Ishikawa Diagrams

a.k.a Fishbone Diagrams, Cause-and-Effect Diagrams

Reference
George, M.L., Rowlands, D., Price, M. & Maxey, J. (2005) *The Lean Six Sigma Pocket Toolbook*. New York, New York: McGraw-Hill

What is it?

Ishikawa diagrams are a visual way to conduct root cause analysis (while leveraging '5 Whys') on multiple potential causes

How is it used?

- Ishikawa diagrams are used to capture potentials causes for problems
- Frequently used cause categories include:
    - Method (process)
    - Materials
    - Measurement (data collection)
    - Machine
    - Manpower (training/people)
    - Mother Nature (for environment)

Why is it used?

- Most simply, ishikawa diagrams are brainstorming tools
- Ishikawa diagrams are also useful as inputs for hypothesis tests to determine which of the 'causes' have the most 'effect'

Pros

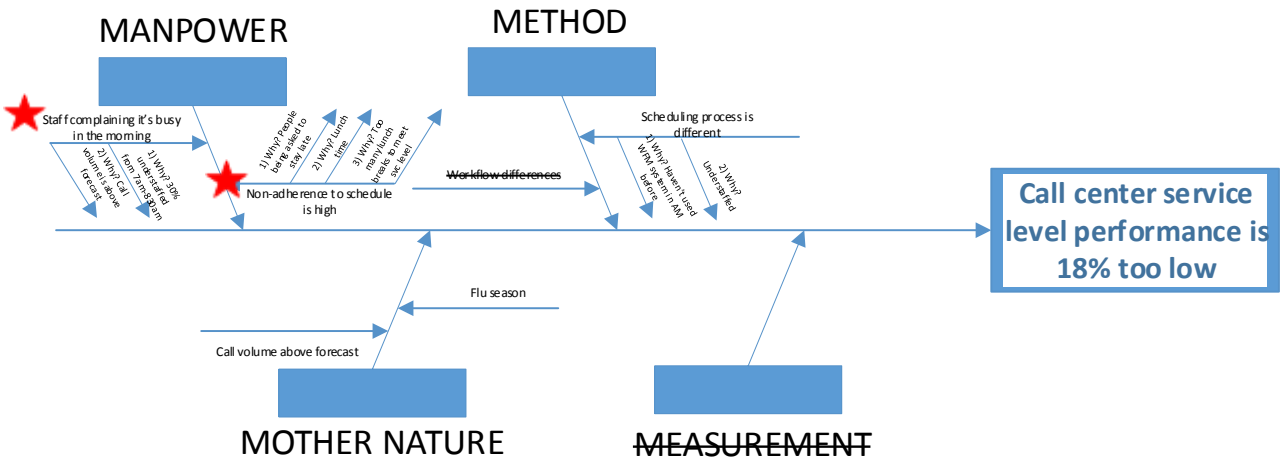
- Comprehensive tools to collect ideas
- Easy to draw

Cons

- Potentially confusing to people
- Difficult to facilitate in group setting

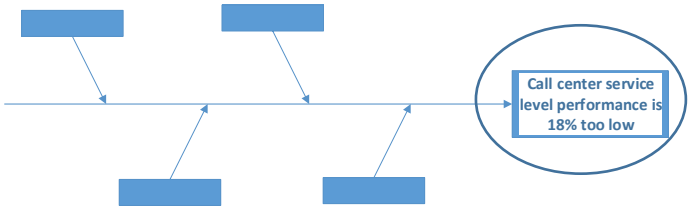
Case Study

A manager in a healthcare call center was having problems with his telephonic service level. His target was 95% of calls answered in 30 seconds, but his performance was currently 77%. To solve this, most days he would simply call staff to come in early and then plead with others to stay late. His manager wouldn't let him hire more staff. After conducting a root cause analysis meeting using an ishikawa diagram, his team quickly drilled down to two high-impact drivers of the low service level: lunchtime breaks and the hours of 7am-830am. After testing a higher staffing complement during these hours, it was determined that adding 2.0 FTEs would boost his service level by 18%, bringing his performance within range. This FTE cost was significantly lower than the cost of performance guarantee penalties and therefore, the manager was given approval to hire.



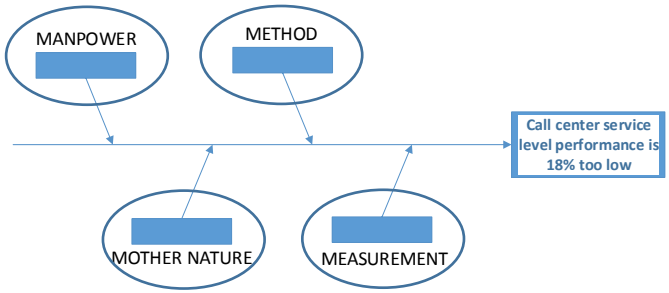
Ishikawa Diagrams: Job Aid

1) Name the problem. Be specific.

