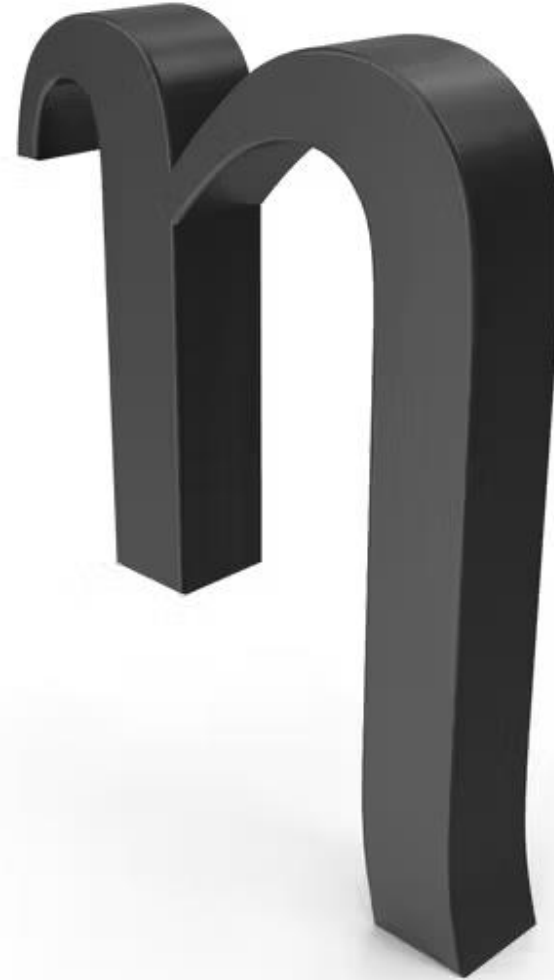η(ETA)
MODULE

D
Define
- Launch Team
- Establish Charter
- Plan Project
- Gather VOC / VOB
- Plan for Change

M
Measure
- Document the Process
- Collect Baseline Data
- Narrow Project Focus

A
Analyze
- Analyze Data
- Identify Root Causes
- Identify and Remove Waste

I
Improve
- Generate Solutions
- Evaluate Solutions
- Optimize Solutions
- Pilot
- Plan and Implement

C
Control
- Control the Process
- Validate Project Benefits

Poka-Yoke

Mistake Proofing / Poka Yoke

➤ Mistake Proofing or Poka-Yoke is a method for avoiding errors in a process

➤ It is a technique or a mechanism for

   o either eliminating errors by making it impossible to make mistakes in the process - **Prevention**

   o or by making the errors obvious at a glance - **Detection**

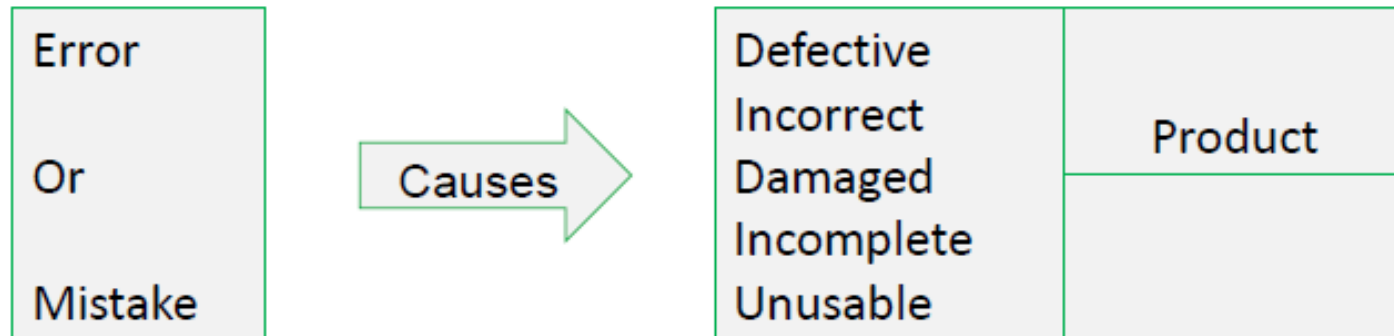➤ It is often considered the best approach to process control

> **It is good to do it right the first time.**
> **It is even better to make it impossible to do it wrong the first time.**

Defects vs. Errors

They are not the same thing!

Defects are the results of the error / mistake!

| Error

Or

Mistake | Causes → | Defective
Incorrect
Damaged
Incomplete
Unusable | Product |

The ability to prevent mistakes is essential because the cause of defects lies in errors committed due to imperfect processes

Defects result from either being unaware of the errors or neglecting to do anything to correct them

Mistake Proofing Techniques

PROBLEM SOLVING APPROACH

Technique	Purpose
Shutdown	Stop the process / machine either just before the error or as soon as the error occurs
Control	Error is impossible, auto-correction
Warning	Alert that something is about to or has gone wrong in the process

"Warning is not considered as a strong Poke-Yoke technique. Why?"
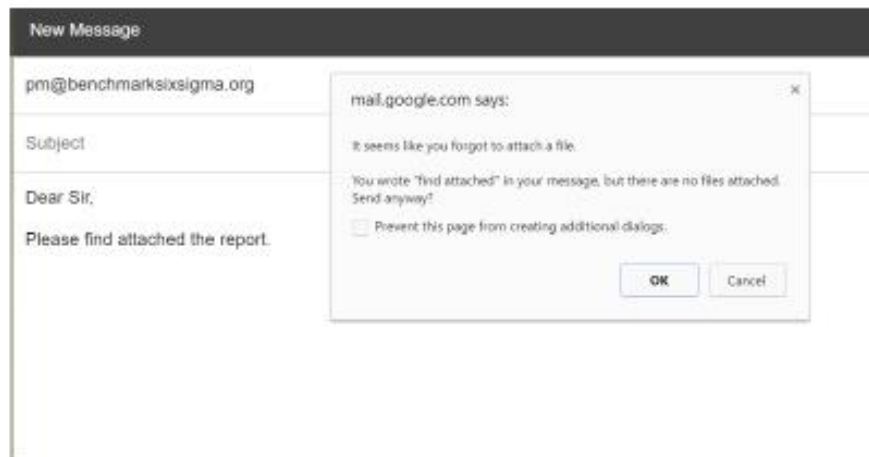
Examples: Shutdown

MCCB

RCCB

INTERLOCKING

Examples: Control

Examples: Warning

CTQ Identification

Benefits of Mistake Proofing

➢ No formal training programs required

➢ Inspection operations eliminated

➢ Opportunity to carry out value adding tasks

➢ Defect-free work

➢ Elimination of rework

Identify the Customer

➢ **"Customer is King"** and hence it is necessary to clearly understand their needs

