LEAN SIX SIGMA TOOLKIT

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What is this Toolkit for?

If you're reading this, you probably already know how important continuous improvement is for the long-term success of any company. This toolkit is designed to **help you get a better understanding of Lean Six Sigma, the methods and tools that come with this framework for continuous improvement.**

In this PowerPoint Presentation, we'll provide you with actionable tools and templates, as well as some additional explanations to help you grasp the concepts better. You can find more useful information behind the **links** and in the **presentation slide notes**.

How to use it?

This presentation will walk you through the key parts. Most slides have additional notes that explain the tools and methods in more detail. For the detailed take on Lean Six Sigma, please refer to our dedicated article:

For more information on innovation management and continuous improvement in general, please refer to our blog.

PLEASE NOTE: This Toolkit is a starting point. Getting results will always take time and effort. These are just some of the possible tools you can use in Lean Six Sigma. Given their level of complexity, if you are new at LSS, we advise you to explore in much detail each tool before taking it into use.

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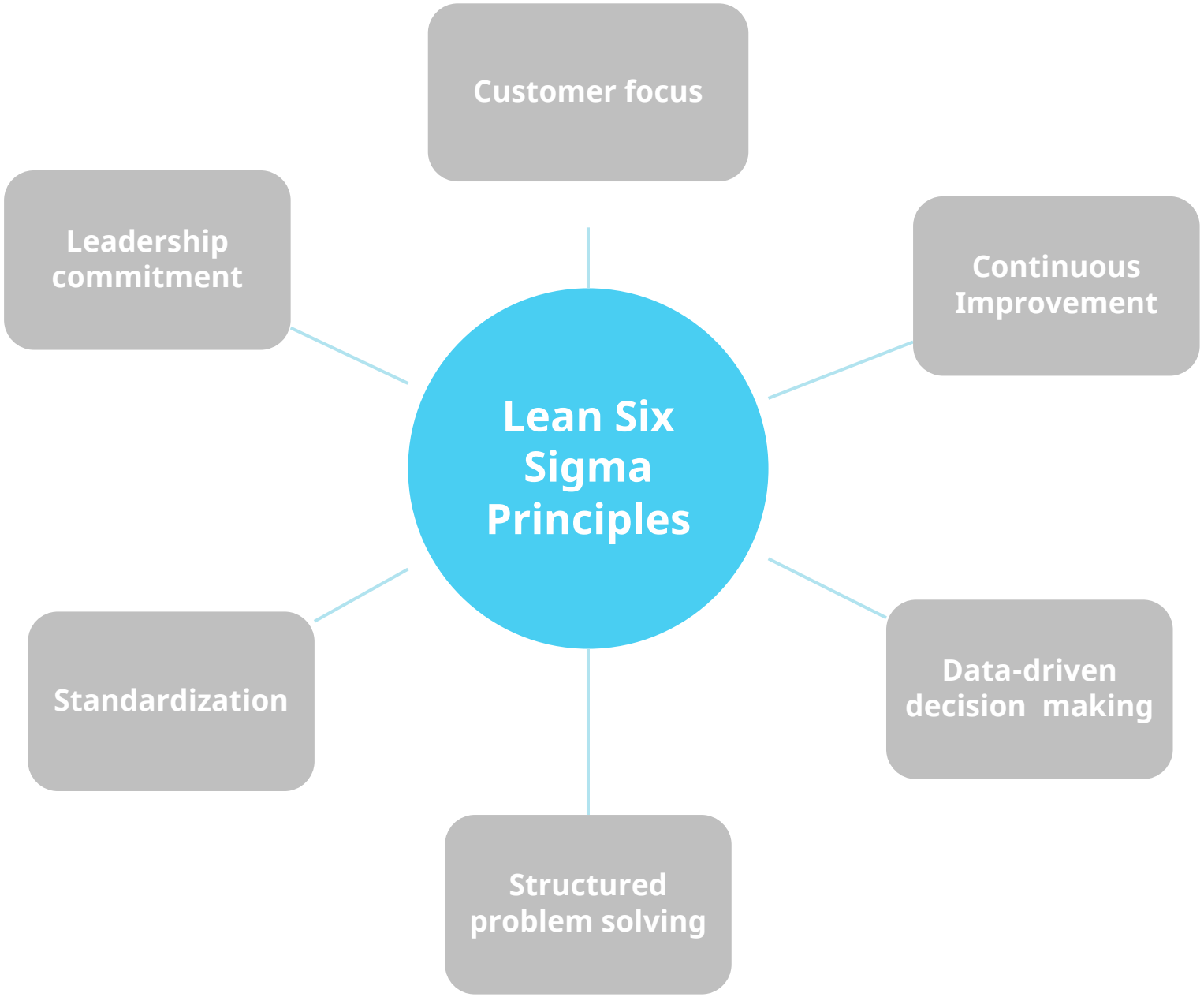

Customer focus
Leadership commitment
Continuous Improvement
Lean Six Sigma Principles
Standardization
Data-driven decision making
Structured problem solving

Lean Six Sigma
DMAIC framework

	Define	Measure	Analyze	Improve	Control
Objective	Define the problem and set up project goals	Measure current performance & look for potential causes of the problem	Analyze the data and identify the root cause of the problem	Develop solutions to address the root causes	Monitor and continuously improve
Knowledge	Understanding of project scope, goals, and objectives. outcomes.	Data collection methods, basic descriptive statistics.	Statistical analysis techniques, root cause analysis methods.	Creativity techniques, process redesign concepts.	Process control concepts, mistake-proofing methods.
Skills	Problem definition, stakeholder management, project scoping.	Data gathering, process mapping, measurement systems.	Identifying patterns, analyzing data, finding root causes.	Generating solutions, piloting changes, evaluating alternatives.	Implement, sustain improvements, develop control plans.
Tools	Project Charter, SIPOC diagram, Voice of the Customer (VOC) analysis, JBTD	Data collection plan, Gage R&R study, Process Map, Histogram, Pareto Chart.	Fishbone Diagram, 5 Whys, Scatter Plot, Regression Analysis. Quantitative and Qualitative tools	Brainstorming, DOE, Simulation, How might we statements, idea challenges	Control Plan, Statistical Process Control (SPC) charts, Standard Operating Procedures (SOPs)

DEFINE

In this phase you:

- Define the issues and action plan necessary to attain the desired results towards process improvement
- Define the issues and improvement activity's objectives
- Understand the problem as a whole and understand the customer's preferences
- Define a problem statement and look at the data to check if the reported issue is relevant

Tools

- **Project Charter**
- **SIPOC Diagram** (Suppliers, Inputs, Process, Outputs, Customers)
- **Process Mapping**
  - Value Stream Map
- **VoC (**Voice of the Customer) analysis
- **JTBD** (Jobs To Be Done)
- **5S**

Project Charter

Project Name:
Date (Last Revision):

Prepared by:
Approved by:

Business case

Why you need an improvement project? Highlight the losses that come from current process, and possible gains by implementing the improvements.

Opportunity statement *(high level problem statement)*

Describe the problem and opportunities in measurable terms. How often the problem occurs, where, and who's impacted?

Defect definition

Goal statement *(SMART objectives)*

What is the improvement? When should it be finalized?

Expected savings

Project scope

Process Start Point

Process End Point

In Scope

Out of Scope

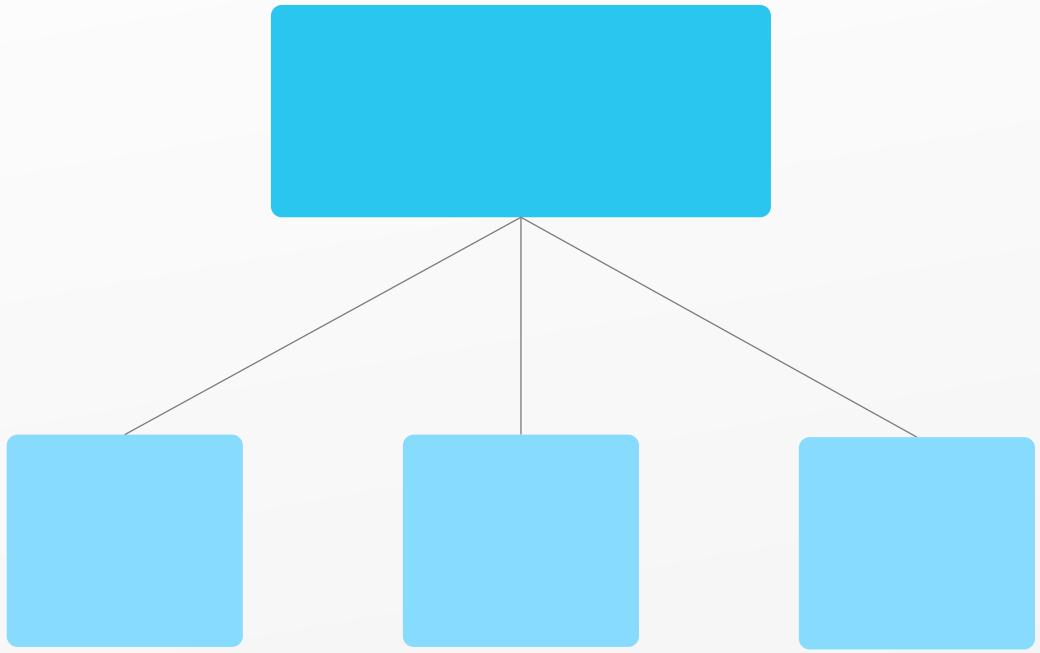
Project plan

Task/Phase	Start Date	End Date	Actual End

Team

Name	Role	Commitment %

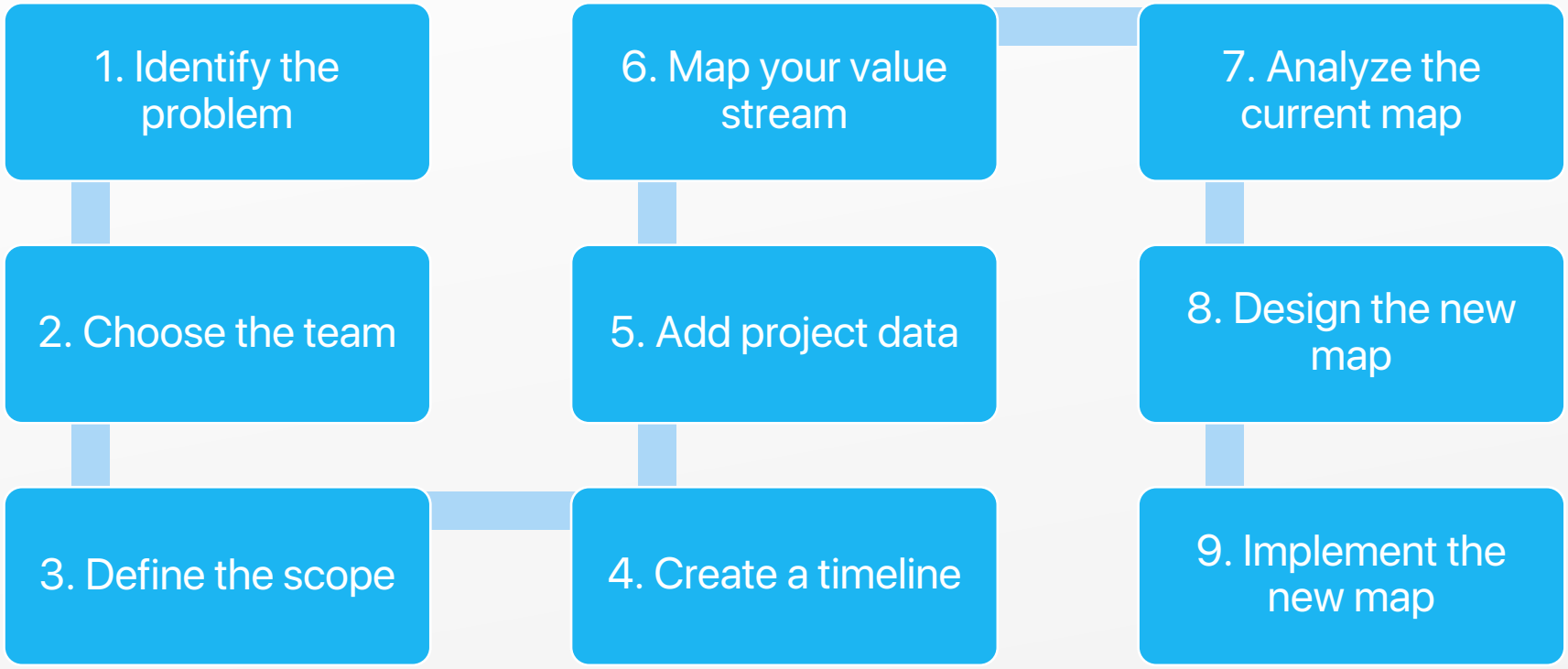
Value Stream Mapping



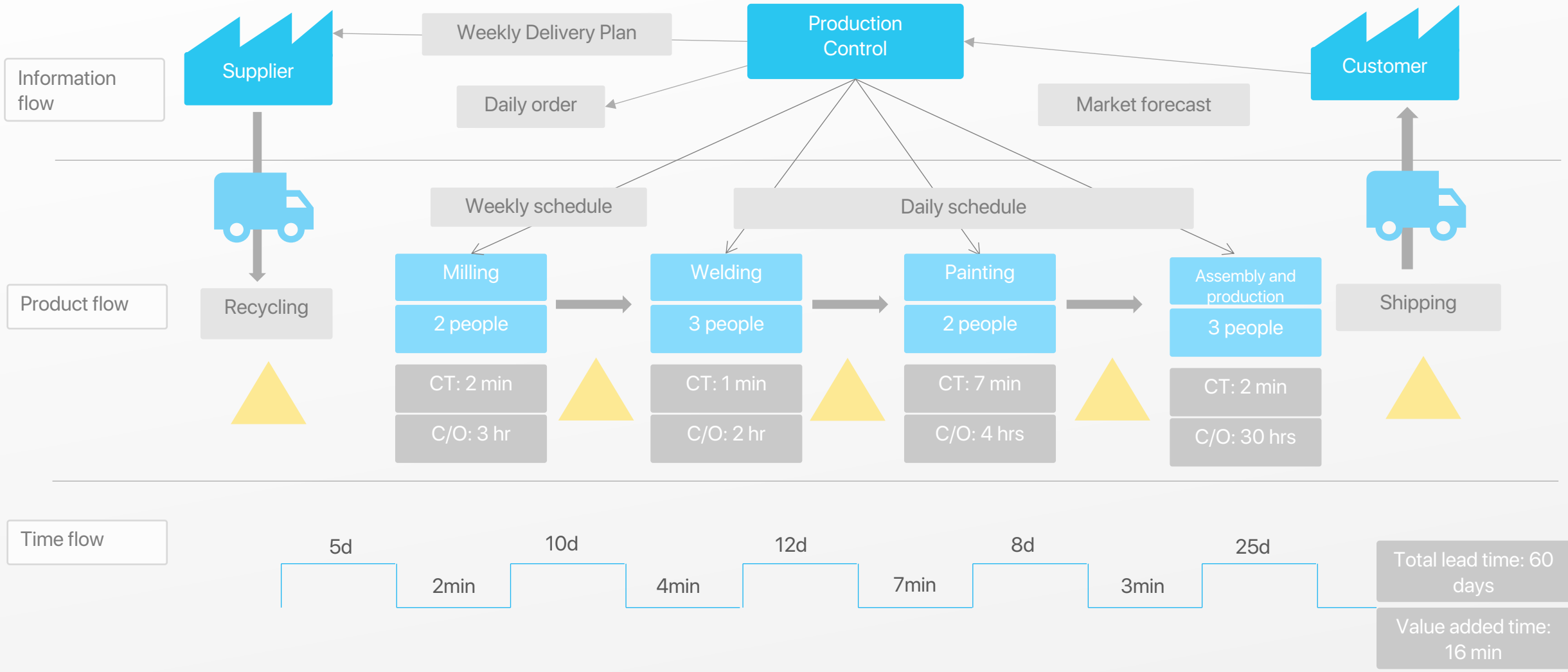
The value stream mapping (VSM) has four major steps meant to help you identify areas of improvement.