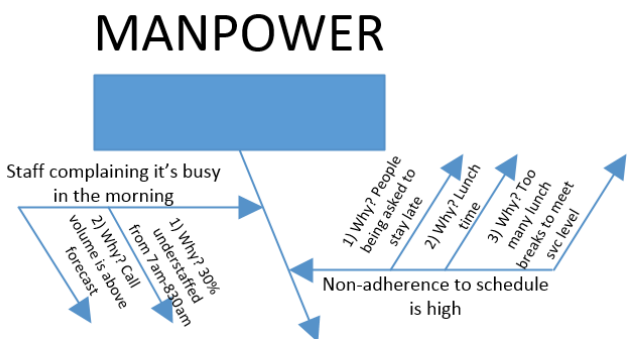


2) Decide the cause categories

Note: in this example, the group decided that 'materials' and 'machines' were non-issues



3) Brainstorm for each category (& conduct '5 Whys')



4) Review for completeness.

- Eliminate causes that do not apply
- Brainstorm for more ideas in categories that contain fewer items

5) Discuss what is (probably) most critical.

- It's OK to rely on people's instincts
- Mark the causes you plan to investigate

6) Confirm the causes

- DO NOT take action without gathering data!
- You must verify the cause (this can be done with statistical hypothesis tests or, at a high level, with Paredo charts or simply by reviewing data)

Critical Incident Technique

Reference
Lipu, S., Williamson, K., Lloyd, A., & Hughes, H. E. (2007). *Critical incident technique*. Centre for Information Studies, Charles Sturt University.

What is it?
a set of procedures for collecting direct observations of human behaviour in such a way as to facilitate their potential usefulness in solving practical problems and developing broad psychological principles

How is it used?
- 5 key steps:
    1. define the activity to be studied and establish its aim
    2. establish plans and specifications for the study, to include location, conditions, types of incidents to be studies, specific behaviors or interactions, etc.
    3. collect the data using methods such as interviews, direct observation, and questionnaires
    4. analyze the data
    5. interpret and report

Pros
- Content rich, first hand
- Practical, straight forward
- Focus on vital issues

Cons
- Possible selectivity or subjectivity
- Time consuming
- May not include routine tasks

Ethics and Intercultural Considerations
- Preserve confidentiality
- Respect dignity
- Explain purpose
- Clarify involvement
- Share use
- Assure it is voluntary
- Avoid coercion
- Allow opt-out anytime
- Heed discomfort
- Honor diversity

Real world use
John Flanagan adapted the technique to education. He questioned high-school students to discover what they liked, what they were able to do, and how much instruction and career counseling they were receiving. Follow-up research 1 year, 5 years, and 11 years after their graduation revealed that schools had frustrated some of the best students. John Flanagan then framed systems for individualized study plans. The Critical Incident technique has since then been used in management—more specifically human resource management, for example, to establish performance requirements for positions; customer service; education; health; information systems development; operation of complex devices; surgery; and industry.

Critical Incident Technique: Job Aid

1) Establish general aims

Aim + **Activity** = **Functional Requirement**

What do you want to accomplish? | *What are you doing?* | *A brief, clear statement*

2) Establish plans and specifications

Specify the Situation
Location, Conditions, and Research participants

Specify Relevance
Types of Critical *Incidents*, Nature of critical *behavior* or *interactions*

Specify Extent
Significance of the positive or negative effect

Identify the Observers
Familiar data collectors with thorough instructions and training in process

3) Collect the data

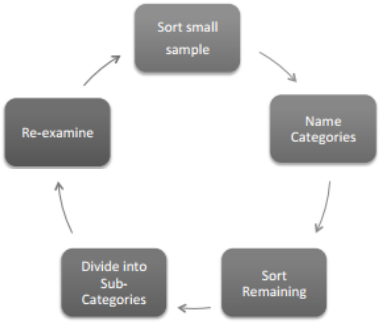
- Focus on incidents that participants have recently taken part in or observed first hand
- Seek contextualized examples
- No firm sample size

Methods

Individual Interviews*
Direct Observation*
Group Interviews
Written Responses/Questionnaires

*Preferred

4) Analyze the data



- Most challenging
- Done concurrently with data collection
- Continued until redundancy occurs
- Classification must relate to application & reflect aim

5) Interpret and report the data

Define activity studied by set of critical behaviors

Explain and justify how previous steps were done

Specific circumstances in which findings apply

Competency Analysis

Reference
Rothwell, W. et al, Human Performance Improvement, 2nd ed

What is it?
Competency analysis is a human performance technology used to determine whether the skills, knowledge and processes of an individual match those required to perform a given occupation.

Information gathered through competency analysis is commonly used for recruitment. It can also inform decisions regarding professional development, organizational development and strategic planning.