➢ Knowing your customer is about understanding what is important to them or what is known as Critical Customer Requirements (CCR)
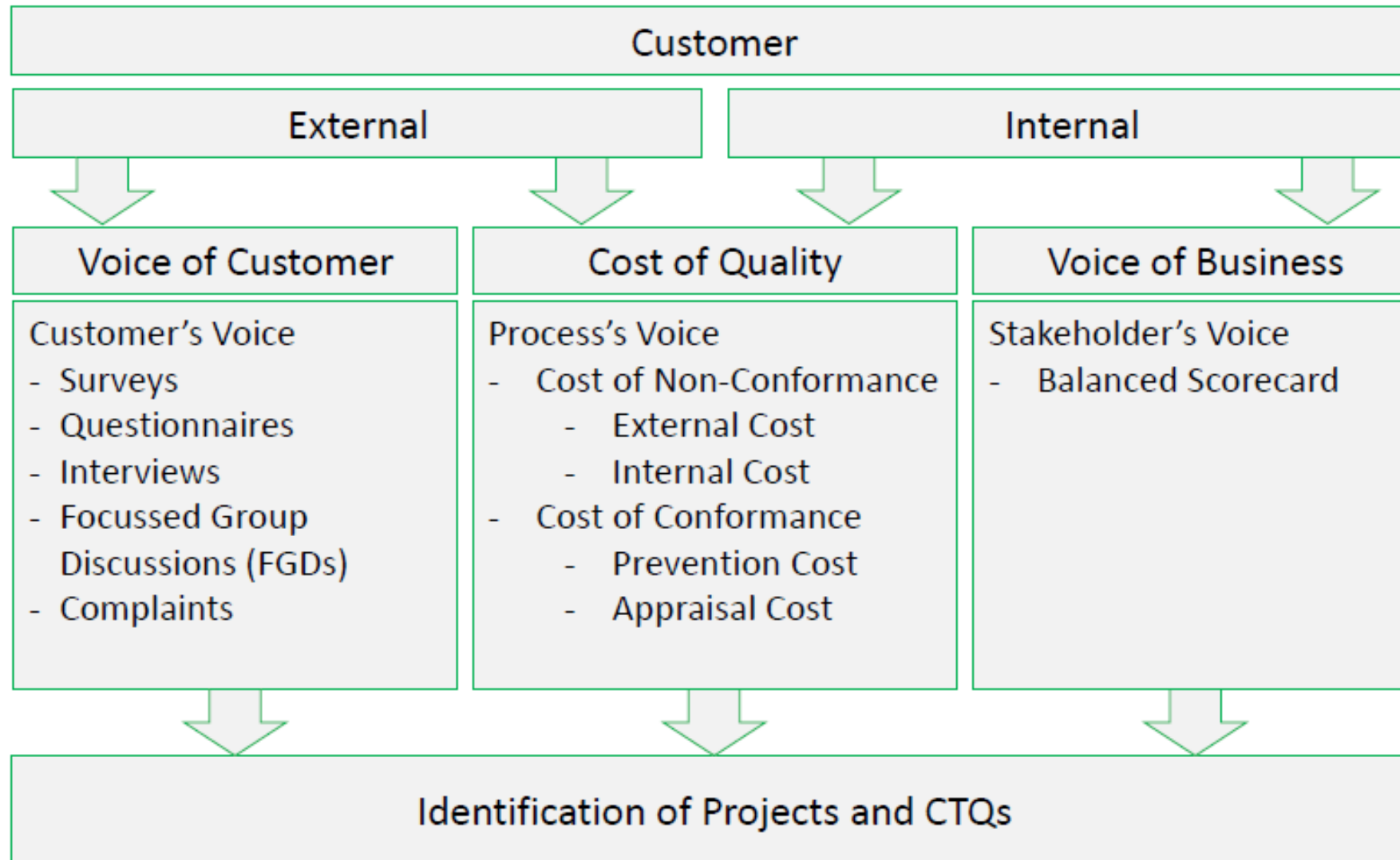
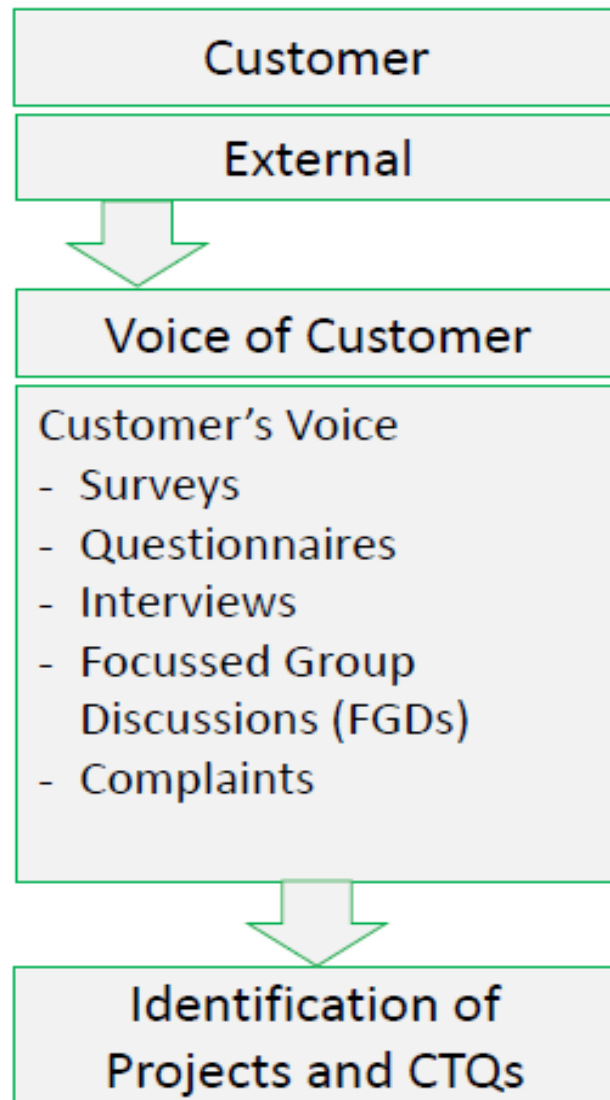| Customer Types	
External	Internal
Direct: those who use the product or the service **Indirect**: those with a vested interest (regulators, compliance bodies etc.)	Those within the organization who receive the output of the process

Project Identification

Customer		
External		**Internal**
Voice of Customer	**Cost of Quality**	**Voice of Business**

Customer's Voice
 	
- Surveys
- Questionnaires
- Interviews
- Focussed Group Discussions (FGDs)
- Complaints
	Process's Voice
	
	- Cost of Non-Conformance
	   - External Cost
	   - Internal Cost
	- Cost of Conformance
	   - Prevention Cost
	   - Appraisal Cost
		Stakeholder's Voice
		
		- Balanced Scorecard

Identification of Projects and CTQs		

VOC

Customer
External

⬇

Voice of Customer

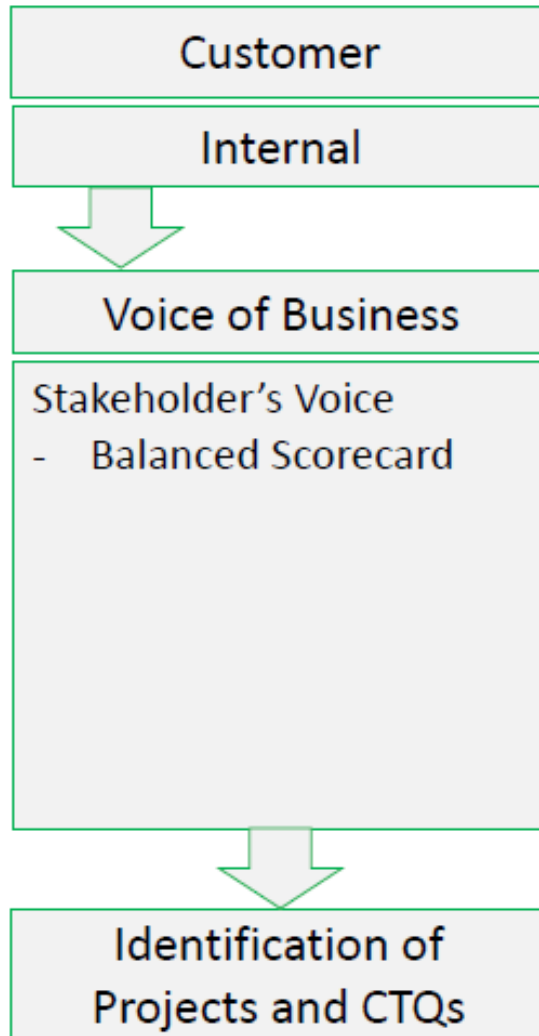| Customer's Voice
- Surveys
- Questionnaires
- Interviews
- Focussed Group Discussions (FGDs)
- Complaints |
|---|

⬇

Identification of Projects and CTQs

Voice of the Customer (VOC) can help you understand the customers requirements. These requirements could be broadly categorized as