1. Map the process
2. Find and eliminate waste
3. Map improvements and future process
4. Implement the new process

The Value Stream Mapping process



Value Stream Mapping example



SIPOC diagram

Example for restaurant food preparation.

Process owner:	KPIs and measurement frequency	Purpose of the process:	Interrelated processes

Suppliers	Inputs	Process	Outputs	Customers
		Process breakdown	What are the key outputs?	Who are the recipients?

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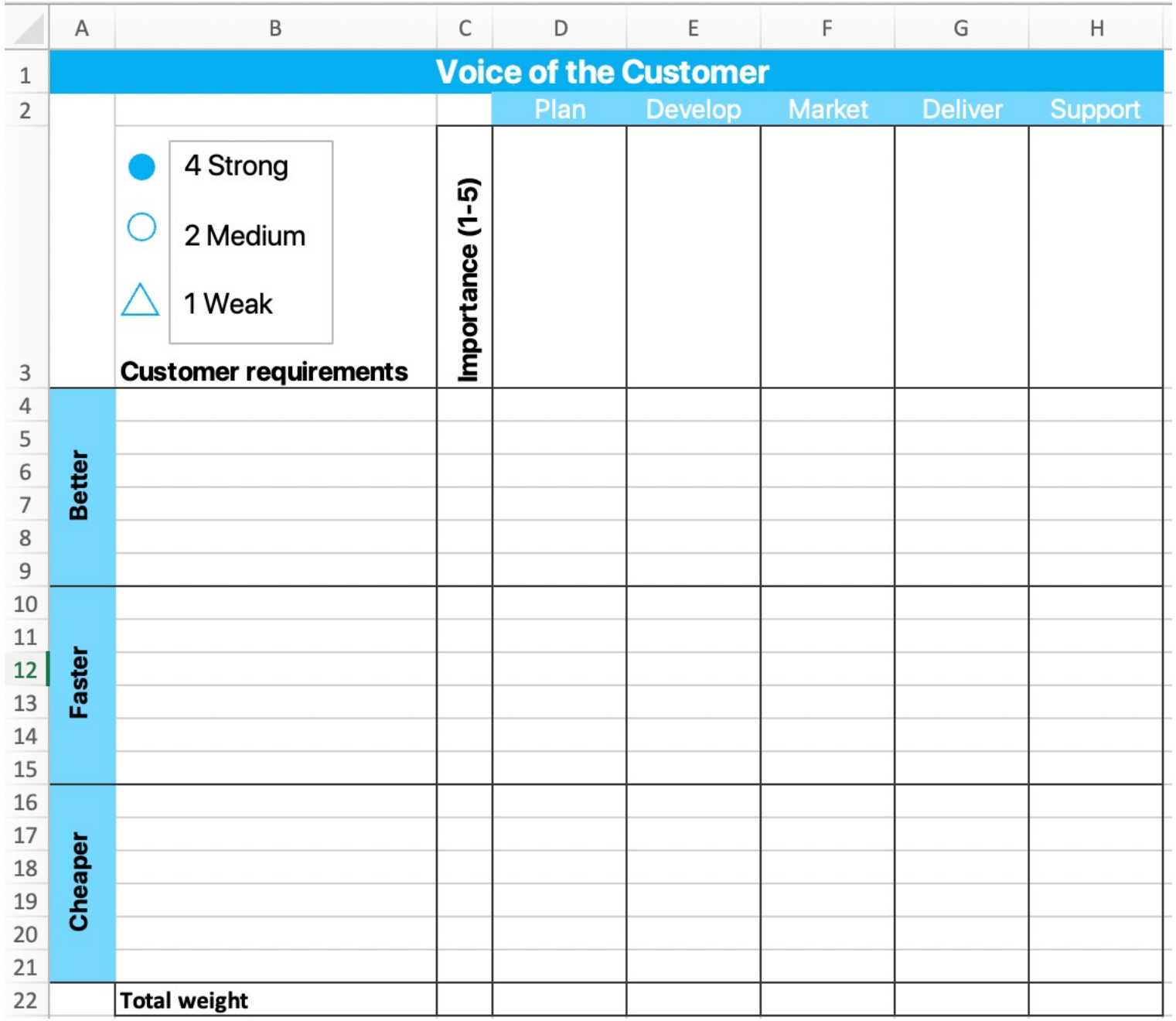


	A	B	C	D	E	F	G	H
1		Voice of the Customer						
2				Plan	Develop	Market	Deliver	Support
3		● 4 Strong ○ 2 Medium △ 1 Weak **Customer requirements**	**Importance (1-5)**					
4	**Better**							
5								
6								
7								
8								
9								
10	**Faster**							
11								
12								
13								
14								
15								
16	**Cheaper**							
17								
18								
19								
20								
21								
22		**Total weight**						

The Jobs To Be Done Canvas

Job executor (who's your end user):

Version:

Project:

Job statement (Verb + object + context)

Job map

1. Define
2. Locate
3. Prepare
4. Confirm
5. Execute
6. Monitor
7. Modify
8. Conclude

Job roles

Emotional

Functional

Social

Forces of progress

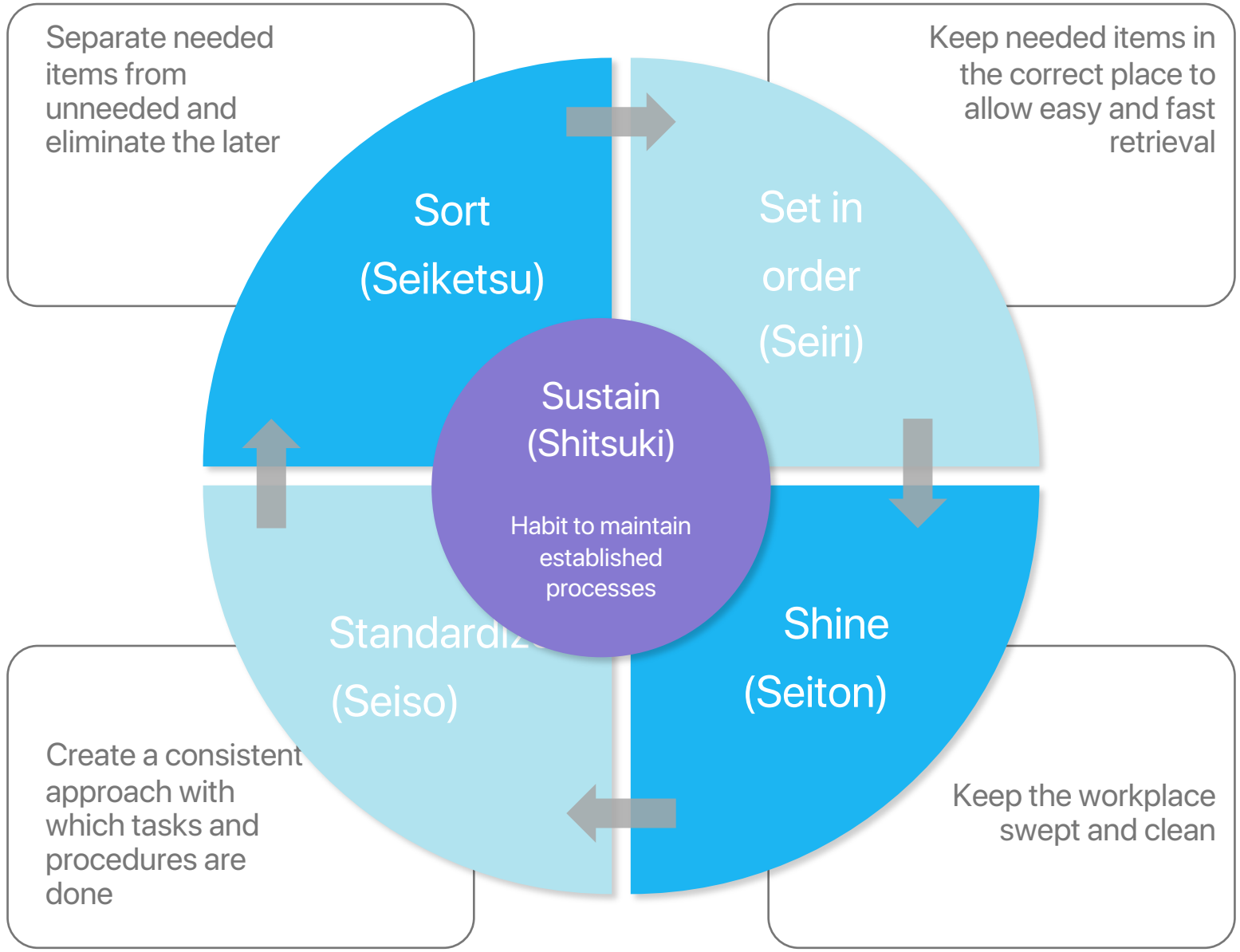
Problem ↗

Progress ↗

Habits ↙

Anxiety ↙

The 5S Framework



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5S Audit Form

Name:	Team:	Date:

SORT Sort out necessary and unnecessary items. The unnecessary items should be removed from the area.	**Unnacceptable** No evidence shown	**Poor** Only evident here and there	**Good** Applied and evident in most areas	**Excellent** Thoroughly evident and apply everywhere	**World Class** Always looking for ways to make even more improvements
1. Items/supplies on surfaces have been sorted, separating needed	1	2	3	4	5
2. Items/supplies in bookcases or on shelves have been sorted, separating needed from unneeded	1	2	3	4	5
3. Items in cupboards or drawers, including desk and file drawers, have been sorted, separating needed from unneeded	1	2	3	4	5
4. Items on floors have been sorted, separating needed from unneeded eliminating floor piles and all cords are safely contained.	1	2	3	4	5
5. Needed items have been placed at the closest location to where they are used the most to minimize the waste of motion.	1	2	3	4	5
6. Unnecessary items have been removed from the work area	1	2	3	4	5
7. Work agreements for the above are documented and all staff know where to find the agreements.	1	2	3	4	5
Total score:					

5S Audit Form

Name:	Team:	Date:

SET IN ORDER A place for everything and everything in its place so it should be easy to find.	**Unnacceptable** No evidence shown	**Poor** Only evident here and there	**Good** Applied and evident in most areas	**Excellent** Thoroughly evident and apply everywhere	**World Class** Always looking for ways to make even more improvements
1. Locations of needed items are labeled and items are in correct locations.	1	2	3	4	5
2. Required quantities for needed items are determined (par levels), including items in desk drawers and in bookshelves.	1	2	3	4	5
3. Locations for movable items are labeled, and items are placed in correct locations (white board/ laminated card/label on wall can be used).	1	2	3	4	5
4. Visual controls and indicators are established including: Posted map of area, including individual room maps.	1	2	3	4	5
5. There is Labeling indicating contents of drawers and cupboards (a new person should be able to locate without assistance).	1	2	3	4	5
Total score:					

5S Audit Form

Name:	Team:	Date:

SHINE Keep work area clean and ready to use. Inspect regularly to ensure sort and set in order are maintained.	**Unnacceptable** No evidence shown	**Poor** Only evident here and there	**Good** Applied and evident in most areas	**Excellent** Thoroughly evident and apply everywhere	**World Class** Always looking for ways to make even more improvements
1. Work areas and equipment are stocked and organized on a consistent basis according to 5S agreements and schedules.	1	2	3	4	5
2. Members of the work group follow 5S agreements on a daily basis.	1	2	3	4	5
3. Sources and frequency of 5S problems are documented as part of routine work by all staff.	1	2	3	4	5
4. Surfaces are cleaned and clear of dust and debris.	1	2	3	4	5
5. Checklists are utilized to identify ongoing Shine duties and the status of these are up-to-date.	1	2	3	4	5
Total score:					

5S Audit Form

Name:	Team:	Date:

STANDARDIZE Maintain the first three S's and have an awareness of improving neatness.	**Unnacceptable** No evidence shown	**Poor** Only evident here and there	**Good** Applied and evident in most areas	**Excellent** Thoroughly evident and apply everywhere	**World Class** Always looking for ways to make even more improvements
1. There is a 5S agreement in place and all employees know where it is located.	1	2	3	4	5
2. . Leadership can explain why 5S is important.	1	2	3	4	5
3. All staff can explain the importance of 5S.	1	2	3	4	5
4. There is a standard process for training and orienting new staff to the 5S system	1	2	3	4	5
5. There is a process in place to ensure unnecessary items do not "creep" back into the work area.	1	2	3	4	5
Total score:					

5S Audit Form

Name:	Team:	Date:

SUSTAIN The 5S Discipline is embedded so that it becomes a way of life. 5S is no longer an event but routine.	**Unnacceptable** No evidence shown	**Poor** Only evident here and there	**Good** Applied and evident in most areas	**Excellent** Thoroughly evident and apply everywhere	**World Class** Always looking for ways to make even more improvements
1. 5S plans and action updates are clearly displayed and current.	1	2	3	4	5
2. . Success stories are displayed and confirmed for improvement.	1	2	3	4	5
3. Staff 5S roles are clearly identified.	1	2	3	4	5
4. Department audits and subsequent improvement plans are displayed and current.	1	2	3	4	5
5. Are work instructions and procedures available in the workplace regularly reviewed/kept up to date?	1	2	3	4	5
6. Are display boards, activity charts, notice boards, etc. up to date and regularly checked?	1	2	3	4	5
Total score:					

MEASURE

In this phase you:

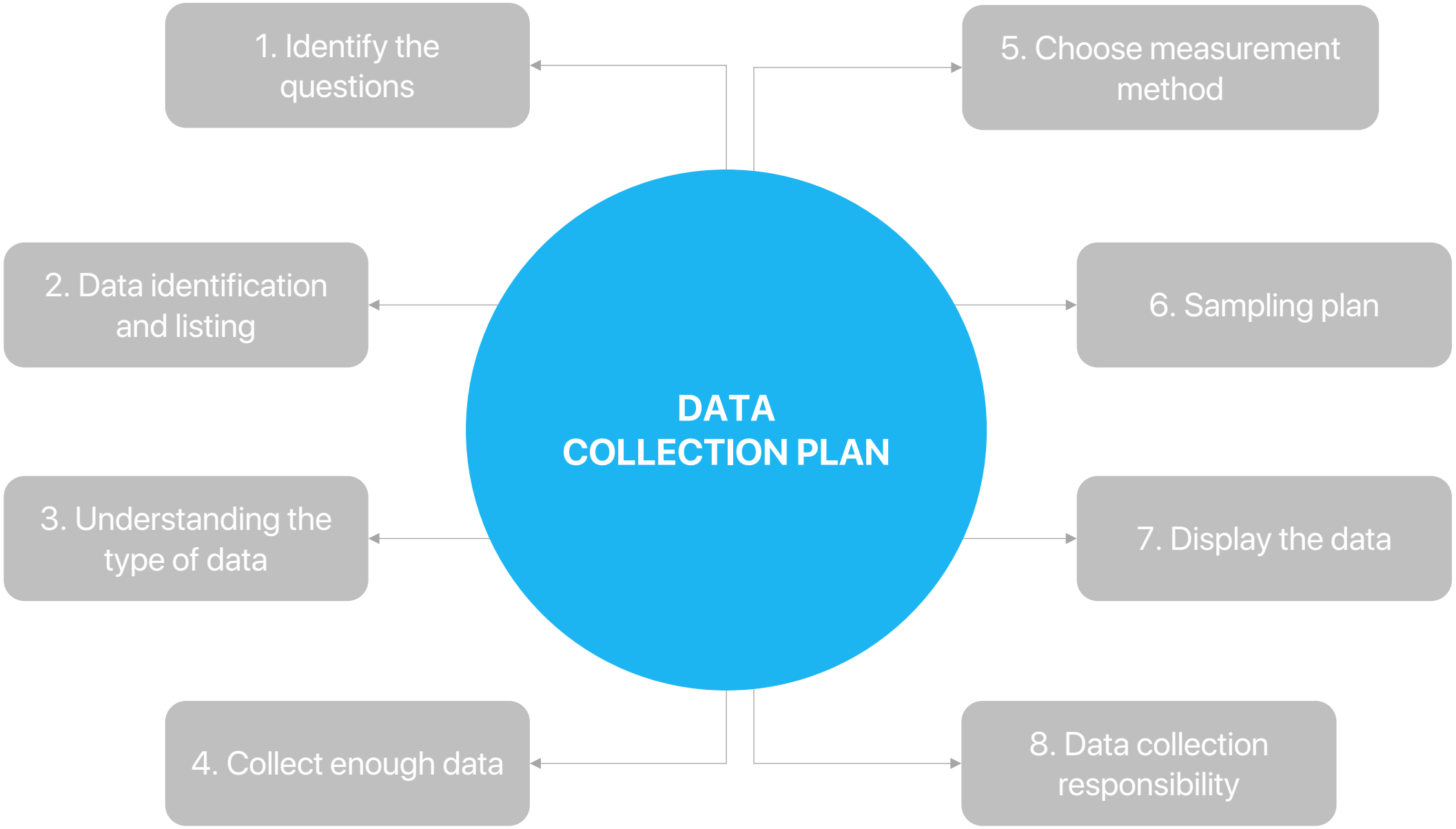
- Gather data from the process and determine the current quality level
- Measure the existing system by defining valid and reliable metrics which will help in tracking progress towards the goal
- Measure and monitors the project’s development and performance as soon as starting to work on it