Examples

How is it used?
- The organization must determine what specific skills and knowledge are required to perform a job, and then what levels are maximal, acceptable and not-acceptable.
- Information gathered is compared to performance criteria from job analysis and inform of performance gaps.

Why is it used?
- It increases the organization's ability to predict an individual's success in a particular job.
- Individuals with the right competencies are more likely to contribute to the growth of the organization.

Business impacts of a hiring mistake:
- Hiring mistakes are costly! Lost productivity, profits
- Negative affect on employee morale
- Negative impact on client relations
- Costs to recruit and train another worker

Pros
- Fewer hiring mistakes
- Greater ability to predict success
- Lower turnover

Cons
- Cost of assessments
- Observer bias, human error
- Validity and reliability

Competency Analysis: Job Aid

1) Complete job analysis

- Complete a job analysis for the role to identify core responsibilities

2) Determine desired competencies of those in the role

- Collect data from exemplary performers and satisfactory performers to determine what competencies are demonstrated when completing the core tasks
- Competencies demonstrated by both performance levels represent the minimum necessary competencies
- If no performers are available, leverage management direction for competencies to align with business goals

3) Determine which competencies to interview for

- Identify whether all competencies should be screened for
- Do any of the competencies need to be weighted more importantly?

4) Select individual assessment tools for interviewing

- Determine which assessment tools are viable for use (e.g. Structure interviews, work sample collection, etc) based of balance of speed, cost or quality

5) Quantify the approach

- Create the assessments based on your competency model
- Determine the scoring methodology for the assessment process

6) Determine success measures

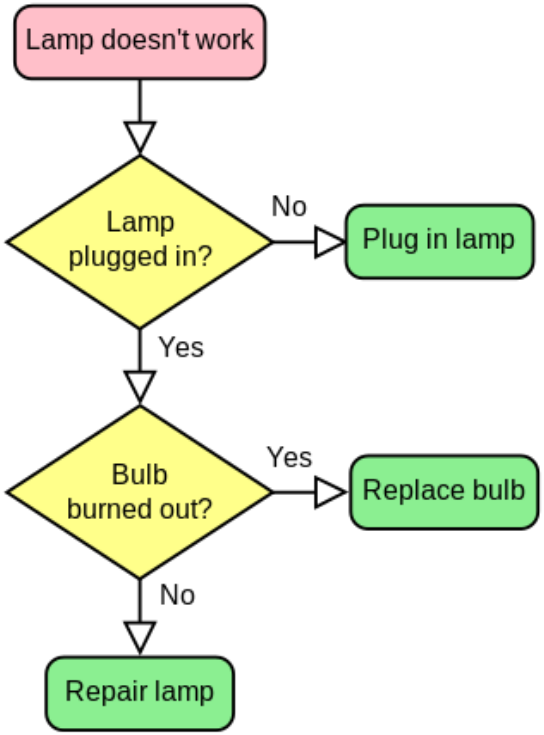
- Identify measures that will indicate your success level

Process Flowcharting

Reference
http://en.wikipedia.org/wiki/Flowchart

What is it?
A **flowchart** is a type of diagram that represents an algorithm, workflow or **process**, showing the steps as boxes of various kinds, and their order by connecting them with arrows. This diagrammatic representation illustrates a solution model to a given problem.

Example



How is it used?
1. To plan a project – map out new project
2. To create process documentation – work procedure, work instructions, training materials
3. To take control of business process – workflow management, meeting customer's needs
4. To provide troubleshooting guide – decision tree type, True/False diagnosis model.
5. Regulatory and quality management requirement
6. Computer programming

Why is it used?
- Better communication
- Proper documentation
- Effective analysis
- Systemic overview
- Relationship mapping
- Logic accuracy

Pros
- Better communication
- Proper documentation
- Effective analysis
- Systemic overview
- Logic accuracy

Cons
- Time consuming
- Laborious
- Hard to modify and reproduce
- Complex logic

Process Flowcharting: Job Aid

1) Determine purpose of flowchart

- Identify why you are drawing a flowchart.
- Described the process to be charted in a one-line statement

2) Consider scope of chart

- Decide on the start and end points of the flowchart.
- Start with the initial ("trigger") event of the process in the flowchart.
- Consider whether the chart will be detailed or high level

3) Map out each detailed step

- Note each successive action in concise terms
- Avoid ambiguous descriptions

4) Use right symbols to draw the flowchart

Symbol	Name	Function
	Start/end	An oval represents a start or end point.
	Arrows	A line is a connector that shows relationships between the representative shapes.
	Input/Output	A parallelogram represents input or ouptut.
	Process	A rectangle represents a process.
	Decision	A diamond indicates a decision.

http://www.smartdraw.com/software/flowchart-symbols.htm

5) Fulfill each 'branch'