1. Features: Does the process provide what the customer expects? This closely relates to quality of the product and/or service

2. Delivery: Does the process meet the customer's time frame? This closely relates to timeliness of the product and/or service

3. Expense: Does the customer perceive value for the price? This closely relates to cost of the product and/or service

VOC is the as-is expression of customer needs and desires

✓ May be specific – "I need delivery on Tuesday"

✓ May be ambiguous – "Deliver faster"

VOB

Customer

Internal

↓

Voice of Business

Stakeholder's Voice
- Balanced Scorecard

↓

Identification of Projects and CTQs

Voice of the Business (VOB) is often best obtained from the Process Owner and represents the health of the organization
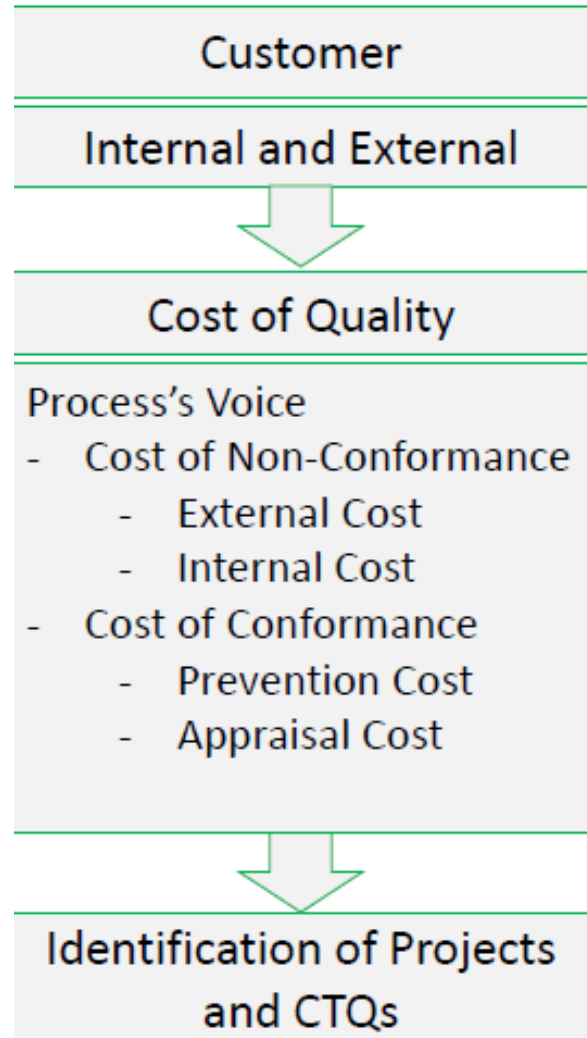
VOB is usually captured using a Balanced Scorecard – organization's scorecard. It comprises of around 20 measures under 4 components

1. Financial Metrics
2. Customer Metrics
3. Internal Business Process Metrics
4. Learning and Growth Metrics

These measures provide information about

➢ Past Performance (Lagging Indicators)

➢ Future Performance (Leading Indicators)

Cost of Quality (COQ)

Customer
Internal and External

↓

Cost of Quality

Process's Voice
- Cost of Non-Conformance
- External Cost
- Internal Cost
- Cost of Conformance
- Prevention Cost
- Appraisal Cost

↓

Identification of Projects and CTQs

Cost of Quality (COQ) is the cost that an organization has to bear to ensure good quality or to pay for poor quality products or services.

COQ is made up of four elements

1. Cost of Non-conformance

   a) External costs – warranties, litigations, refunds, recalls

   b) Internal costs – rework, scrap

2. Cost of Conformance

   a) Prevention costs – error proofing, training

   b) Appraisal costs – audits, inspections etc.

COQ

- COQ can also be understood as Tangible (visible) and Intangible (invisible) Costs
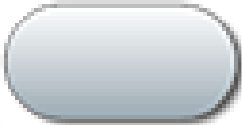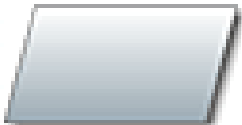- Both Visible and Hidden costs provide a project opportunity

Inspection

Warranty

Recode

Rework

Rejects

Litigations

Visible Costs

(less obvious)

Engineering change order

Lost sales

Time value of money

Late delivery

Expediting costs

More Set-ups

Excess inventory

Working Capital allocations

Long cycle times

Excessive Material Orders/Planning

Hidden Costs

Lost Customer Loyalty

CTQ – Critical To Quality
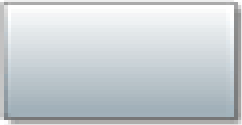
➢ A CTQ is a product or service characteristic that satisfies a

  o Customer Requirement (VOC or VOB)

  o Process Requirement (COQ)

➢ There are measures which relate to the three important parameters of product or service output

  o Critical to Quality (CTQ)

  o Critical to Cost (CTC)

  o Critical to Delivery (CTD)

➢ All the three above are referred in some companies as CTQ because cost and delivery are considered part of quality. Some companies consider the three separately

➢ A project could be picked up on any one of the three measures

➢ E.g. – productivity, error %, average handling time, warranty cost, lead time, daily sales outstanding, defective %

Decide Scope & Team Members

High Level Process Map

➢ Process Map is a graphical representation of the flow of material and/or information in a process. It shows the following

- o The start point
- o The end point
- o The decision points
- o Sequence of steps
- o Current involvement of functions/ departments

➢ Process Maps are living documents and must be changed as the process is changed

- o They represent what is currently happening, not what you think is happening
- o They should be created by the people who are closest to the process

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.

High Level Process Map

Standard symbols for process mapping

A **RECTANGLE** indicates an activity. Statements within the rectangle should begin with a verb
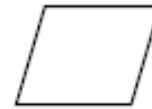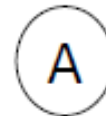
Input and Outtput of process

A **DIAMOND** signifies a decision point. Only two paths emerge from a decision point: No and Yes

