days longer than needed. Rental cost is 100 per day		$0.1 \times 3000 \times 2 \times 100 = 60,000$ p.a.
Rejected equipment	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 100.	Disrupted schedules. Employee stress and frustration	$3000 \times 0.05 \times 100 = 15,000$ 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 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	$0.1 \times 3000 \times 4 \times 100 \times 0.02 = 2400$ p.a.

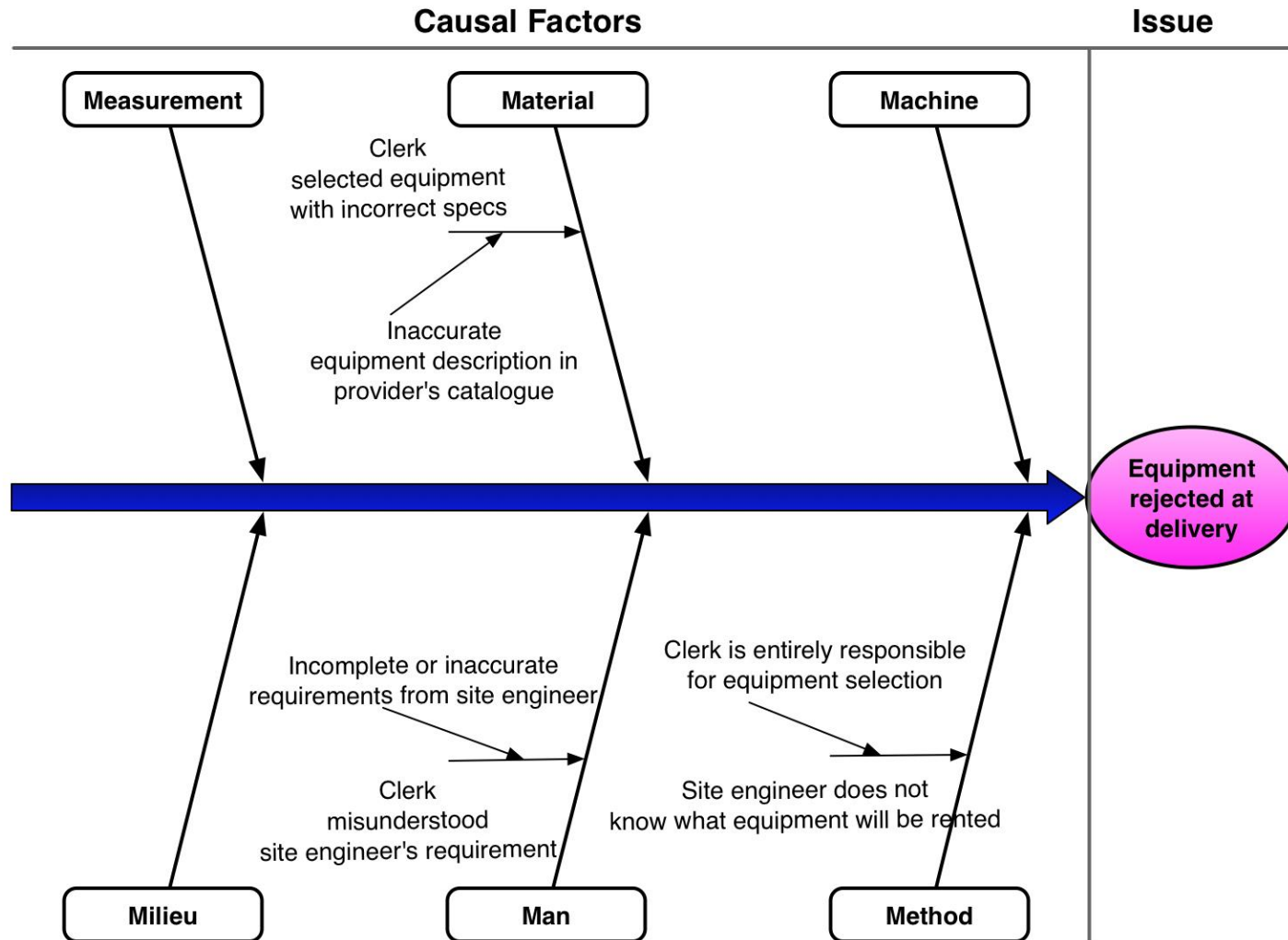# Two-Dimensional Prioritization: PICK Chart
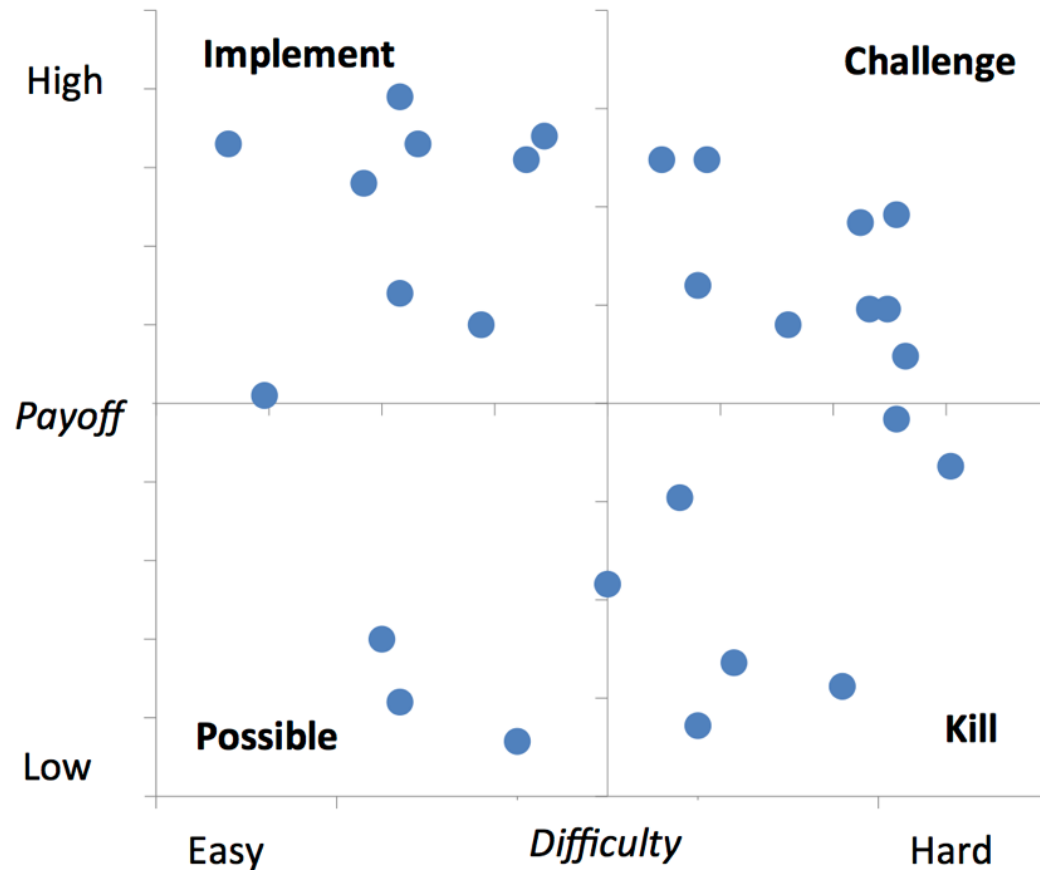
Techniques for issue analysis
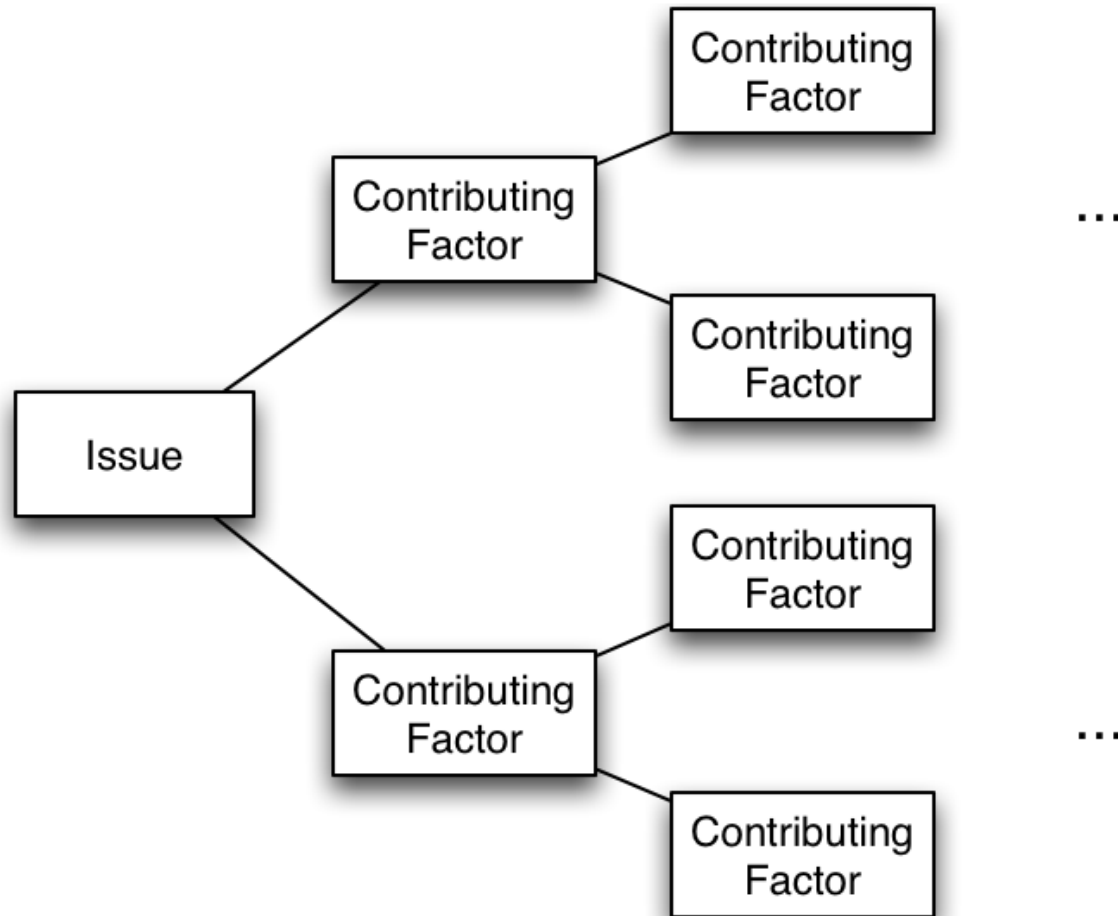
- Cause-effect diagrams
- Why-why diagrams
- Pareto charts