Tools

- **Data collection plan**
- **Process Map**
- Histogram
- Pareto Charts
- **Gemba walk**

What good measurement looks like

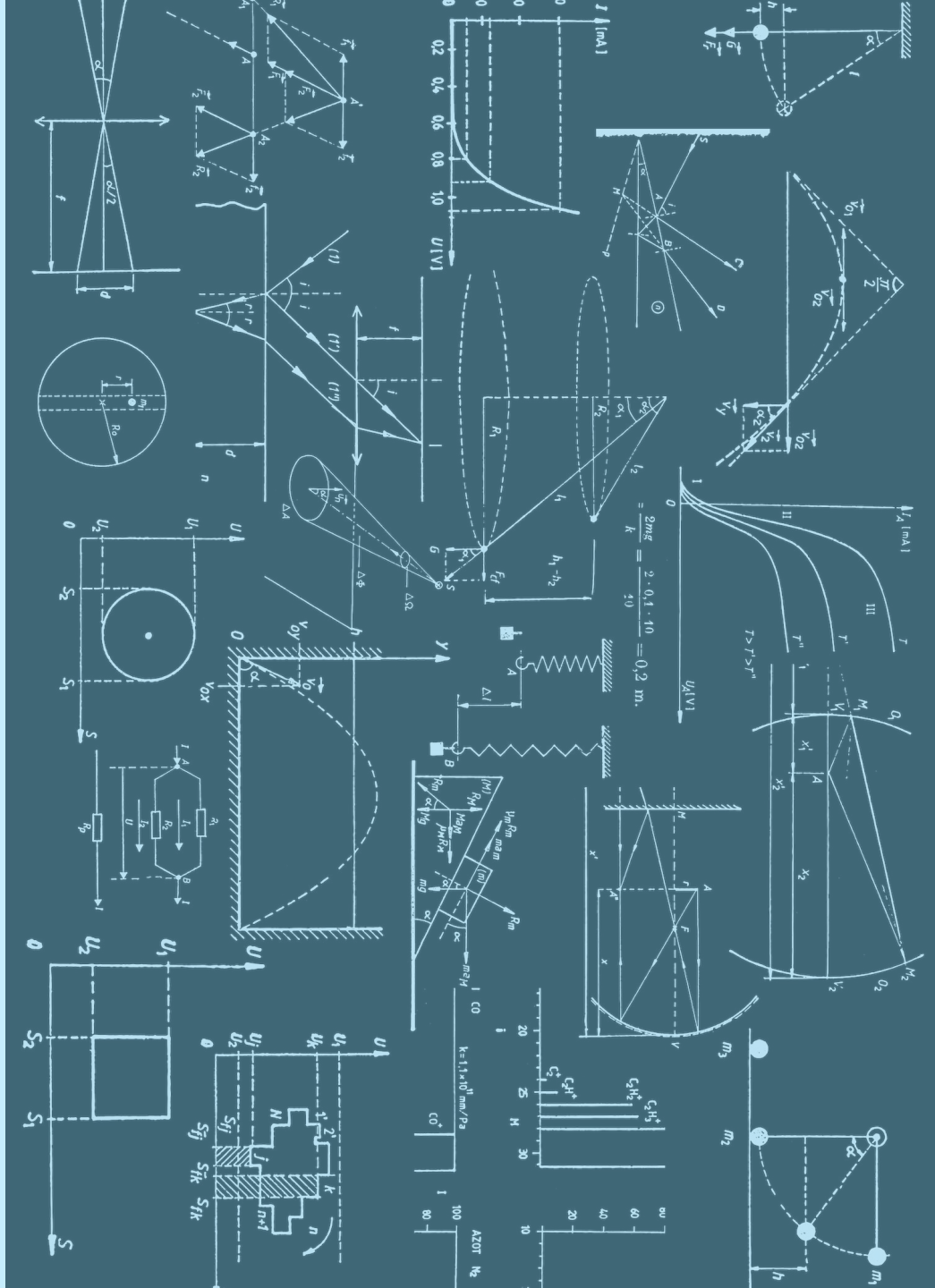
1. **Relevance:** directly relate to the process or problem being analyzed.
2. **Accuracy:** must be precise and minimize errors.
3. **Consistency:** consistent across multiple trials or operators, ensuring reliable results.
4. **Precision:** provide sufficient detail to differentiate between variations.
5. **Validity:** accurately capture the aspect of the process being analyzed, reflecting the true state of affairs.
6. **Reliability:** consistently yield similar results over time and across different circumstances.
7. **Completeness:** cover all relevant aspects of the process without omitting critical data points.
8. **Objective:** unbiased and not influenced by personal opinions or interpretations.
9. **Traceability:** have a clear and documented path to the source data, ensuring transparency.
10. **Measurable Units:** expressed in standard units that are easily understood and compared.
11. **Repeatable:** Others should be able to replicate the measurements using the same methods and tools to verify results.
12. **Traceable:** Each measurement should be traceable back to its original source, ensuring data integrity.
13. **Quantifiable:** capable of being expressed numerically, allowing for quantitative analysis.


1. Identify the questions
5. Choose measurement method
2. Data identification and listing
DATA COLLECTION PLAN
6. Sampling plan
3. Understanding the type of data
7. Display the data
4. Collect enough data
8. Data collection responsibility

Basic LSS measurements

The goal of any improvement project is to make processes, products, or services:

- **Better:** DPU, DPMO, RTY
- **Faster:** Cycle Time
- **Cheaper:** COPQ



Process Map

A **Process Map** is a valuable tool for gaining a clear understanding of the current state of a process.
To effectively use a Process Map :

1. **Clearly Define Scope**
2. **Involve Stakeholders**
3. **Use Standard Symbols**
4. **Keep it Simple**
5. **Maintain Consistency**
6. **Sequence and Flow:**
7. **Use Descriptive Labels**
8. **Avoid Overloading**
9. **Consider Swimlane Diagrams**
10. **Validate with Stakeholders**
11. **Update Regularly**

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Manufacturing flow example

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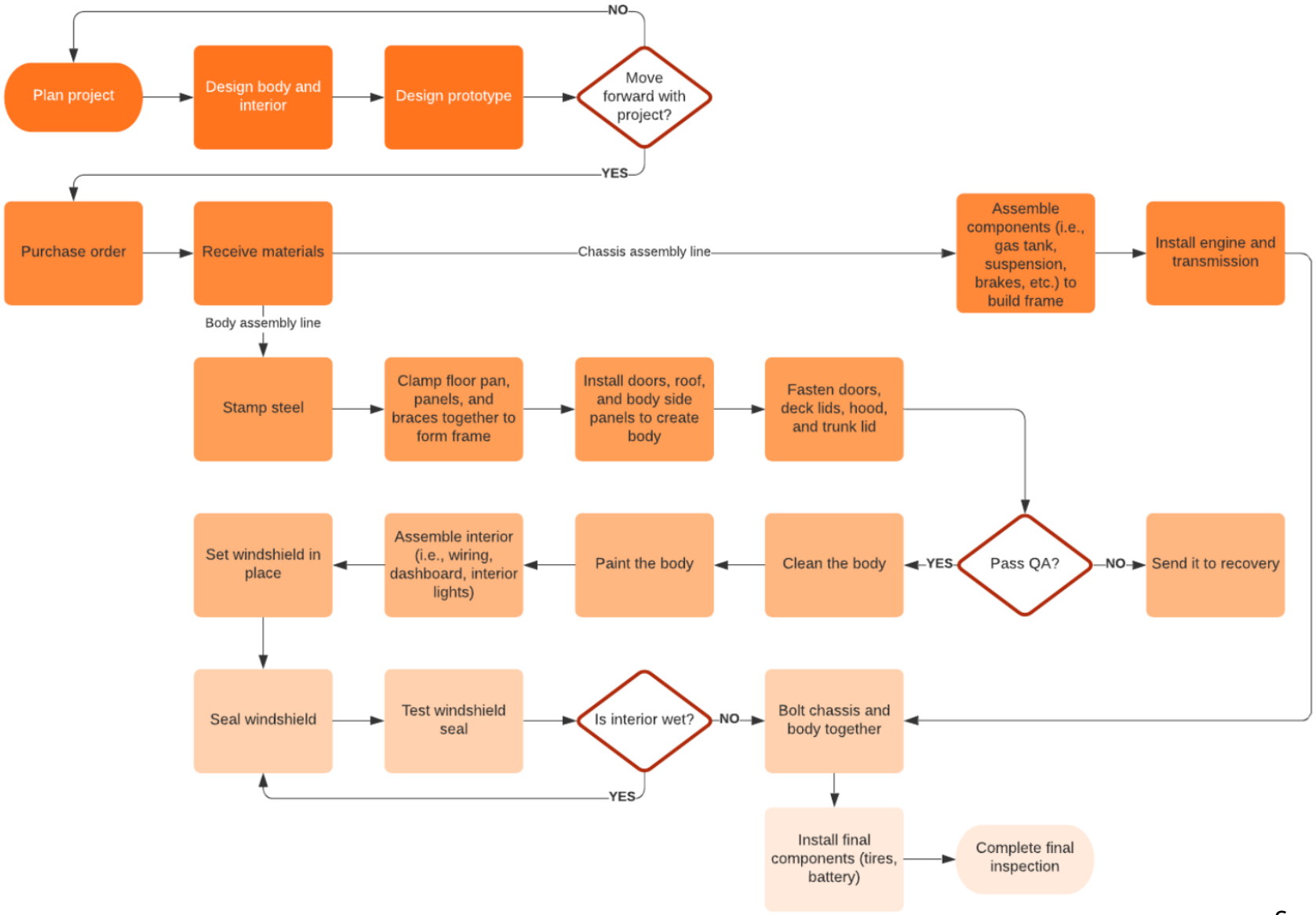


Source: lucidchart.com

Defects per Unit (DPU)

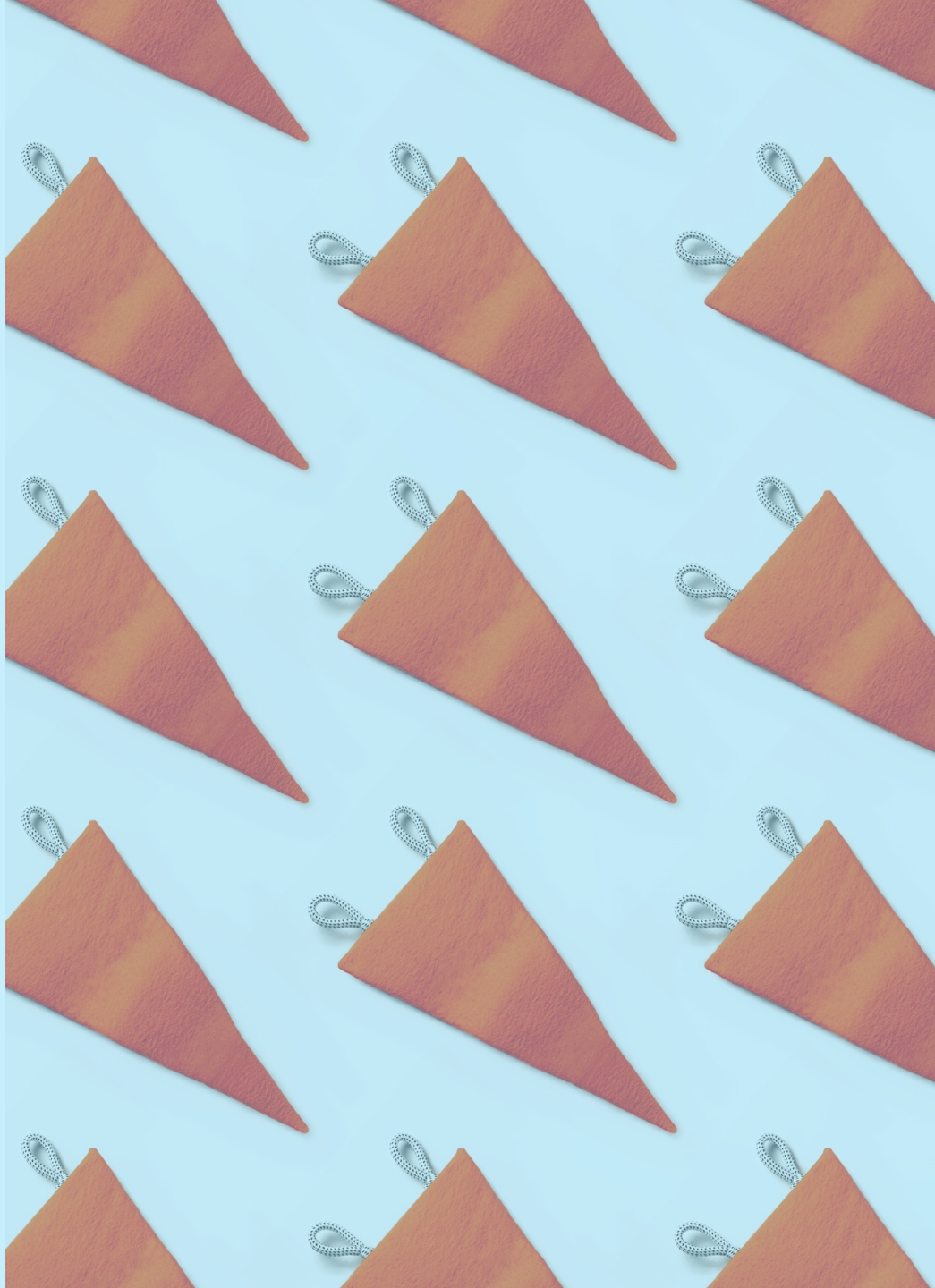
Formula for Calculating DPU: DPU = Total Number of Defects / Total Number of Units

Example: Defects in Manufacturing

Let's say a manufacturing process produces 500 widgets, and during the production process, 75 defects are identified.

DPU = Total Number of Defects / Total Number of Units DPU = 75 defects / 500 units DPU = 0.15 defects per unit

Interpretation: In this example, the calculated DPU is 0.15, which means there are, on average, 0.15 defects per unit produced by the manufacturing process. This metric helps quantify the quality level of the product, and lower DPU values indicate higher product quality.