An **ELLIPSE** shows the start and end of the process

An **ARROW** shows the connection and direction of flow

A **CIRCLE WITH A LETTER OR NUMBER INSIDE** symbolizes the continuation of a flowchart to another page
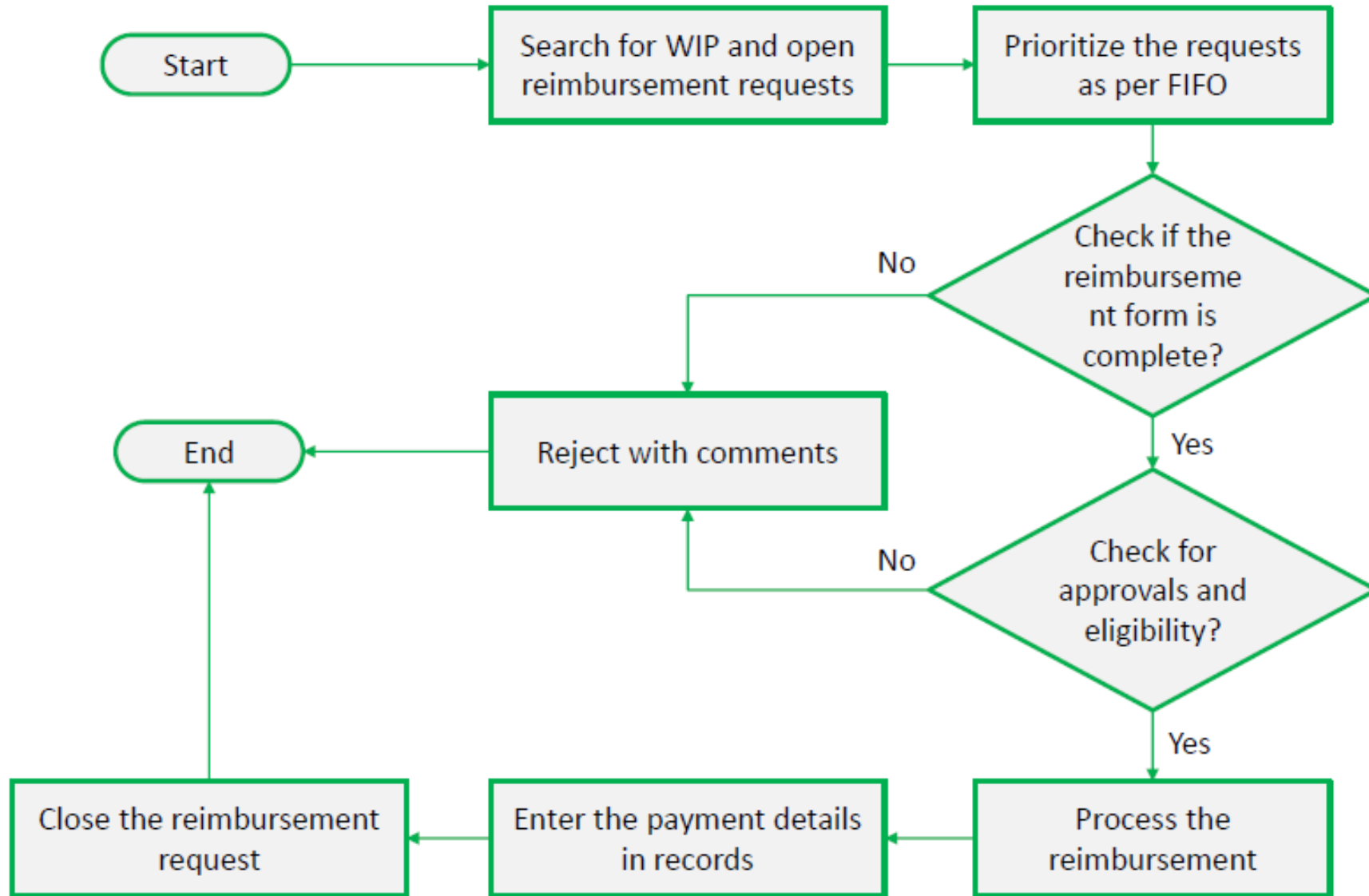
Steps in Reimbursement Process   SCOPE OF THE PROJECT

Create the High-level Process Map for the employee reimbursement process

1. Search for WIP and open reimbursement requests in the queue
2. Prioritize the requests as per FIFO
3. Check if the reimbursement form is complete (employee, bank, reimbursement details along with receipts)
4. If incomplete, request is rejected with comments
5. If complete, check for necessary approvals and eligibility
6. If anything is missing, request is rejected with comments
7. If everything is in order, process the reimbursement payment
8. Enter the payment details in records
9. Close the reimbursement request

Answer: High-level Process Map SCOPE OF THE PROJECT

SCOPE OF THE PROJECT

S	I	P	O	C
SUPPLIERS	**INPUTS**	**PROCESS**	**OUTPUTS**	**CUSTOMERS**
Who supplies the materials / inputs?	What resources are needed or provided by the supplier? Can be materials or information.	What steps or activities are carried out to created value for the customer?	What products or services are created by (or result from) the process?	Who are the customers?

SCOPE OF THE PROJECT

SIPOC Template
Process Name:

S	I	P	O	C
Suppliers	**Inputs**	**Process**	**Outputs**	**Customers**
Who supplies the inputs to the process?	What are the input to the process?	Describe the process in 4-7 steps (or draw process below)	What are the process outputs?	Who are the customers for the outputs of the process?

SIPOC Diagrams

Suppliers

Inputs

Process

Outputs

Customer

Suppliers	Inputs	Process	Outputs	Customer
Grocery Stores	Dough	Prepare Dough	Whole Pizza	Dine in
Dairy Farms	Sauce	Add Sauce	Pizza Slices	Take out
Vegetable farms	Peperoni	Add toppings		Home Delivery
	Cheese	Add cheese		
	Peppers	Bake in oven		
		Remove and package		

SIPOC for a restaurant visit   **SCOPE OF THE PROJECT**

|	Supplier	Input	Process	Output	Customer
1			Arriving to the restaurant		
2	Waiter	Table request	Table assigned	Occupied table	Restaurant guest
3	Restaurant guest	Verbal order	Food order	Written order	Waiter/Chef
4	Chef/waiter	Food	Eat food	Dirty tableware	Waiter/dishwasher
5	Restaurant guest	Money	Pay bill	Cash/money transfer	Waiter
6		Restaurant guest	Leave the restaurant	Table free	

Team

Typical team members in a project team are

➢ Sponsor

➢ Champion

➢ Project Lead / Project Manager

➢ Process Owner

➢ Mentor

➢ Subject Matter Expert

➢ 4-5 people from the process

" Identify the team members for our project on improving the FTR for employee reimbursement process"
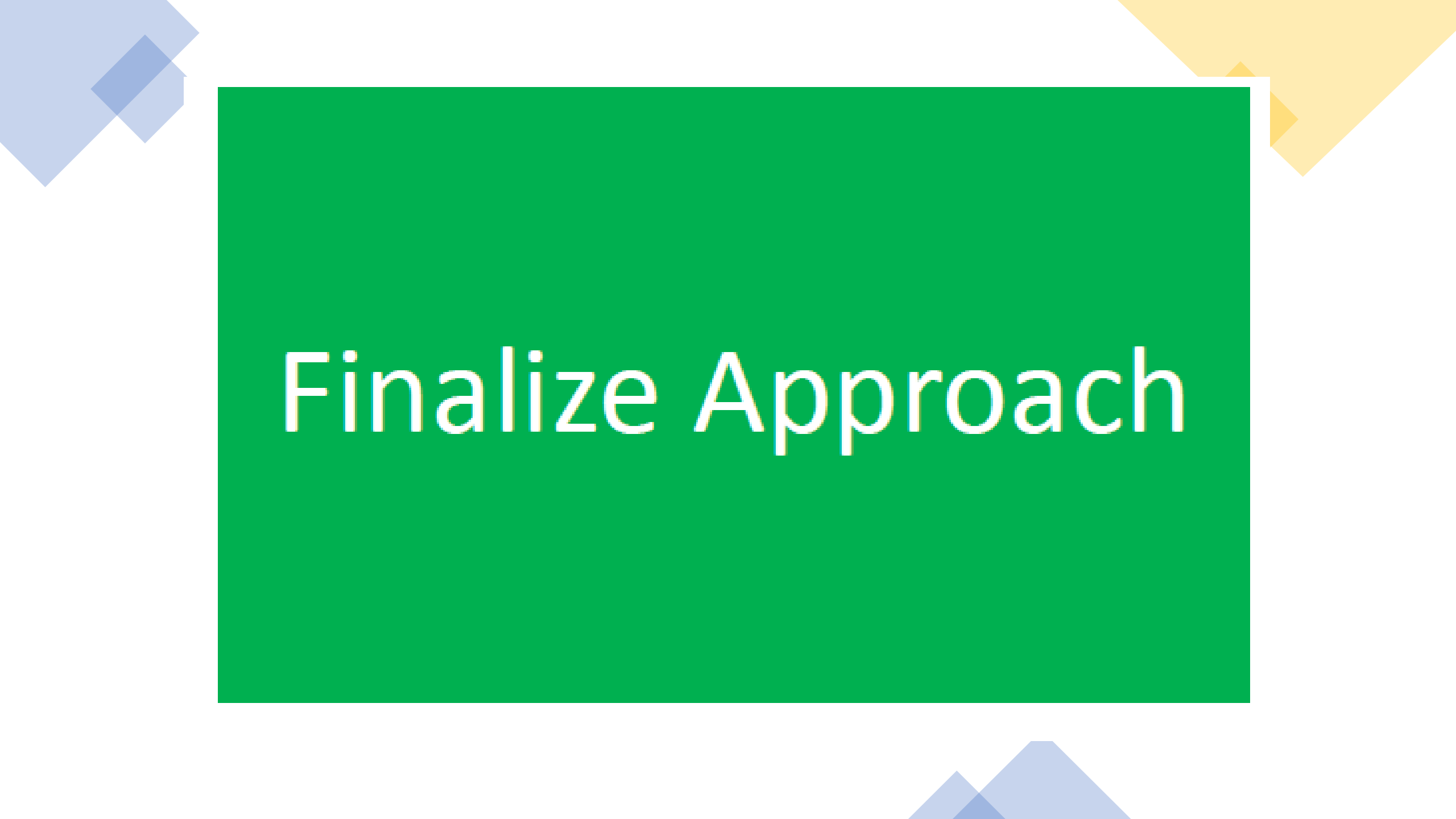
Stages of Team Formation
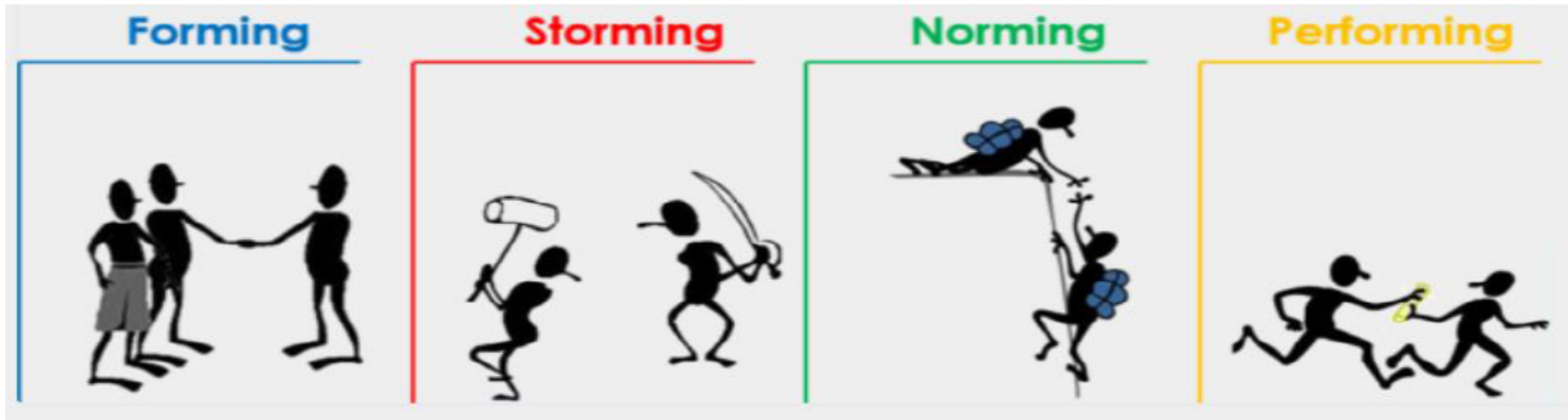
Forming	Storming	Norming	Performing
- Members are enthusiastic about the new opportunity - Interpersonal relationships are established	- Intragroup conflicts - Team members still do not see themselves as a part of a team	- Group harmony is restored - Members start helping each other	- Productive collaboration - Members start contributing to their full potential to achieve project goals