Cause-Effect (Fishbone) Diagrams

Cause-effect diagram (rejected equipment)

Causal Factors | **Issue**

Measurement

Material

Machine

Clerk selected equipment with incorrect specs

Inaccurate equipment description in provider's catalogue

Equipment rejected at delivery

Incomplete or inaccurate requirements from site engineer

Clerk misunderstood site engineer's requirement

Clerk is entirely responsible for equipment selection

Site engineer does not know what equipment will be rented

Milieu

Man

Method

Why-Why Diagram

Why-why diagram (equipment rental)

Site engineers keep equipment longer, why?

- Site engineer fears that equipment will not be available later when needed, why?
  - time between request and delivery too long, why?
    - excessive time spent in finding a suitable equipment and approving the request, why?
      - time spent by clerk contacting possibly multiple suppliers sequentially;
      - time spent waiting for works engineer to check the requests;

PICK Chart

- Complements impact analysis
- Helps making decisions about issues
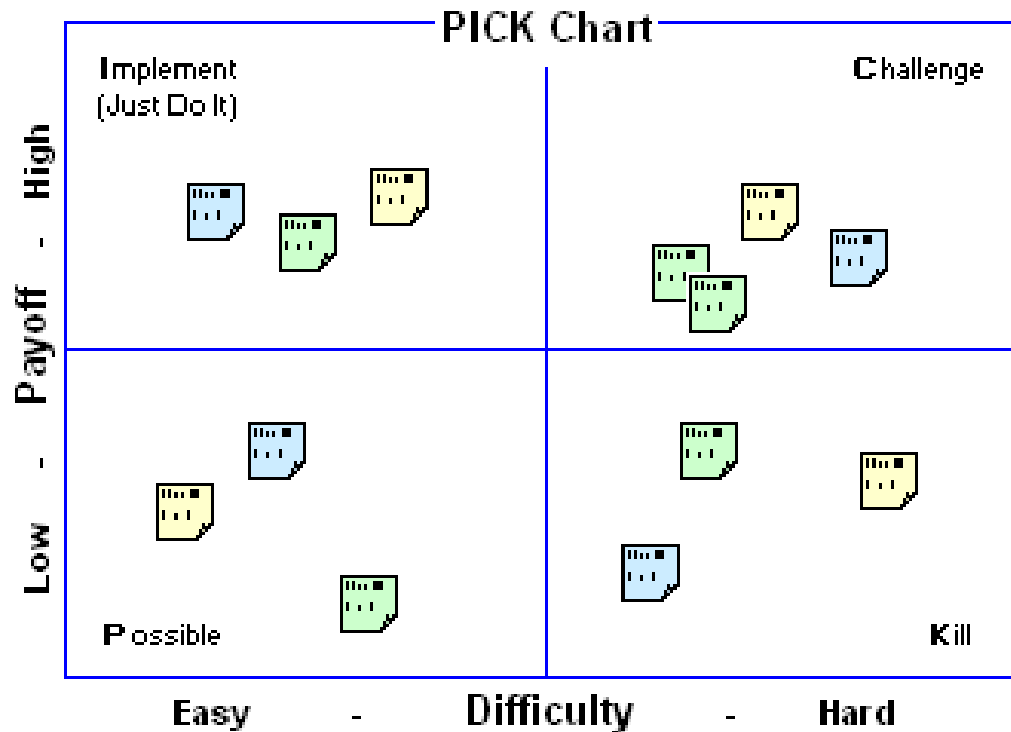
Pareto chart

- 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