Defects Per Million Opportunities (DPMO)

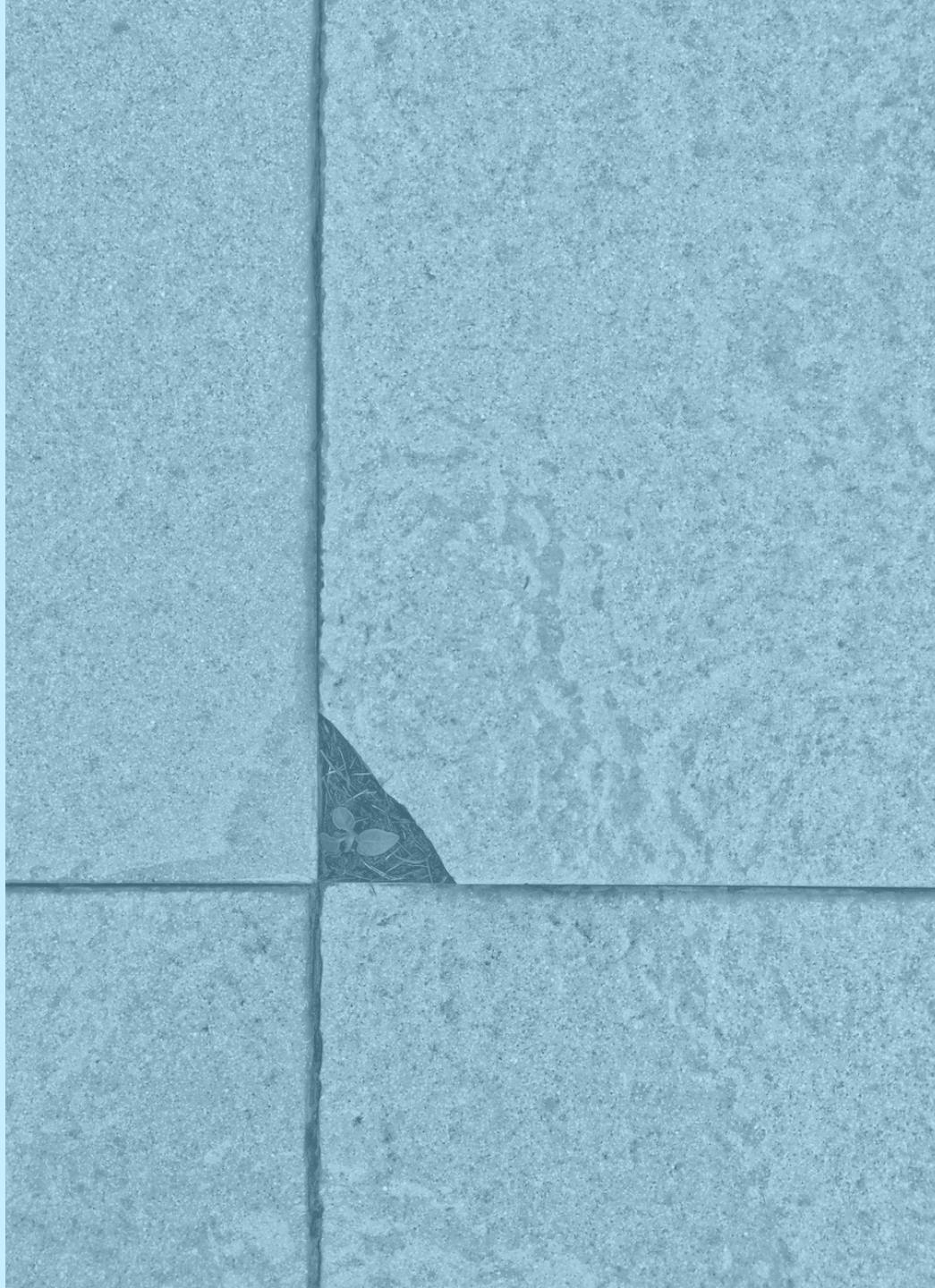
Formula for Calculating DPMO: DPMO = (Total Number of Defects / Total Number of Units) × 1,000,000

Example: Defects in a Software Application

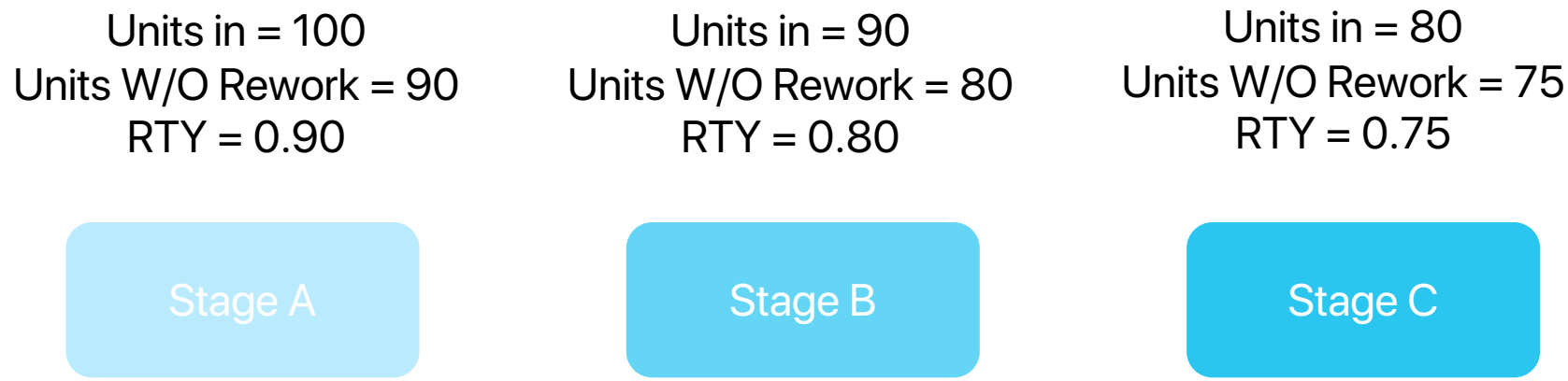
Let's consider a software application that undergoes testing for defects. In a batch of 10,000 lines of code, 25 defects are identified.

DPMO = (Total Number of Defects / Total Number of Units) × 1,000,000 DPMO = (25 defects / 10,000 units) × 1,000,000 DPMO = 2,500 DPMO

Interpretation: In this example, the calculated DPMO is 2,500, which means there are, on average, 2,500 defects per one million opportunities for defects in the software application's code. Lower DPMO values indicate better process performance and higher product quality.



Rolled Throughput Yield (RPY)



RTY = (Yield at Stage A) x (Yield at Stage B) x (Yield at Final Assembly) = 0.90 * 0.80 * 0.75 = 0.54 or 54%

Cycle Time

Formula for Calculating Cycle Time: Cycle Time = Total Elapsed Time / Number of Cycles

Example: Manufacturing Cycle Time

Consider a manufacturing process that produces a specific product. The process consists of multiple steps, from raw material acquisition to finished product assembly. Let's say the total elapsed time for the manufacturing process is 120 hours, and during that time, 30 production cycles were completed.

Cycle Time = Total Elapsed Time / Number of Cycles Cycle Time = 120 hours / 30 cycles Cycle Time = 4 hours per cycle

Interpretation: In this example, the calculated cycle time is 4 hours per cycle. This means it takes an average of 4 hours to complete each production cycle in the manufacturing process. Lower cycle times indicate faster process execution and improved efficiency.

Cost of Poor Quality (COPQ)

Formula for Calculating COPQ: COPQ = Internal Failure Costs + External Failure Costs + Appraisal Costs + Prevention Costs

Example: Manufacturing COPQ

Consider a manufacturing company that produces electronic devices. The COPQ components are as follows:

Internal Failure Costs: $10,000 (cost of rework, scrap)

External Failure Costs: $5,000 (warranty claims, returns)

Appraisal Costs: $2,000 (inspection, testing)

Prevention Costs: $3,000 (training, quality improvement initiatives)

COPQ = Internal Failure Costs + External Failure Costs + Appraisal Costs + Prevention Costs COPQ = $10,000 + $5,000 + $2,000 + $3,000 COPQ = $20,000

Interpretation: In this example, the calculated COPQ is $20,000. This represents the total cost incurred due to poor quality, including both tangible and intangible expenses. Reducing COPQ is a critical objective in process improvement to enhance efficiency, minimize waste, and increase customer satisfaction.

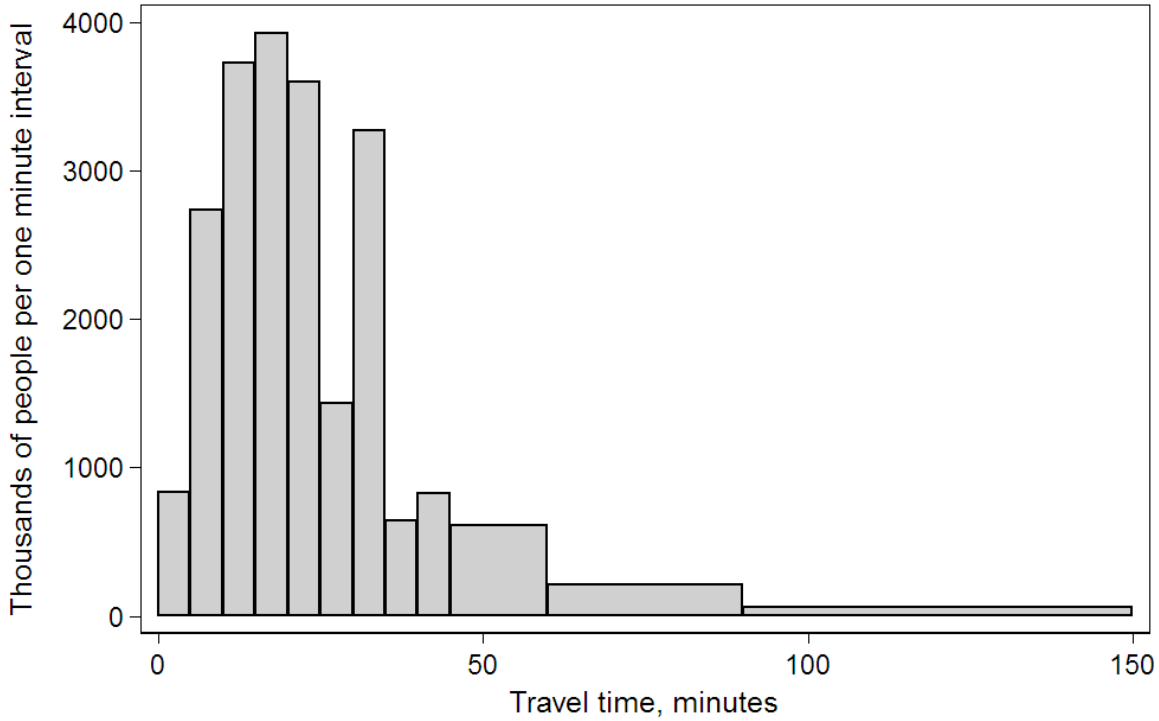
Histogram

A Histogram is a graphical representation of **data distribution**, showing the **frequency of data points within specified intervals** or "bins."

It helps visualize the shape and spread of data, allowing you to understand the **central tendency and variability**.

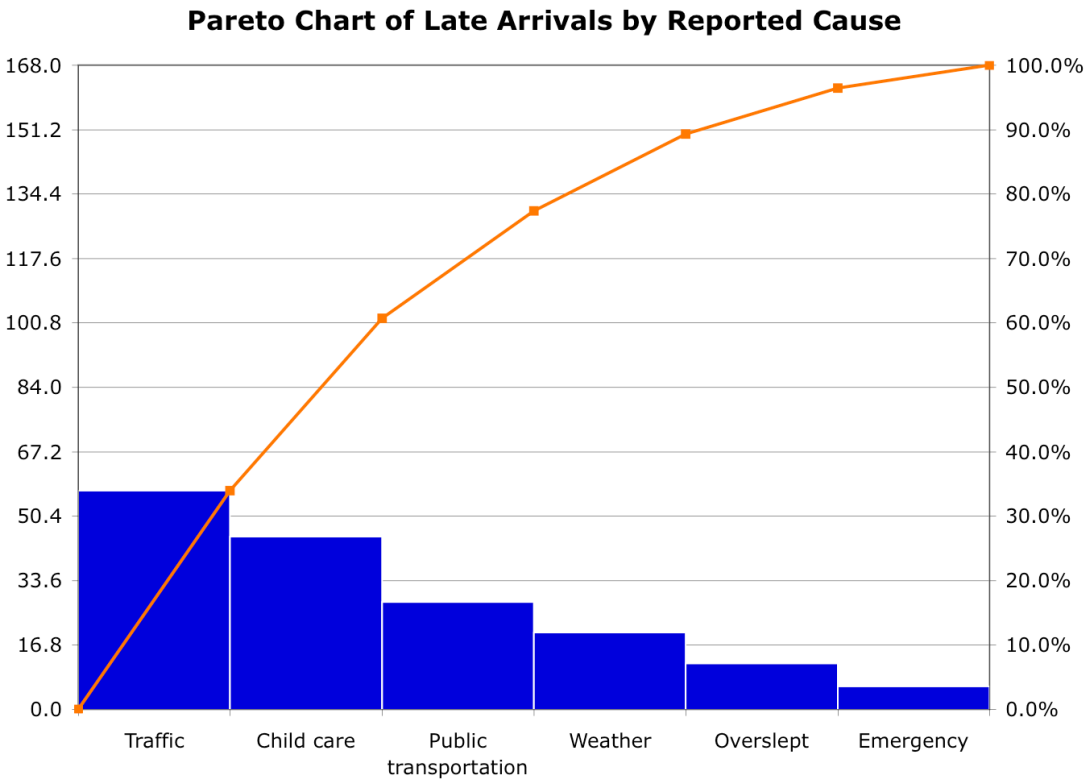
Histograms are used to analyze continuous data, such as measurements or quantities.

They provide insights into the distribution of data, including information about modes, skewness, and outliers.