Finalize Approach

What problem to select for a Six Sigma Project?

	Cause	Solution
A	Known	Known
B	Known	Unknown
C	Unknown	Known
D	Unknown	Unknown

Select a Project guidelines

What not to select?

✓ A "bean-sized" project so that the improvements are too small to be appreciated

✓ A "world-hunger" project wherein implementing the solutions is beyond the control of the stakeholders

✓ A cross functional project impacting multiple functions / teams / departments

✓ A project on a complex process

✓ An unmanageable project that is difficult to complete in about 3-6 months

Finalize Project Charter

Finalize Project Charter

A project charter is a written document that works as an agreement between management and the team about what is expected from the project.

The Charter:

- ✓ Clarifies what is expected of the team
- ✓ Keeps the team focused
- ✓ Keeps the team aligned with organizational priorities
- ✓ Transfers the project from the champion(s) to the project team

Project Charter Development is an iterative process, a living document which will change over time

Key Elements of a Project Charter

Business Case	• Why should we do this project? • Why is this project required now?
Opportunity or Problem Statement	• What "pain" are we or our customers experiencing?
Goal Statement	• What are our SMART improvement objectives and targets?
Project Scope	• What are the boundaries of the initiative (start and end points of the process or parts of a system)?
Team Selection	• Who are the team members? • What is their role?
Project Timelines	• When are we going to complete the work? • What are the major milestones (tollgates)?

Problem Statement and Business Case

Problem Statement

➢ What is the "pain"?

➢ Where is the "Pain"?

➢ How much is the "pain"?

➢ Since when is the "pain"?

Business Case

➢ The Business Case communicates the strategic need for the project in terms of potential benefits

➢ Highlights the adverse impact of not doing the project

➢ Creates urgency for the project

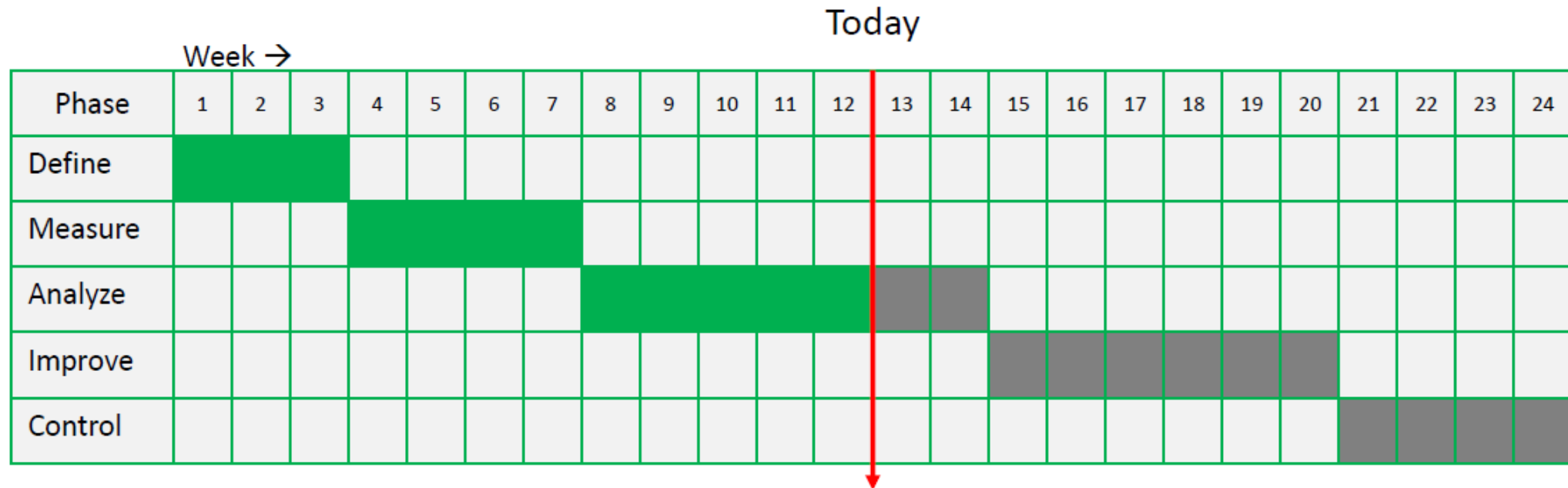"Write the Problem Statement and Business Case for exercise"

Goal Statement

➤ Starts with a "Verb"

➤ Is SMART

- ○ Specific - Does it address a real business problem?

- ○ Measurable - Are we able to measure the problem, establish a baseline, and set targets for improvement?

- ○ Achievable - Is the goal achievable?

- ○ Relevant - Does it relate to a business objective?

- ○ Time Bound - Have we set a date for completion?