- When the flowchart branches into a complex number of options (i.e. decisions), pick one and proceed
- Continue describing each event, action or decision as it occurs in sequence, until the process is concluded (to a "target" point).
- Return to the prior decision point and complete a different scenario

Pareto Diagram

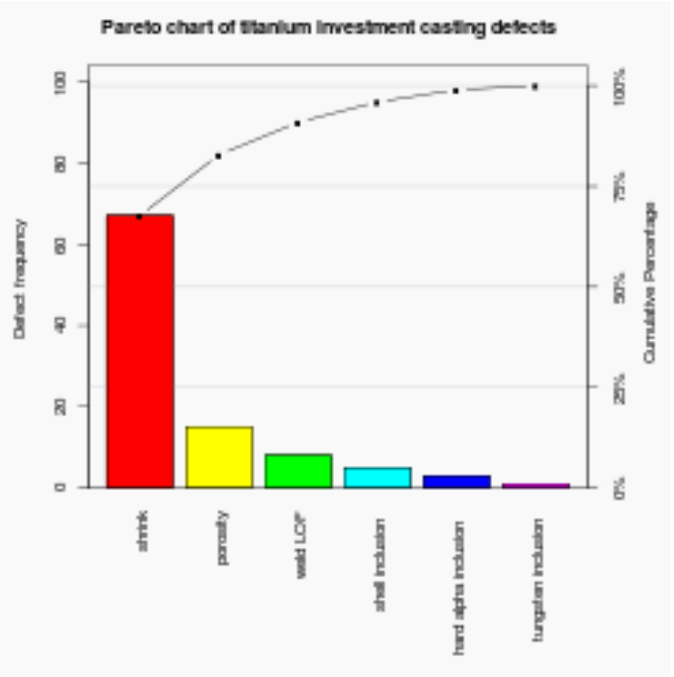
Reference
http://en.wikipedia.org/wiki/Pareto_chart

What is it?
Named after Vilfredo Pareto, an Italian economist, a Pareto chart formats defect data to illustrate which categories of defect are most contributing to overall quality problems

Why is it used?
The Pareto chart/diagram is valuable to graphically display cause categories, and the quantity of issues in each category. Given the format of the tool, it is easy to quickly see which categories are contributing to the problem. For instance, if you see that one of five categories is responsible for 80% of the problem, then that single category is where you should spend most of your time.

When is it used?
- Quality control
- Process improvement
- Risk management
- Project management
- Grant proposals

Example



Pros
- Helps prioritize
- Demonstrates root cause
- Easy to assemble

Cons
- Ignores the value of ‘quick wins’
- Can easily misrepresent the data if the data is not representative

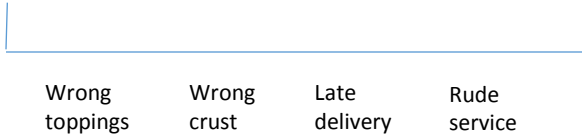
Pareto Diagram: Job Aid

1) Identify data

- Track data on quality issues, by category of issue, and frequency of each error type.
- Ensure a representative sample size from the total population of errors is attained.

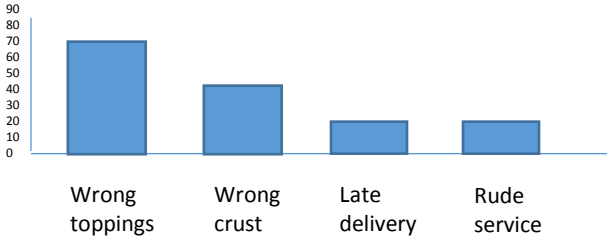
2) Categorize the data and start the chart

- List the categories from low to high defect count
- Along the x-axis of a chart, place the categories in order, from high to low



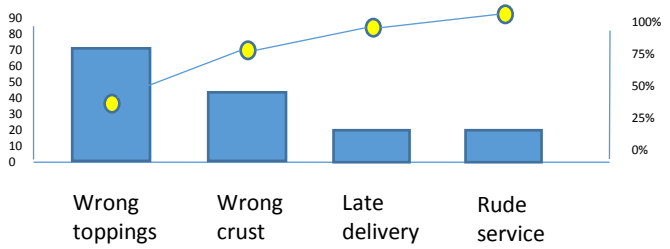
3) Bar Graph the data

- Using the left y-axis, note the raw number of incidences for each category create a vertical bar to illustrate that category's quantity



4) Determine percentages

- Along the right y-axis, indicate '% of total' vertically, from 0% to 100%
- Plot above each category's bar, the actual % of total for that category. Then connect the dots in a line graph.



5) Focus in

- Determine the fewest number categories that contribute to 80% of the overall problem and focus there.
  - Example: wrong toppings and wrong crust would solve 80% of quality issue, which would result in focus efforts on production, rather than driving or service.