Pareto Charts

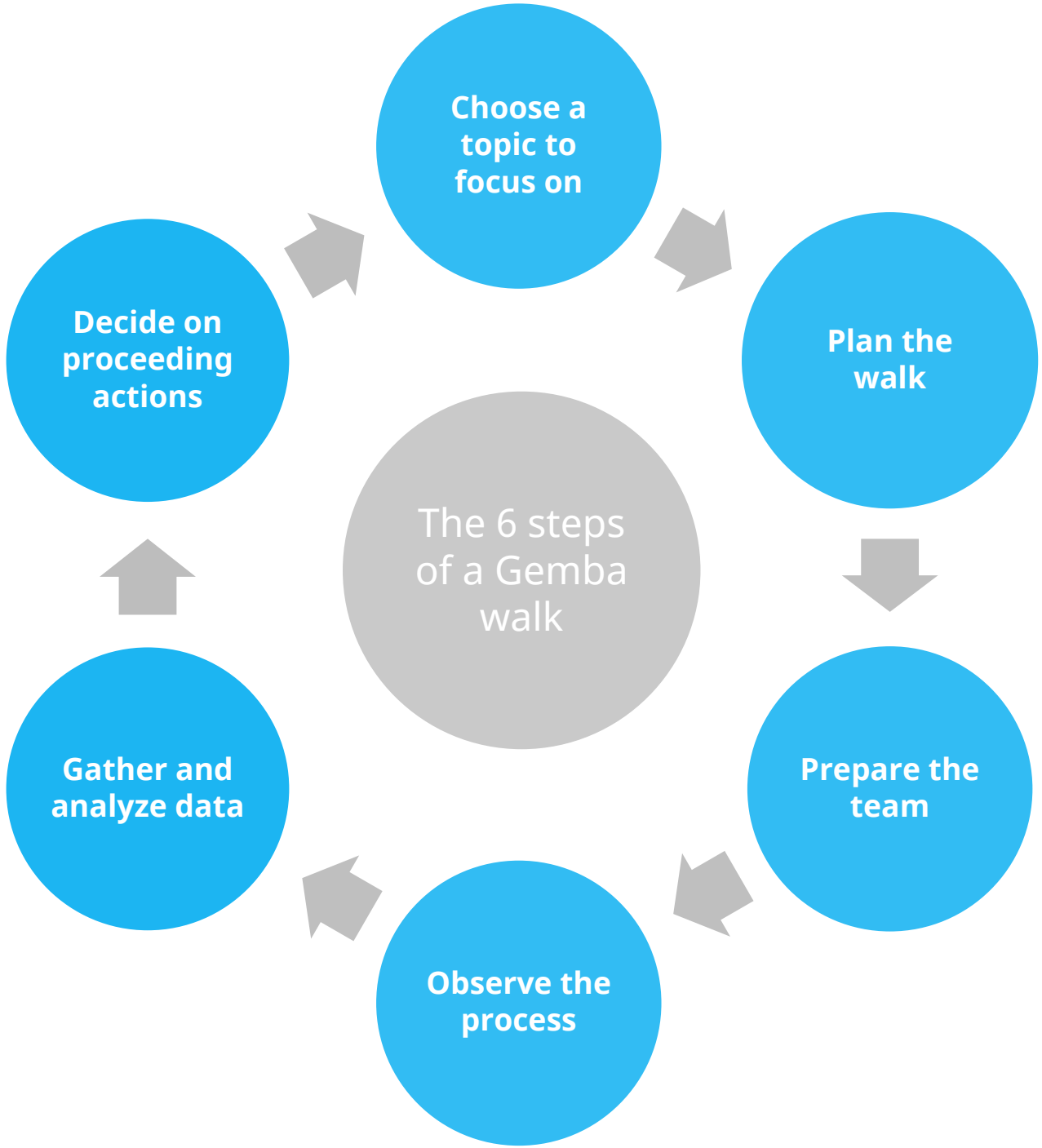
- A Pareto Chart is a bar chart that combines both bar and line graphs to display data in descending order of frequency or importance.
- It is used to prioritize problems or issues based on the **Pareto Principle (80/20 rule),** which suggests that a **significant portion of the effects** (80%) comes from a **small number of causes** 20%).
- Pareto Charts help identify the **vital few factors contributing to the majority of issues**.
- They are particularly effective for **identifying areas of focus and prioritizing improvement efforts**.



Gemba Walk

To do a Gemba walk, you go where the real work happens. They are a great tool for managers. Here's how to run one:

1. Go meet frontline employees: factory floor, customer service, maintenance...
2. Go unannounced and don't plan questions in advance
3. Observe closely, be curious, ask questions to understand a) what's going on and b) if employees could fix one (or a few) thing, what would that be, and why
4. Consider using other inquisitive tools, such as the five whys to truly understand why something happens



Gemba Walk – 3 rules

1. **Go see**. Observe up close how things are created and whether the reality in the field is aligned with the business objectives and expectations.

2. **Ask why**. Try to understand each steps, the ins and outs of the processes.

3. **Act and show respect**. Be mindful about the work of employees and show appreciation and genuine interest for what they do. The intention is not to “boss people around”.

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Gemba Walk – your checklist to get started

- ❑ **Start by choosing a topic you will focus on during your walk**
  This provides a purpose and determines the kind of information you are after and ensures effective results. You don't have to predefine the challenge, as your focus is to identify possible issues and challenging elements, but it's important to be aware of the context beforehand.

- ❑ **Plan the walk**
  Be strategic and proactive in your approach. For this, you need to prepare a set of questions you will ask, as well as a clear structure of the steps you will take, the areas you will visit and the intent for each of those.

- ❑ **Prepare the team**
  While you don't have to announce when it will take place, it's important to inform employees about the Gemba walks, and their purpose. It's not about testing them, but about learning and improvement. Similarly, if someone will join your walk, train them to know what to observe and what to pay attention to.

- ❑ **Observe the process**
  The manager's role is not to show how it's done. Observe without interrupting people or correcting their behaviour. Your goal is not to intervene, but to simply learn, observe, analyze and take notes.

- ❑ **Gather and analyze data**
  Once you have gathered all the information you can go back to the drawing board, analyze the findings and identify areas where teams can act.

- ❑ **Work on an action plan**
  Include the steps to follow, and action required and communicate the findings to the teams. Then start over and prepare for the next Gemba walks to dig deeper or to explore new areas. It's best to repeat these during different times of the week and of the day.

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Gemba Walk

1. Go and See

Observer:	Participants:	Work area :	Process:	Observation date:

Process analysis

1. What is the standard or process you are working on?	2. What is the purpose of this process?	3. What measures are in place to assess the success of the process?
4. What challenges impact the outputs of the process?	5. Do you have ready access to all the resources necessary for the process?	6. How do you think this process can be improved?

Problem solving

1. What kind of problems are you facing in your daily work?	2. Why is this a challenge?	3. What can we do to implement corrective action?

Continuous Improvement

1. What is today’s priority and why?	2. Is there something you want to improve in your daily routine?	3. Is the information documented and up-to-date?

ANALYZE

In this phase you:

- Locate the source of the issue
- Figure out what causes it
- Keep a close eye on the entire process along with the data
- Assess the progress by making a list of difficulties and concerns that arise from the data and observations

Tools

Quantitative

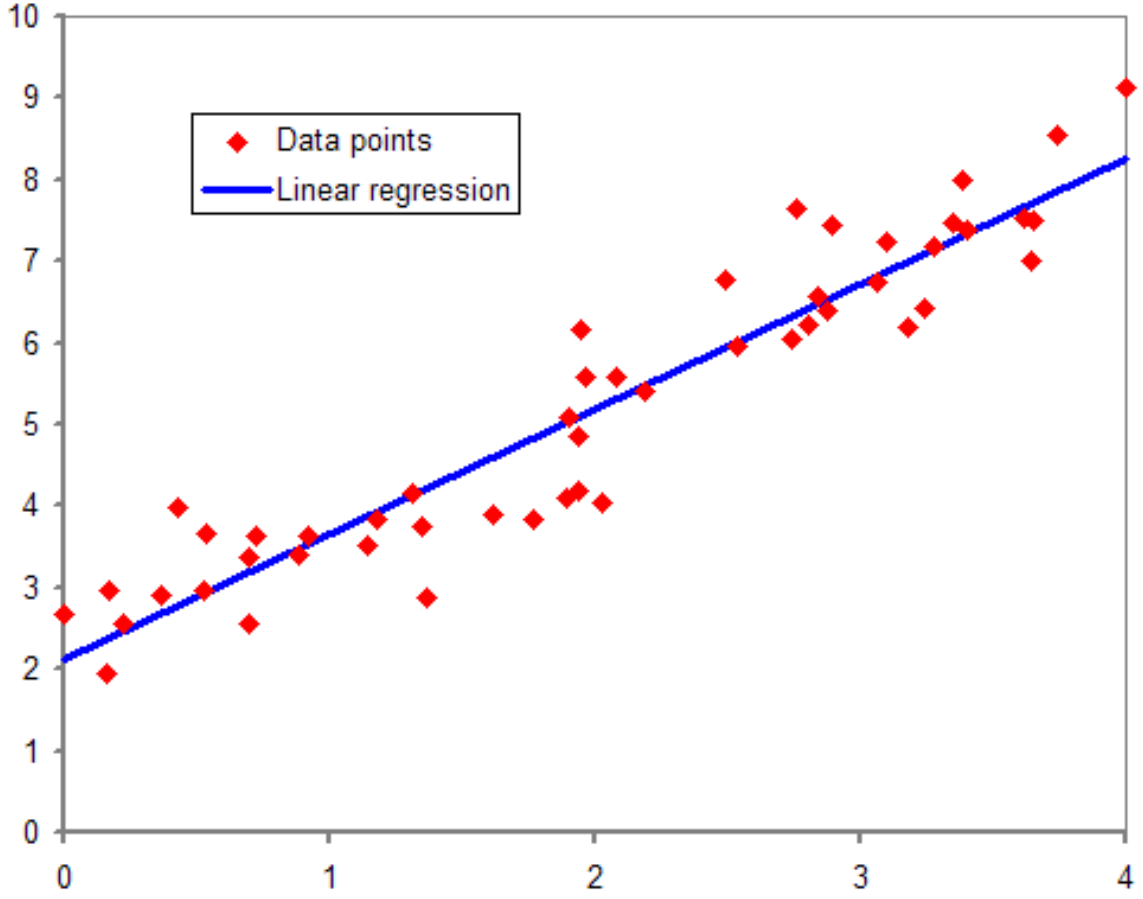
- **Regression analysis**
- Histogram
- Pareto Charts

Qualitative

- **Fishbone diagram**
- **5 Whys**
- **FMEA**
- **XY Matrix**

Regression Analysis

- A statistical technique used to examine the relationship between **one or more independent variables** (also known as predictors or features) and a **dependent variable** (also known as the outcome or response variable).
- It helps to understand how changes in the independent variables are associated with changes in the dependent variable.
- The primary goal of regression analysis is to establish a mathematical equation that can predict the value of the dependent variable based on the values of the independent variables. This equation is known as the regression equation or model.



Regression Analysis

Several tools and software platforms can be used for regression analysis, depending on your familiarity with statistical software and the complexity of your analysis.

Some commonly used tools for regression analysis:

- **Microsoft Excel**: Excel offers built-in functions for linear regression analysis. It's suitable for basic regression tasks and simple data sets.
- **Minitab**: Minitab is a statistical software designed for quality improvement and data analysis. It provides user-friendly tools for regression analysis, including multiple regression and logistic regression.
- **IBM SPSS**: SPSS is a comprehensive software for statistical analysis. It offers various regression analysis tools, including linear regression, logistic regression, and more.

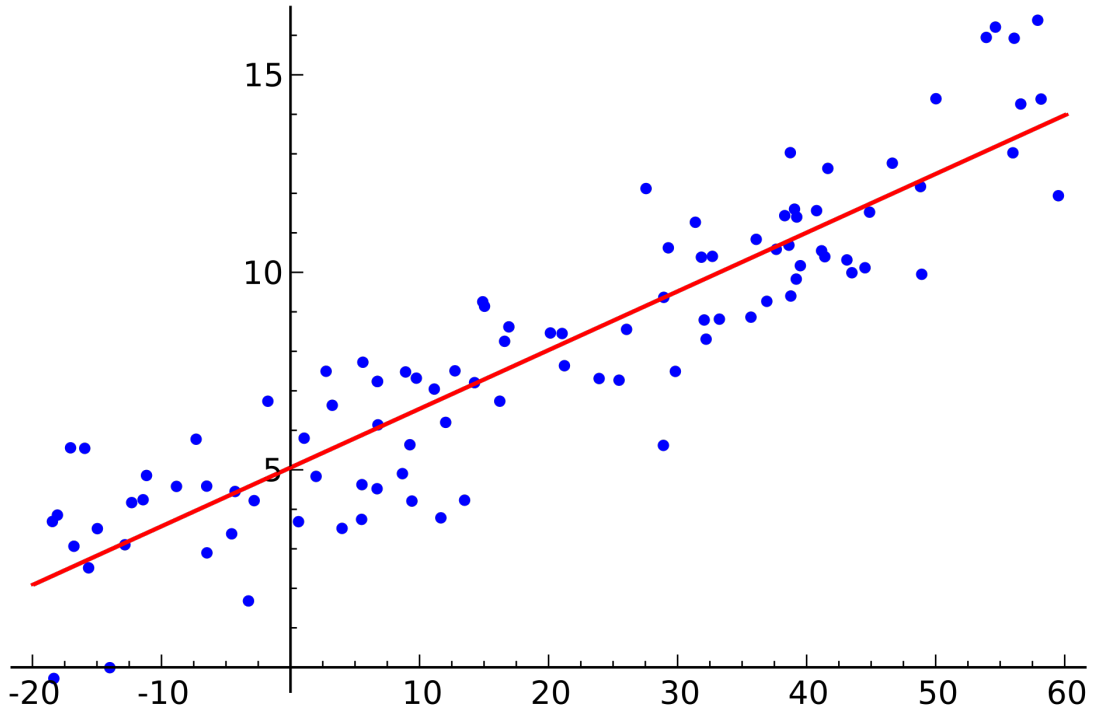
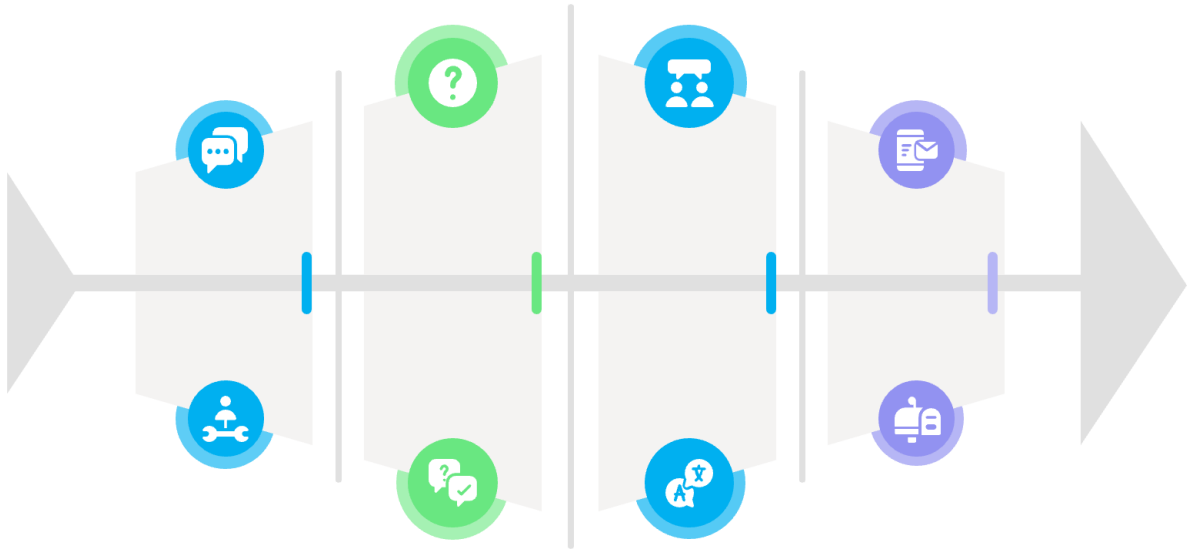


Illustration of linear regression on a data set

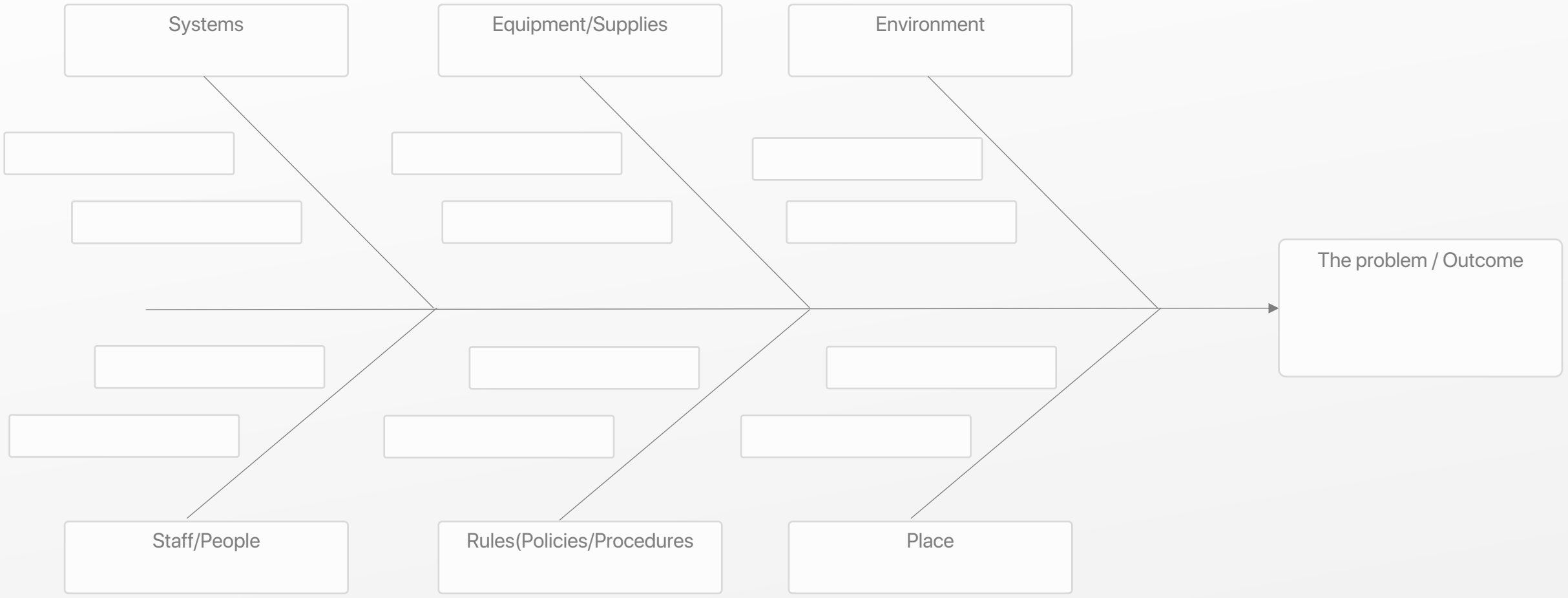
Fishbone Diagram

- The fishbone diagram, also known as the Ishikawa diagram or cause-and-effect diagram, is a visual tool used in problem-solving and process improvement.
- It helps identify the root causes of a specific problem or issue by breaking down potential causes into various categories.
- The diagram resembles the skeleton of a fish, with the "head" representing the problem and the "bones" representing potential causes.