➤ Template for Goal Statement

To (Improve/Reduce) the (CTQ) for (Name of the process) from ____ to _____ by (Time frame)

"Write the SMART Goal statement"

Timelines

Gantt chart is used to decide the timelines of the project. It depicts

➢ Activities in the project

➢ Start time of each activity

➢ Duration of each activity

➢ End time of each activity

➢ Progress as on date

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Define	██	██	██																					
Measure				██	██	██	██																	
Analyze								██	██	██	██	██	▓▓	▓▓										
Improve															▓▓	▓▓	▓▓	▓▓	▓▓	▓▓				
Control																					▓▓	▓▓	▓▓	▓▓

Week →

Today

Define Phase Summary

Key points to remember:

1. In Define Phase, Project ideas are generated and a project is selected

2. Primary CTQ and Secondary CTQs are identified from VOC, VOB and COQ

3. A project charter is created which consists of Background of the project, CTQ and Goals, Business case, Team members, Project Scope and Project Plan.

   a) Goals should be SMART

   b) Business Case should be clearly written as it creates urgency in top management and management realizes the need of the project

   c) Project Scope – In-scope and Out-scope elements can be listed, or we may use SIPOC to scope the project. It reduces the risk of scope creep

   d) Project Plan mentions the milestones and timelines of the project

   e) Project Charter is a living document and can/may be revised

4. SIPOC helps us identify the inputs and their supplier, output and their customers and the high-level process map. It may also be used for scoping a project

Outputs of Define Phase

➢ Approved Project Charter

➢ SIPOC diagram

➢ Overview Flow Chart

➢ Team Ready for Measure Phase

The main output of the Define phase is the
Approved Project Charter

Define Tollgate Checklist Part 1

✓ Has the project been chosen because it is in alignment with organizational goals and the strategic direction of the 'business'?

✓ What is the problem statement – detailing (what) is the problem, (when) was the problem first seen, (where) was is it seen, and what is the (magnitude or extent) of the problem. Is the problem measured in terms of Quality, Cycle Time, Cost Efficiency, net expected financial benefits?

✓ Does a goal statement exist that defines the results expected to be achieved by the process, with reasonable and measurable targets? Is the goal developed for the "what" in the problem statement, thus measured in terms of Quality, Cycle Time or Cost Efficiency?

✓ Does a financial business case exist, explaining the potential impact (i.e. measured in dollars) of the project on the organisation budgets, Net Operating Results, etc.?

Define Tollgate Checklist Part 2

✓ Is the project scope reasonable? Have constraints and key assumptions been identified?

✓ Who is on the team? Are they the right resources and has their required time commitment to the project been confirmed by your sponsor and team ?

✓ What is the high level project plan? What are the key milestones (i.e. dates of tollgate reviews for DMAIC projects)?

✓ Who are the customers for this process? What are their requirements? Are they measurable? How were the requirements determined?

✓ Who are the key stakeholders? How will they be involved in the project? How will progress be communicated to them? Do they agree to the project?

✓ What kinds of barriers/obstacles will need assistance to be removed? Has the risk mitigation plan to deal with the identified risks been developed?

Answers: Project Charter Elements

> ➤ **Business Case**

Astor Infotech Global Services, processes reimbursements for Afex Travel and Cards. They must process 90% of the reimbursements correctly (FTR). The performance for the last 3 months is not meeting the 90% target due to which they are paying a monthly penalty of $40000. This project would improve the FTR to 90% and save $40000 per month

> ➤ **Problem Statement**

The First Time Right % (FTR%) for employee reimbursements process is at 70% against a target of 90% for the last 3 months

> ➤ **Goal Statement**

To improve the FTR for employee reimbursement process from 70% to 90% by Sep'2020 while ensuring that average processing time is not deteriorated

Operational Definition of CTQ

What and Where to measure?

✓ Preparing the SIPOC diagram and a more detailed process map can help a team select its measures

✓ Choosing good measures require a clear understanding of the definitions of and relationships between Output, Process, and Input measures

X- Predictor
Leading Indicators

Y- Results
Lagging Indicators

Inputs (X) → **Process** → **Outputs**

- Arrival Time
- Accuracy
- Cost
- Key Specs

- Process Map – activities, decisions and arrows

- Customer Satisfaction
- Total Defects
- Cycle Time
- Cost Profit
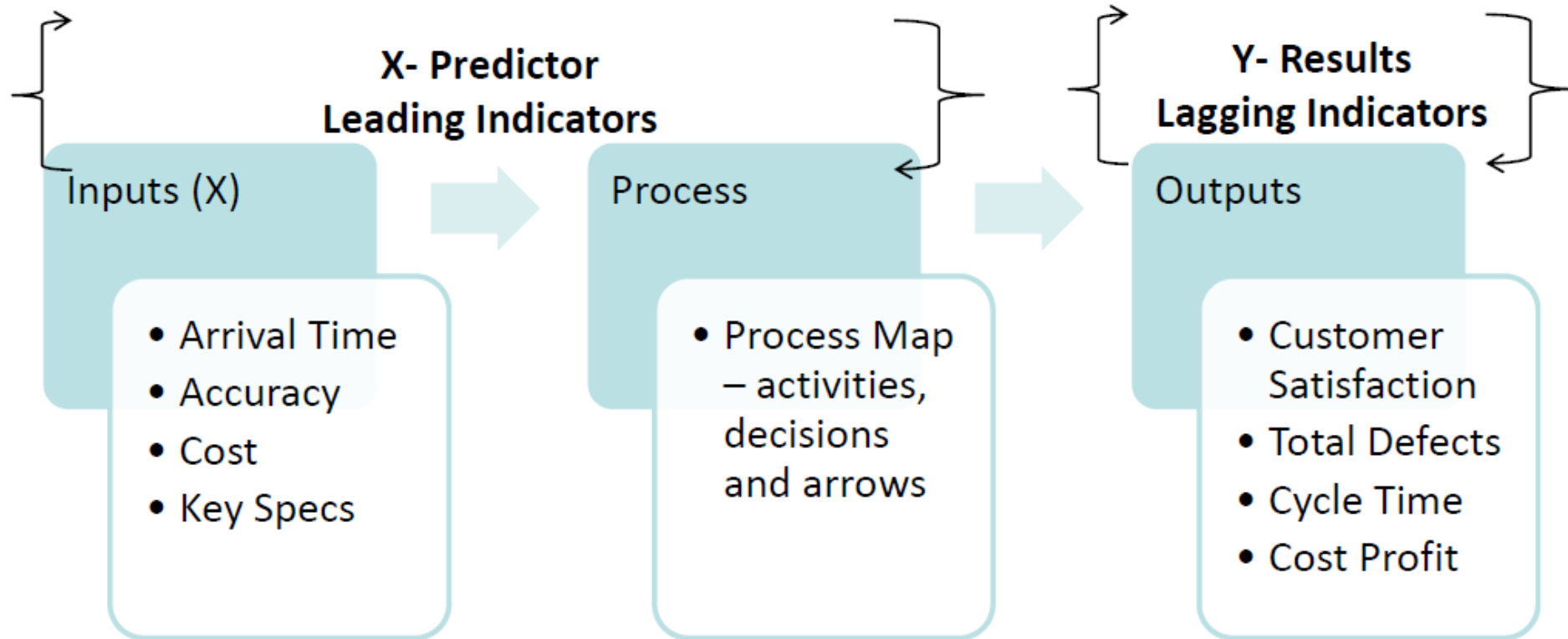
✓ Generally, you can influence some of the X's but not all. Lean Six Sigma projects will generally address those X's which can be influenced and which have the greatest leverage

Operational Definition

It is a clear, concise detailed definition of a measure. Operational definitions should be very precise and be written to avoid possible variation in interpretations

Why it is critical...

✓ Each individual "counts" things the same way and we can plan how to measure effectively

✓ To ensure common, consistent interpretation of results, so we can operate with a clear understanding and with fewer surprises

From General to Specific:

Step 1 – Translate what you want to know into something you can count

Step 2 – Create an "air-tight" description of the item or characteristic to be counted

Step 3 – Test your Operational Definition to make sure it is truly "air-tight"

Note: Sometimes you will need to do some "digging" up-front to arrive at better operational definitions. It is usually worth the effort!!

What is your understanding of the metric "Flight Duration"?

Template

CTQ	Data Type	Operational Definition	LSL	USL	Target

Measurement System

Types of MSA
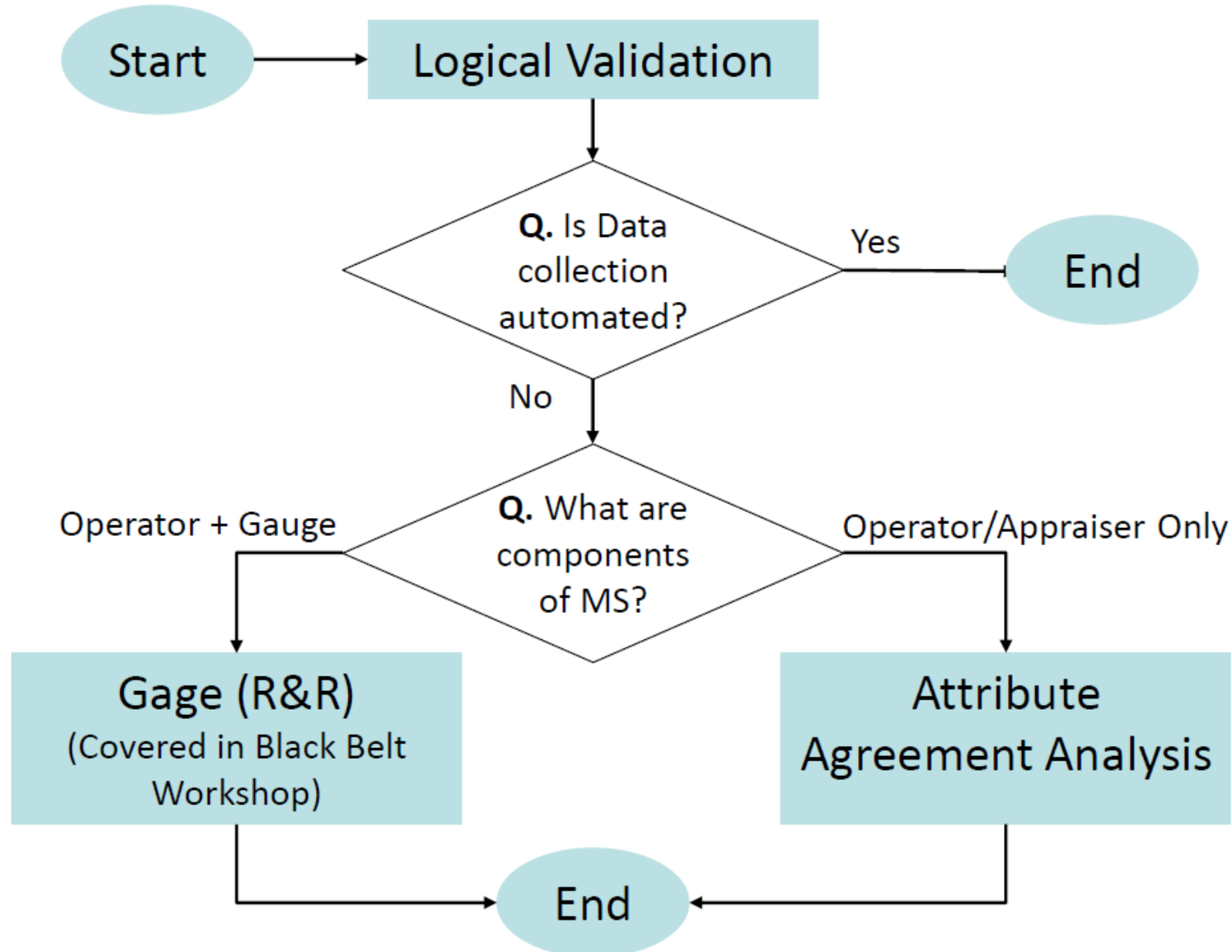
Logical Validation

➢ Used to validate the system or the logic for data collection

➢ The most common is "Time spent in office"

The purpose of a Logical Validation is:

➢ To determine if the system is capturing the data as it is supposed to

➢ To assess if the logic built into the system is working as designed

➢ "Targeted Input" to the system is the method used for logical validation

➢ Discover areas where:

  o System needs to be updated / modified

"Identify some areas where logical validation is used?"

Attribute Agreement Analysis

➢ Used to calibrate the data collection for attribute or discrete data

➢ The most common of these is a go/no-go gage which has only two possible results

➢ Other attribute systems, for example visual standards, may result in five to seven classifications, such as very good, good, fair, poor, very poor

The purpose of an Attribute MSA is:

➢ To determine if all appraisers use the same criteria to determine "pass" from "fail"

➢ To assess your inspection standards against your customer's requirements

➢ To determine how well appraisers are conforming to themselves

➢ To identify how appraisers are conforming to a "known master," which includes:

    ○ How often operators ship defective product

    ○ How often operators dispose of acceptable product

➢ Discover areas where:

    ○ Training is required

    ○ Procedures must be developed

    ○ Standards are not available

Attribute Agreement Analysis- Procedure

1. Set aside 15 to 30 test samples of the item you're measuring. Make sure these samples represent the full range of variation being encountered

2. Create a "master" standard that designates each of the test samples into its true attribute category

3. Select 2 or 3 typical appraisers and have them review the sample items just as they normally would in the measurement system, but in random order. Record their attribute assessment for each item

4. Place the test samples in a new random order, and have the appraisers repeat their attribute assessments. (Don't reveal the new order to the appraisers!). Record the repeated measurements

Attribute Agreement Analysis- Procedure

5. For each appraiser, go through the test sample items and calculate the percentage of items where their first and second measurements agree. This percentage is the repeatability of that appraiser

6. Going through each of the sample items of the study, calculate the percentage of times where all of the appraisers' attribute assessments agree for the first and second measurements for each sample. This percentage is the reproducibility of the measurement system

7. You can also calculate the percent of the time all the appraisers' attribute assessments agree with each other and with the "master" standard created in Step 2. This percentage, which is referred to as the Accuracy (effectiveness) of the measurement system

Measurement System Analysis

- ✓ Appraiser Repeatability:_____

  _____

- ✓ Appraiser Accuracy:_____

  _____

- ✓ Team Reproducibility:_____

  _____

- ✓ Team Accuracy:_____

  _____

Attribute Agreement Analysis

Stat>Quality Tools>Attribute Agreement Analysis...