Root cause analysis: The fishbone diagram

Project:	Date:



Root cause analysis: 5 Whys

2. Ask Why

Define the problem:

Root cause problem:

What is happening? What is causing it?

1. (Symptom)

Why is that?

2. (Symptom)

Why is that?

3. (Symptom)

Why is that?

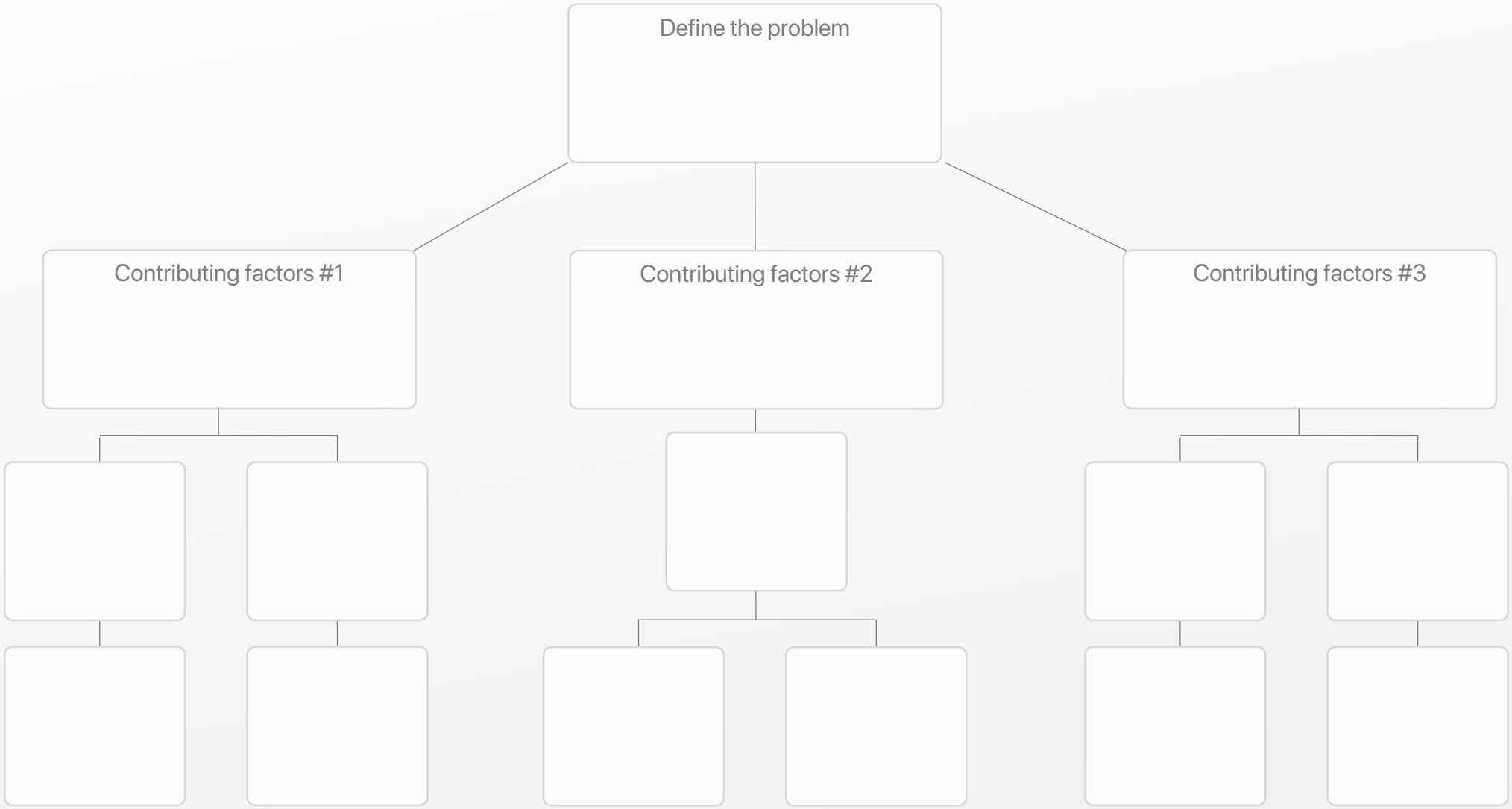
4. (Symptom)

Why is that?

5. (Symptom)

Root cause analysis: 5 Whys – The tree framework

If there is more than one pathway and you identify more than one root cause, you can group several root causes under the tree framework.



FMEA – Failure Mode Effect Analysis

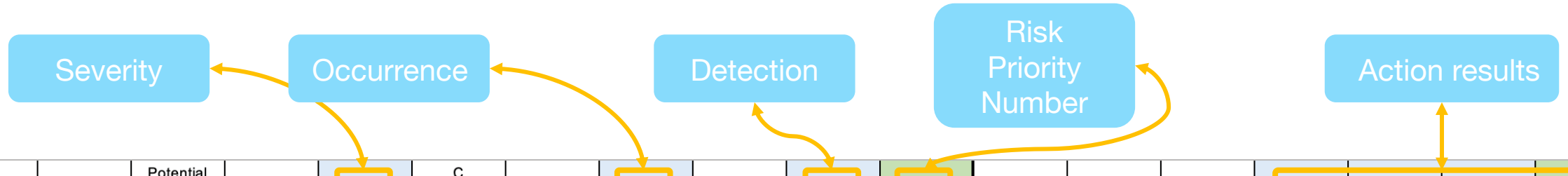
FMEA is a systematic process that requires thoughtful consideration for all of the potential failure mode associated with a new design or process.

FMEA helps teams proactively assess the impact of failures, prioritize them based on severity, and develop strategies to prevent or minimize their effects.

Before you get started with FMEA, establish the ground rules:

- Define the scale you plan on using for **Severity, Occurrence and Detection**
- Document any assumptions
- Define your **Acceptable Risk Level**

The FMEA – Failure Mode Effect Analysis

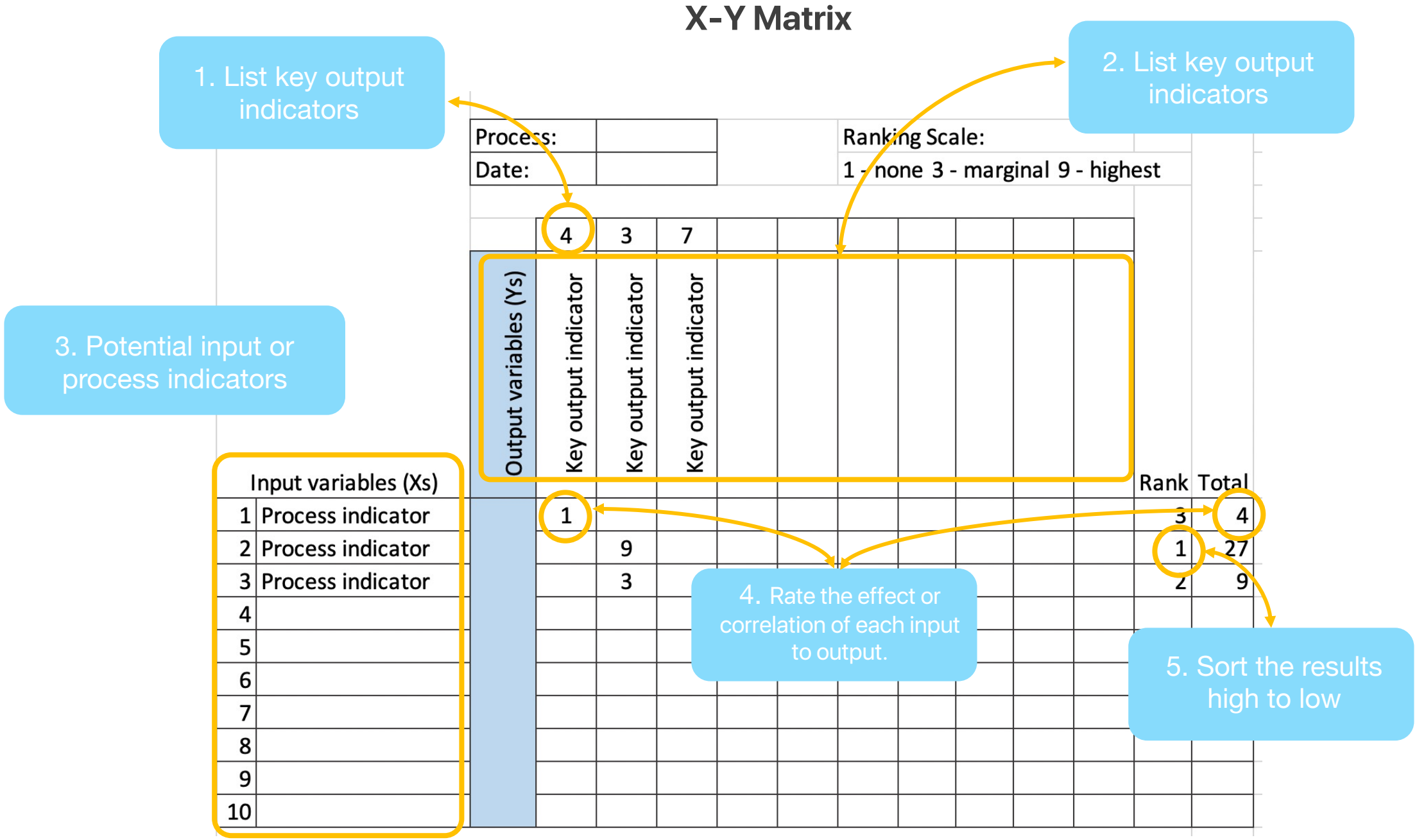


#	Process Function (Step)	Potential Failure Modes (process defects)	Potential Failure Effects (KPOVs)	SEV	Class	Potential Causes of Failure (KPIVs)	OCC	Current Process Controls	DET	RPN	Recommend Actions	Responsible Person & Target Date	Taken Actions	SEV	OCC	DET	RPN
										0							0
1										0							0
2										0							0
3										0							0
4										0							0
5										0							0
6										0							0
7										0							0
8										0							0
9										0							0
10										0							0
11										0							0
12										0							0
13										0							0
14										0							0
15										0							0
16										0							0
17										0							0
18										0							0
19										0							0
20										0							0
21										0							0
22										0							0
23										0							0
24										0							0

X-Y Matrix – Prioritizing the root causes

- A tool used to prioritise the potential strength of the relationship between **input and process indicators (Xs)** and the **output indicators (Ys)**
- This is a subjective analysis tool that provides structure in team decision making. It's used to **decide what X data to collect.**
- To identify the X in the X-Y Matrix, you use data from three main sources:
  - **process mapping**
  - **fishbone diagram**
  - **data analysis - graphs and statistics**

X-Y Matrix


1. List key output indicators
2. List key output indicators
3. Potential input or process indicators
4. Rate the effect or correlation of each input to output.
5. Sort the results high to low
Process:
Date:
Ranking Scale:
1 - none 3 - marginal 9 - highest
4
3
7
Output variables (Ys)
Key output indicator
Key output indicator
Key output indicator
Input variables (Xs)
Rank
Total
1 Process indicator
1
3
4
2 Process indicator
9
1
27
3 Process indicator
3
2
9
4
5
6
7
8
9
10

IMPROVE

In this phase you:

- Devise a plan to address the identified root causes
- Proposing and choosing a solution to improve the system
- Identify new methods to do things better, cheaper, faster
- After figuring out the solutions, put them in action, track and measure the progress

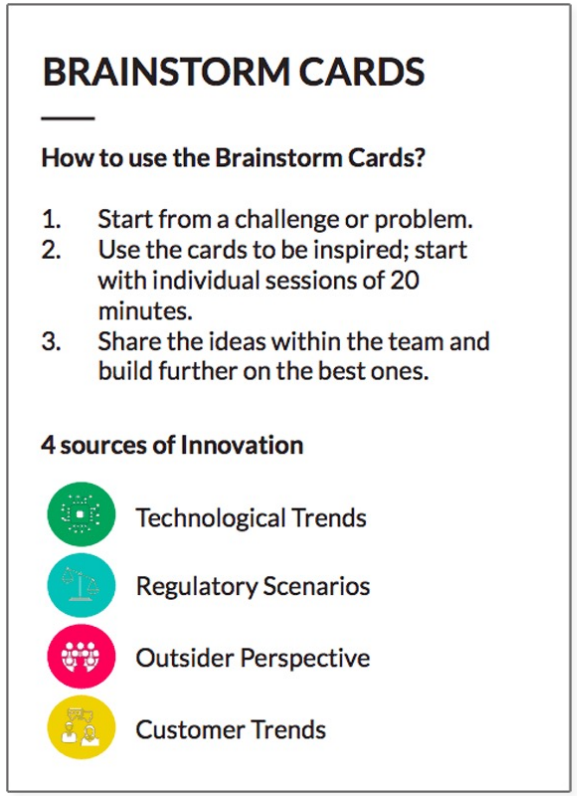
Tools

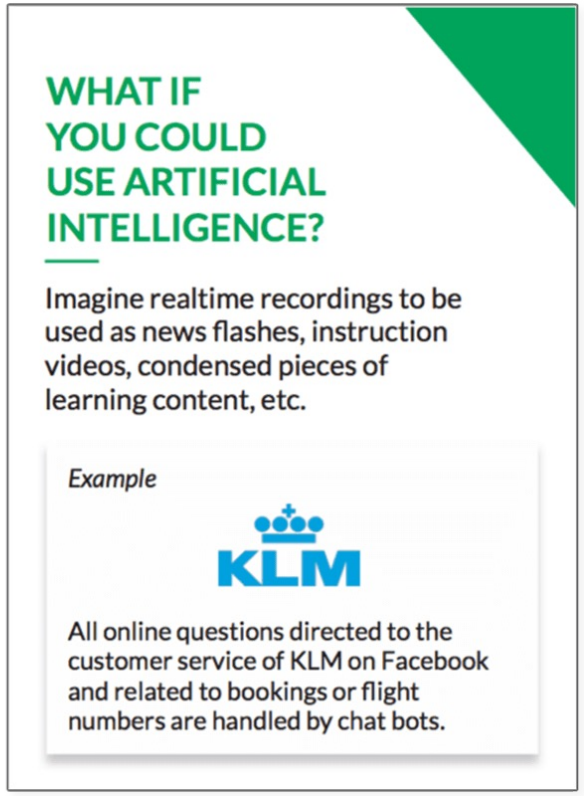
- **Brainstorming, idea generation & idea challenges**
- Design for Experiments (DOE)
- **How Might We Statements (HMW)**
- **5S**
- **Failure Mode Effect Analysis (FMEA)**

Brainstorming techniques

Brainstorm cards are a useful tool created by the Board of Innovation for coming up with dozens of new ideas related to whatever challenge or problem you are currently working with.

Brainstorm cards help you consider external factors such as: societal trends, new technologies, and regulation in the context of your business.





board of innovation

Read more: Idea Generation – Brainstorm Cards

Analogy thinking

Analogy thinking is a technique for using information from one source to solve a problem in another context. Often one solution to a problem or opportunity can be used to solve another problem.

Analogy thinking can, for example, be used for analyzing a successful business, identifying what makes it great, and then applying those same principles for your business. This is an effortless method for coming up with new ideas that are pre-validated.

You can use The Analogy Thinking Canvas to map your ideas.

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Read more: Idea Generation – Analogy Thinking

Opposite thinking

Opposite/reverse thinking is a technique that can help you question long-held assumptions related to your business.

It's a useful tool to consider if you feel your team is stuck with the conventional mindset and coming up with those **"out-of-the-box ideas"** seems to be difficult.

Often, the best solutions aren't found through a linear thought process. Although our brains are wired that way, aopposite thinking can help us question the norm.

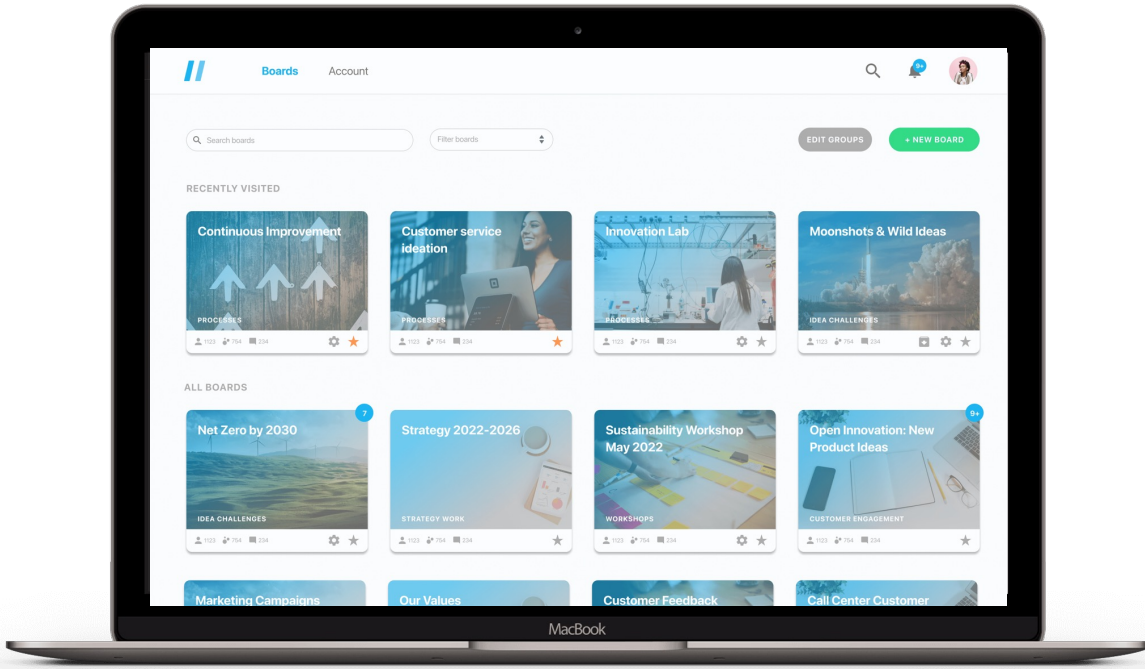
With this type of thinking, you consider the exact opposite of what's normal.

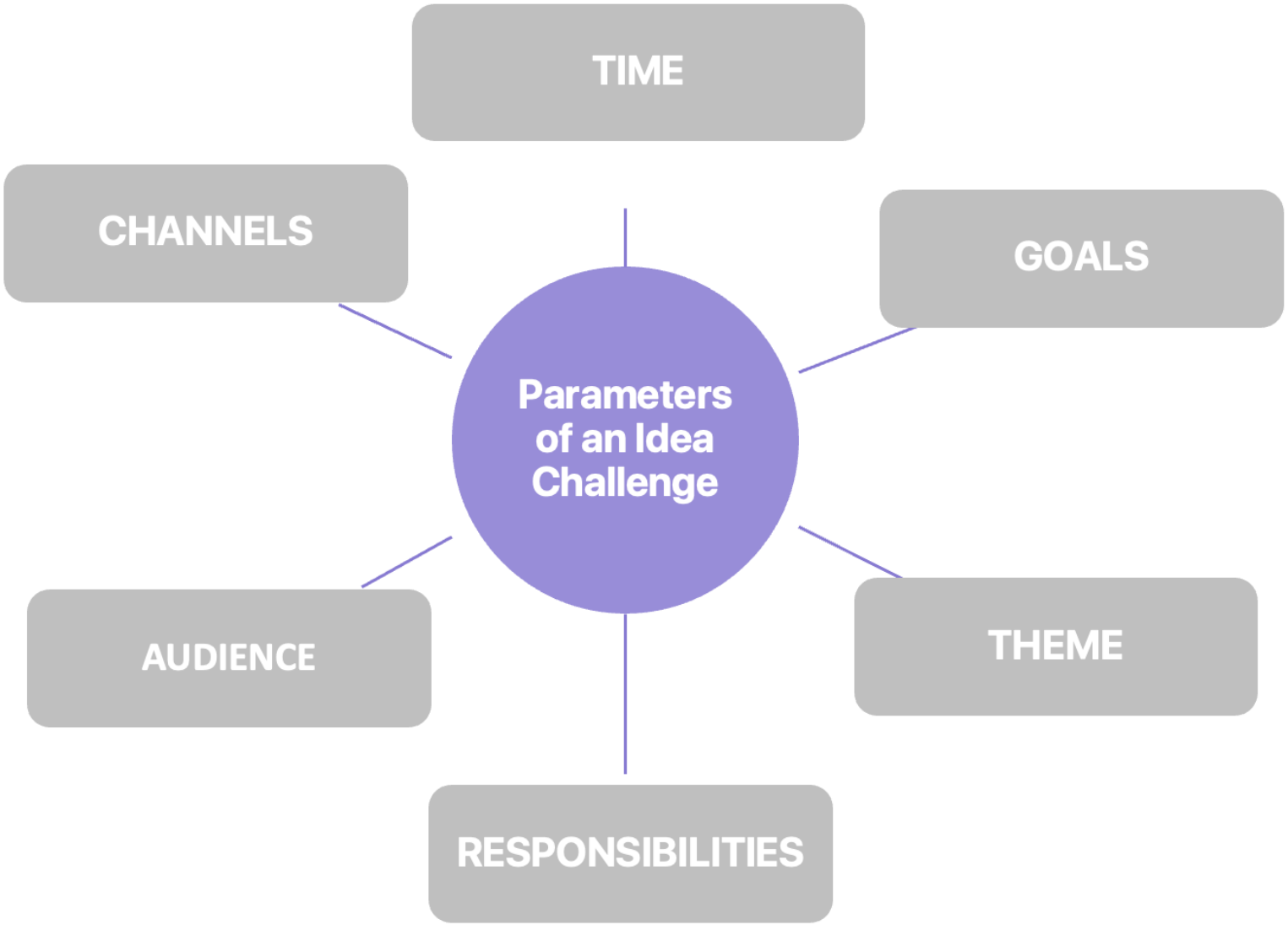
board of innovation

Read more: Idea Generation – Opposite Thinking

Idea Challenges

- An idea challenge is a focused form of innovation where you raise a desire, concern, or area of improvement with the hopes of finding creative solutions.
- It usually starts off in the form of a question and is guided towards a specific audience, mandated by other preset parameters.
- Idea challenges are a very versatile and useful in a variety of situations. By setting different specifications and parameters, you can customize idea challenges to fit a variety of different use cases.




TIME
CHANNELS
GOALS
Parameters of an Idea Challenge
AUDIENCE
THEME
RESPONSIBILITIES

Design of Experiments (DOE)

DOE is a powerful **data collection and analysis tool** that can be used in a variety of experimental situations.

DOE allows for multiple input factors to be manipulated, determining their effect on a desired output (response). By manipulating multiple inputs at the same time, DOE can identify important interactions that may be missed when experimenting with one factor at a time.

When we think that more than one input factor might affect the output, DOE comes in handy. For instance, if we want to know how both temperature and pressure impact the strength of a glue bond.

DOE can also be used to confirm **suspected input/output relationships** and to **develop a predictive equation** suitable for performing what-if analysis.

Example

Test Plan for Bread Quality Improvement

Factors and Levels:
Factor 1: Baking Temperature (Low, Medium, High)
Factor 2: Kneading Time (Short, Medium, Long)

Experimental Design:
Full Factorial Design (Test all combinations of factors and levels)

Experiment Setup:
1. Prepare batches of bread dough.
2. Apply the designated baking temperature and kneading time for each combination.

Data Collection:
After baking, gather taste testers to rate the texture and taste of each bread batch on a scale of 1 to 5 (1 being poor and 5 being excellent).

Trial	Baking Temperature	Kneading Time	Texture Rating	Taste Rating
1	Low	Short	3	4
2	Low	Medium	2	3
3	Low	Long	4	4
4	Medium	Short	4	5
5	Medium	Medium	5	4
6	Medium	Long	3	3
7	High	Short	5	5
8	High	Medium	5	4
9	High	Long	4	3

Data Analysis:
Analyze the data to understand how baking temperature and kneading time affect texture and taste ratings. Look for patterns and significant effects.

Optimization:
Based on the analysis, determine the optimal combination of baking temperature and kneading time that leads to the highest texture and taste ratings.

How Might We Statements

- HMW questions is a technique used to **define solvable problems** in desig**n thinking or innovation cycles**.
- It turns declarative statements and uncertainties into questions that do not imply judgment or constrains, and do not hint at a solution. Instead, HMW questions provoke creative thinking and invite as many suggestions as possible.
- HMW helps you define problems based on initial research or direct customer feedback. So, before you kick off a workshop or brainstorming sessions, make sure to have a solid knowledge base **on challenges, issues or problems your organizations is facing.**

Steps to consider

1. **Target audience research** (TA). People are at the core of the HMW technique. Research your customers (users). This step will help you identify your customer's (user's) needs and pain points. Keep in mind that the HMW technique is meant to help create the **best version** of your product or service, and here the best means **created for the target user**.

2. **Point of View** (POV) **statement**. POV is a method to reshape challenges into actionable steps. It is a combination of your **target audience**, their **needs**, and **insights** (reasons behind their needs) uncovered during the research phase. Interaction Design Foundation offers the following formula for a POV statement:

3. **Frame the challenge**. With insights into your target audience and their challenges, narrow down the problem that your team will focus on. Anything that your TA addressed as challenging is worth improving and looking at as a target for an HMW session.

Team/Name

HMW Questions: Turn POV Challenges into Opportunities

1. Target Audience

Pet owner.

Tourist.

Innovation manager.

Person interested in sustainable produce.

Marketing professional.

Librarian.

...

2. Their Needs

Needs an access to the history of their pet's veterinary care information.

Needs access to public transportation tickets.

Needs a place that would help them with handling employee yearly feedback.

...

3. Insights

Pet owner loves their pet and want to be on time for their recommended check-up, but they cannot find the paper reference written by the vet during the last visit.

City visitors feel compelled to take taxis, which are very expensive, because they don't know how to buy public transportation ticker nor if the short-term tickets even exist.

...

HMW Questions: Template

Team/Name

Recommended formula:

How Might We [*action*] [*do what*] so that [*TA*] [*insight*].

How Might We create [*action*] an easy method to collect and store information related to our treated animals [*do what*], **so that** pet owners [*TA*] could check the information without calling us and saving their/our time?

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

HMW Questions: Template

Team/Name

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How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

How Might We...

so that...

CONTROL

In this phase you:

- Ensure that the changes will last and problems will not occur again
- Any deviation should be recorded and brought to the attention of the team
- Control strategy to monitor the ongoing performance

Tools

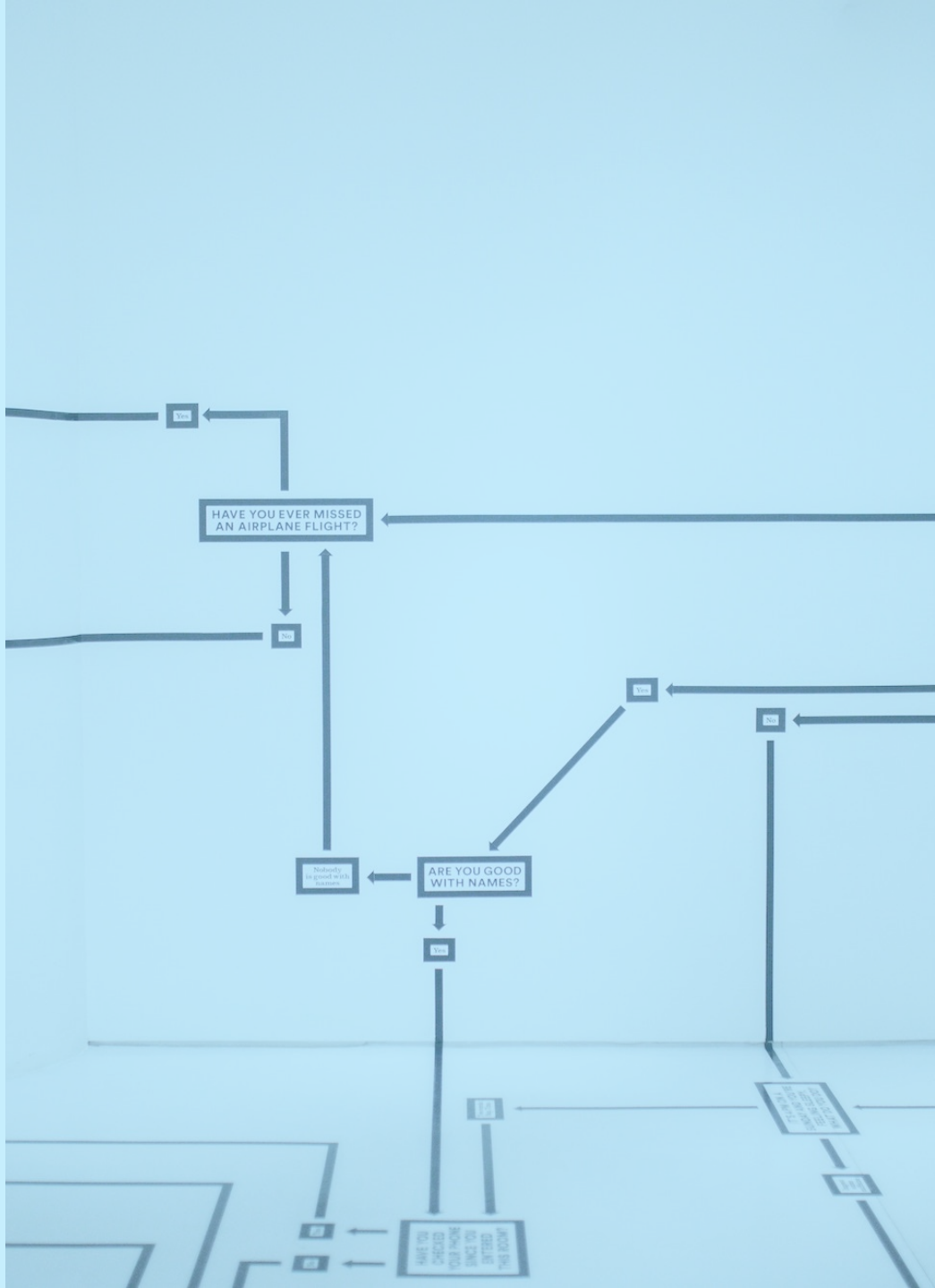
- Control Plan
- Statistical Process Control (SPC) charts
- Standard Operating Procedures (SOP)

Control Plan

During the Control Phase, the Control Plan ensures that the improvements made in the earlier phases are integrated into the day-to-day operations. It provides a systematic approach to monitor, manage, and respond to any potential issues that may arise.

The Control Plan should include the following elements:

1. **Key Process Steps**
2. **Measurement and Monitoring**
3. **Frequency of Monitoring**
4. **Responsibilities**
5. **Control Limits and Targets**
6. **Actions and Responses**
7. **Documentation**



CONTROL PLAN

Date:

Reference Number:	Rev, Date:	Approval:
Part Name / Description:		Approval:

REF #	PROCESS NAME/ OPERATION DESCRIPTION	SAFETY OR CTQ?	SPECIFICATIONS AND CONTROLS				REACTION PLAN
			SPECIFICATION / TOLERANCE	EVALUATION / MEASUREMENT	SAMPLING REQUIREMENT	CONTROL METHOD	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Statistical Process Control (SPC) Charts

A documented set of step-by-step instructions, guidelines, or protocols that outline how a specific task, process, or activity should be performed within an organization.

Any process has Causes of Variation known as:

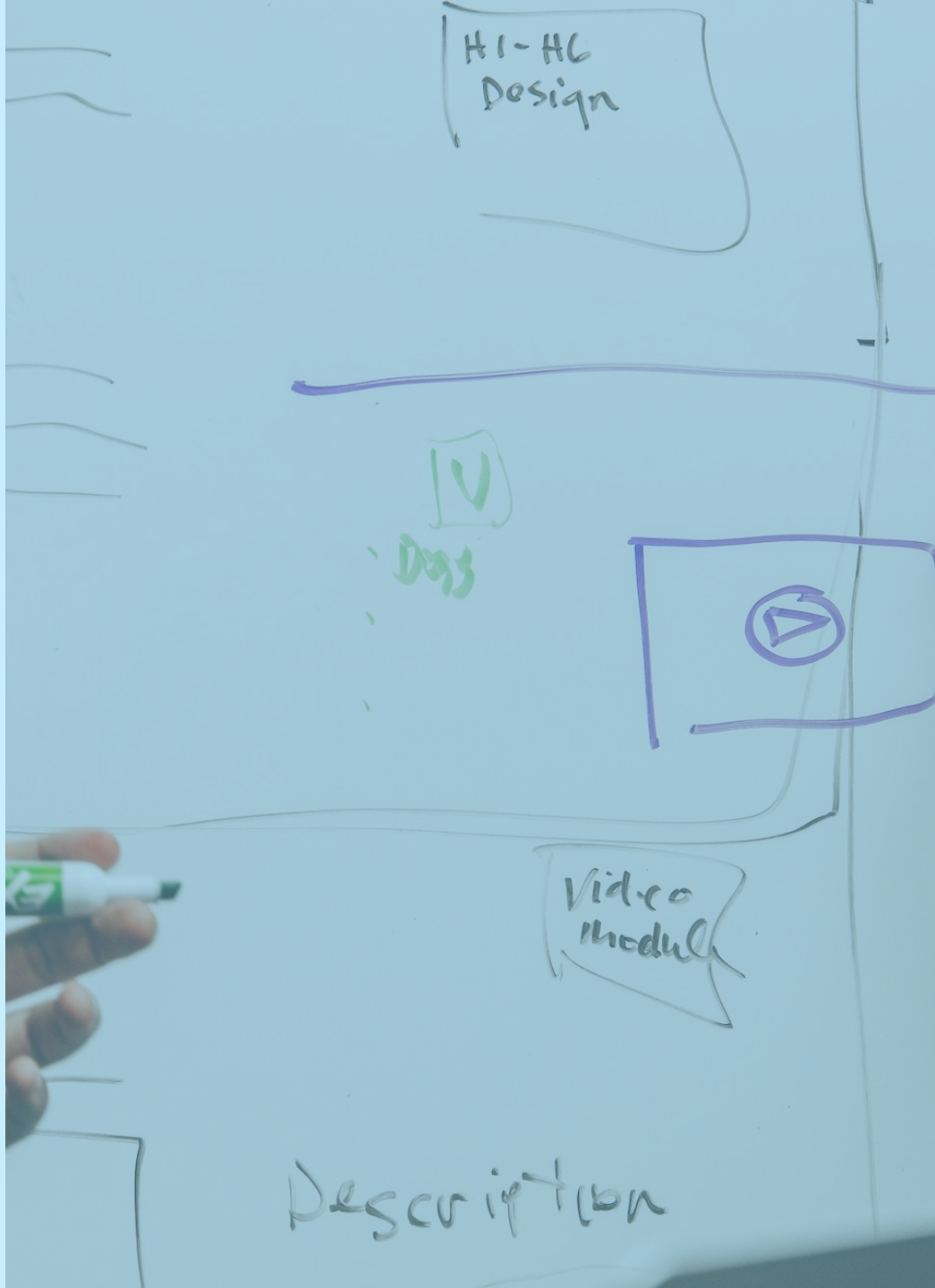
Common Causes: natural variability

Special Causes: unnatural variability

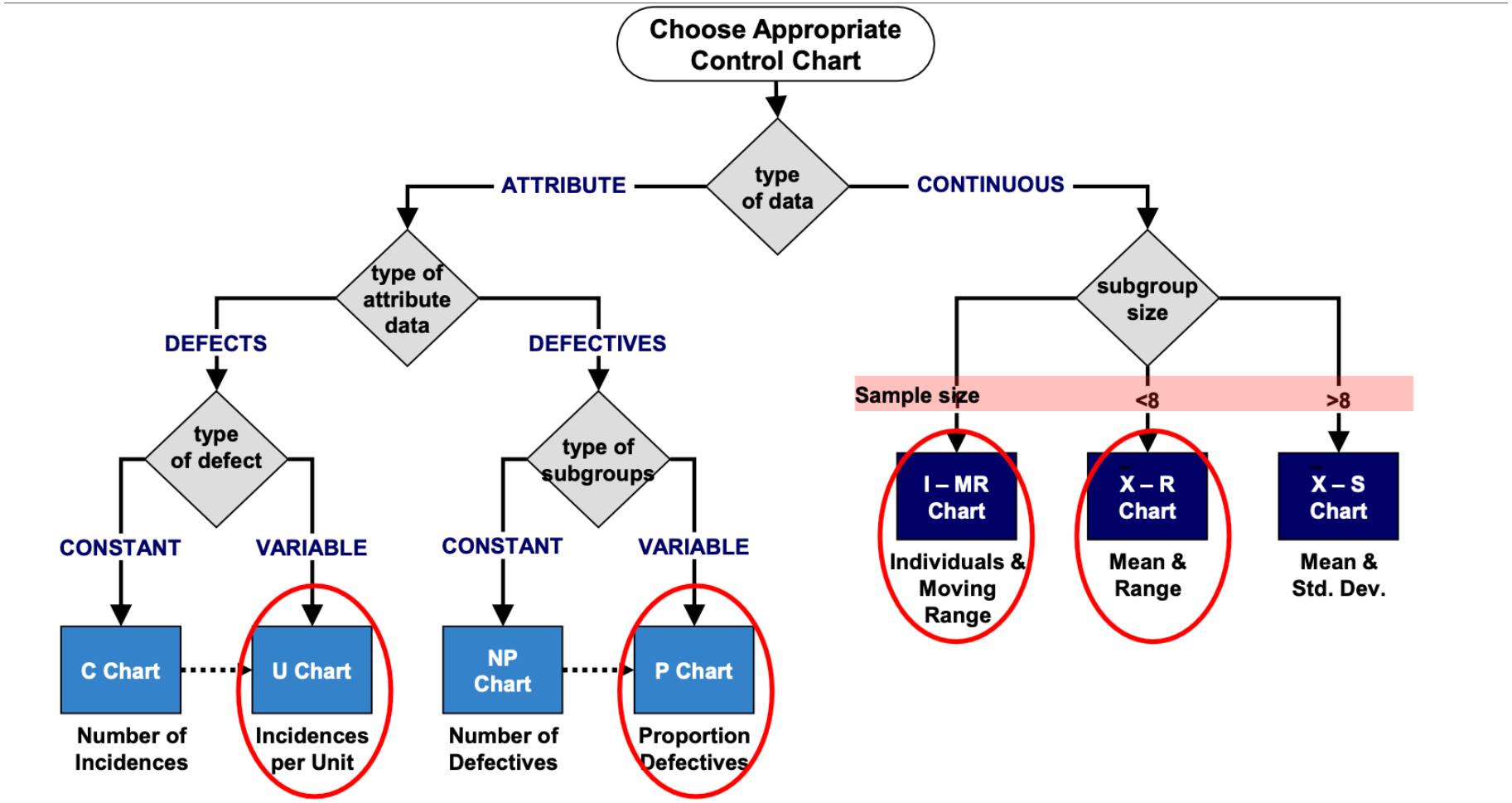
- **Assignable**: The reason for the detected variability
- **Pattern Change**: The presence of trends or

unusual patterns

- SPC is a basic tool for monitoring and improving process variation.
- SPC is used to detect the variation given by Special Causes and tells us if the process is "out of control", but it does NOT tell us why.
- SPC is a visual management tool.



Choosing the SPC charts



Standard Operating Procedure (SOP)

How it Works:

1. Documentation: step-by-step instructions for carrying out a process. It includes details on roles, responsibilities, required resources, and specific actions to be taken.

2.Training: training new employees or team members. They help ensure that everyone is trained consistently and follows the same procedures.

3.Consistency: maintain consistency and reduce variations in process execution. This consistency contributes to improved quality and reduced errors.

4.Reference: SOPs serve as a reference for employees to consult when performing a task. They can refer to the document for guidance, reducing the need for constant supervision.

Best Format for an SOP

An effective SOP should be clear, concise, and easy to understand. It should include the following elements:

1. **Title:** Clearly state the name of the process or task the SOP is addressing.
2. **Objective:** Explain the purpose of the process and what the desired outcome is.
3. **Scope:** Define the boundaries of the process and what is covered by the SOP.
4. **Step-by-Step Instructions:** Provide a detailed breakdown of each step in the process, including what needs to be done, who is responsible, and any required resources.
5. **Visual Aids:** Incorporate diagrams, flowcharts, or images to enhance understanding, especially for complex processes.
6. **Roles and Responsibilities:** Clearly define the roles of each team member involved in the process.
7. **Safety Considerations:** Include any safety precautions that need to be followed during the process.
8. **References:** Cite any relevant documents, guidelines, or regulations that should be consulted.
9. **Approval and Revision History:** Indicate who has approved the SOP and provide a record of any updates or revisions.
10. **Contact Information:** Include contact information for questions or clarifications.

Choosing the SOP format

Simple

Use Case:
- Staightforward
- Small scope

Components:
- Statement of purpose or introduction
- Summary or overview
- Details or step by step instructions
- 3-5 sections
- Responsible

Hierarchical

Use Case:
- Complex
- Large scope

Components:
- Statement of purpose
- Table of contents
- Summary or overview
- Details or step by step instructions
- Multiple sections
- Responsible

Flowchart

Use Case:
- Simple or complex
- Flexible scope

Components:
- Statement of purpose or introduction
- Easy to follow flowchart or diagram
- Responsible

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We’re on a mission to help organizations make more innovation happen.

Viima is the all-in-one innovation platform that helps you go from ideas to innovations, every step of the way.

Getting started is fast and easy and the best part is that Viima is completely free for an unlimited number of users!

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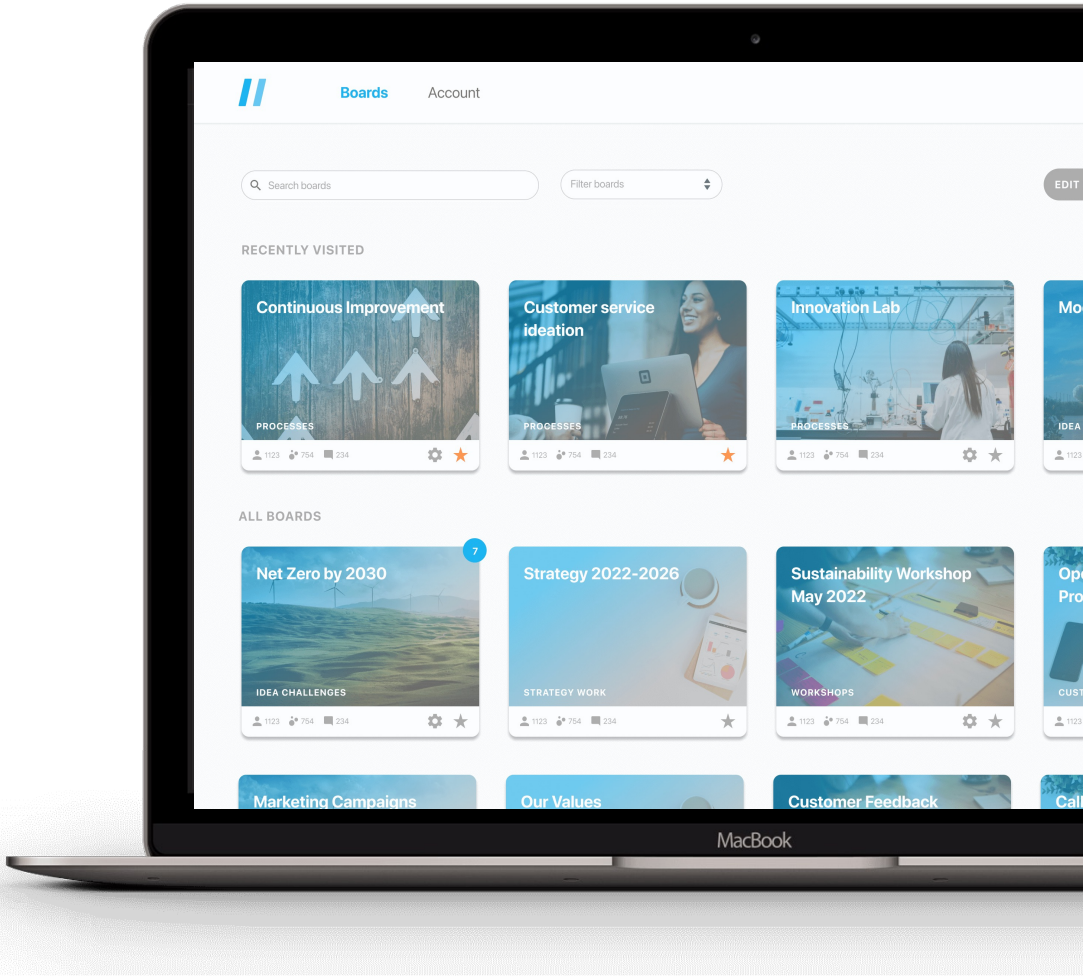

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