Closed Reimbursement.mtw

The QC manager wants to assess the reliability of the QC system for the closed reimbursements. He got 20 completed reimbursements checked by 3 quality representatives for correctness. He passed the same 20 reimbursements to the 3 quality representatives to be checked again.
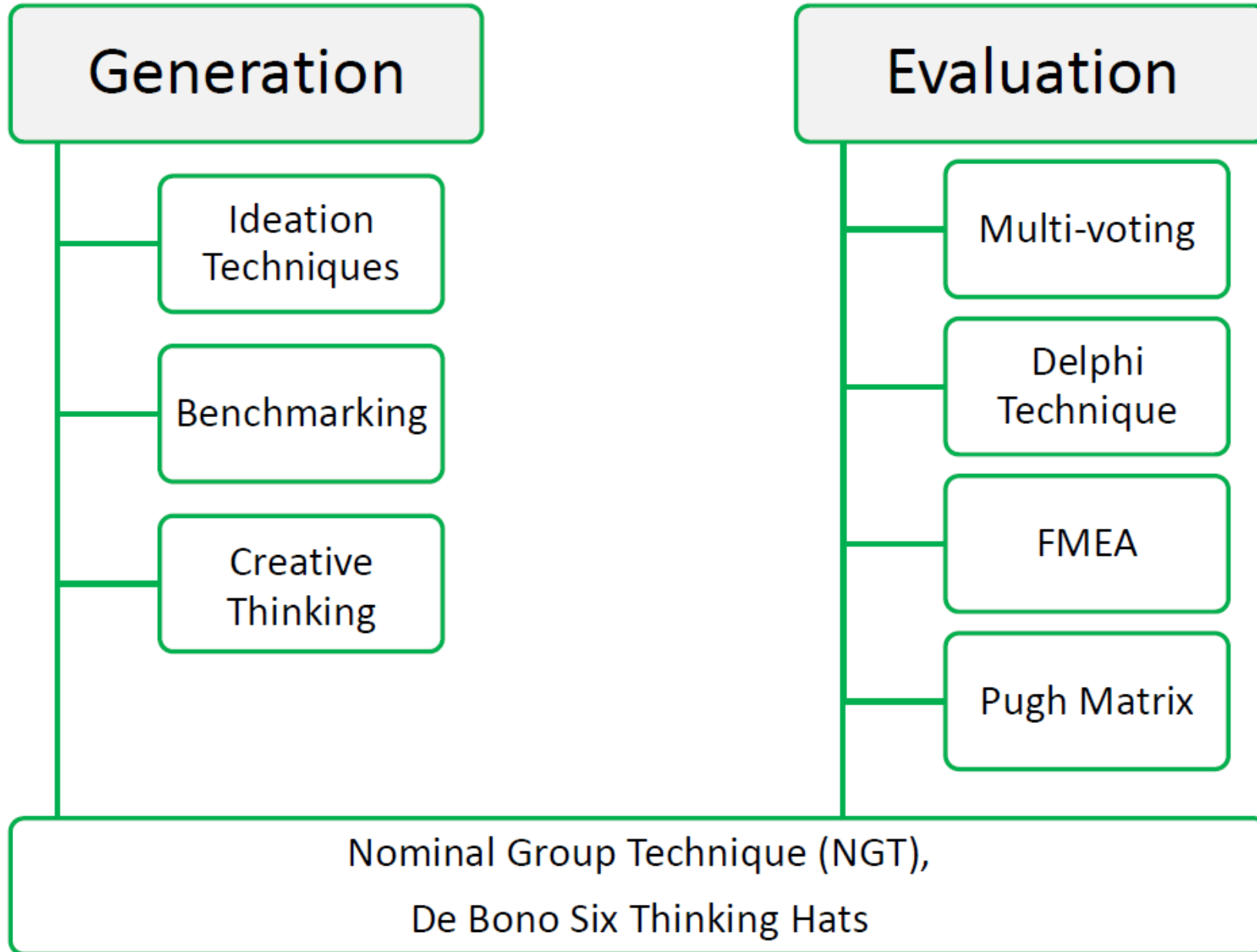
Questions we should ask?

✓ Does the appraiser agree with him/herself on all trials?

✓ Does the appraiser agree with the known standard on all trials?

✓ Do all appraisers agree with themselves and others on all trials? (within and between appraisers)

✓ Do all appraisers agree with themselves, others, and with the standard?

Attribute Agreement Analysis Output

Within Appraiser (Appraiser Repeatability)			
Appraiser	Inspected	Matched	Percent
A	20	17	85
B	20	20	100
C	20	19	95
Each Appraiser versus Standard (Appraiser Accuracy)			
Appraiser	Inspected	Matched	Percent
A	20	15	75
B	20	16	80
C	20	18	90
Between Appraiser (Team Reproducibility)			
Inspected	Matched		Percent
20	12		60
All Appraiser versus Standard (Team Accuracy)			
Inspected	Matched		Percent
20	12		60

Questions we should ask?

✓ Does the appraiser agree with him/herself on all trials?

✓ Does the appraiser agree with the known standard on all trials?

✓ Do all appraisers agree with themselves and others on all trials? (within and between appraisers)

✓ Do all appraisers agree with themselves, others, and with the standard?

Generate Solutions

Generate and Evaluate Solutions

Generation	Evaluation
Ideation Techniques	Multi-voting
Benchmarking	Delphi Technique
Creative Thinking	FMEA
	Pugh Matrix

Nominal Group Technique (NGT),

De Bono Six Thinking Hats

Ideation Technique: Brainstorming

What is Brainstorming?

✓ Brainstorming is a structured method of generating unconstrained solutions and gaining engagement/involvement in the improvement process

✓ It produces many solutions in a short time

✓ It is only about idea generation. It is not about assessment of ideas

Basic Guidelines for Brainstorming

✓ Generate as many ideas as possible

✓ Have lateral as well as vertical thinking

✓ Do not criticize any idea and encourage all participants. It is important to avoid the dominance of some persons

Brainstorming (Round Robin Style)

✓ Clearly state the **purpose (review/clarify the problem)**

✓ Give everyone a few minutes of silence to think about the question and individually write down ideas

✓ Gather ideas in "round-robin" style – write on flip-chart (it's OK to "Pass")

✓ Don't discuss or criticize ideas; often ideas "from left field" are the most useful

✓ Build on ideas of others. Listen to the others' ideas – you may be inspired!

✓ When the "round-robin" has slowed down, open the brainstorming session up to any additional ideas

✓ When the brainstorm has ended, review the list of ideas

   ○ Make sure everybody understands each idea

   ○ Consolidate similar ideas

   ○ Clarify ideas and ask for more specific information where necessary

De Bono Six Thinking Hats

Dr. Edward de Bono developed a technique for helping teams stay focused on creative problem solving by avoiding negativity and group arguments. This technique is called the Six Thinking Hats.

It can be used to enhance team creativity and evaluate ideas. This technique can be applied during solution or idea generation and can also assist in building consensus. This technique has been used world-wide, in a variety of corporations.

White: neutral, objective	**Red**: emotional and intuitive
Black: Cautious and Careful	**Yellow**: Hope, positive and speculative
Green: Creative and lateral thinking	**Blue**: Control and organized thinking

How to use Six thinking Hats?

Method 1 – Everyone has a different hat (variants)

✓ A thinker puts on or takes off one of the hats

✓ A facilitator asks a thinker to put on or take off one of the hats

✓ All thinkers put on one hat for a period of time

✓ Each thinker is assigned a different hat to wear for a period of time

✓ All thinkers wear hats they do not "normally" wear

Method 2

✓ Everyone (except facilitator) wears the same hat

✓ Facilitator (blue hat) indicates when to change hats and what hat to wear

Six Thinking Hats
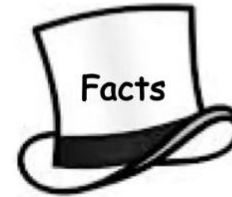
Six Thinking Hats
by Edward de Bono

"to help group discussions and to promote
a more effective decision making. "

challenges to think in
six distinct directions or thinking roles.
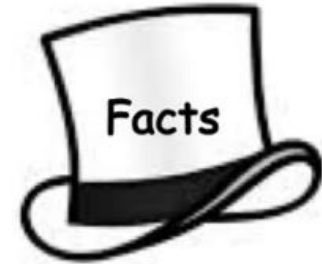
Managing	**Manages and controls the process**
Facts	Calls for information – The facts, just the facts
Emotional	**Express emotions and feelings, loves, and hates**
Optimistic	**Optimism, advantages and opportunities**
Critisicm	**Criticism and judgment, difficulties and risks**
Creative	**Creativity, alternative solutions and new ideas**

How do I use the Six Thinking Hats?

Finding new ideas

Managing — Facts — Emotional — Creative — Optimistic — Critisicm — Managing

Evaluating an idea

Managing — Facts — Emotional — Optimistic — Critisicm — Creative — Managing

finding a solution for wrong deliveries

finding a solution for wrong deliveries

Orders received through phone calls

entered manually

Correct Entry

Wrong Entry
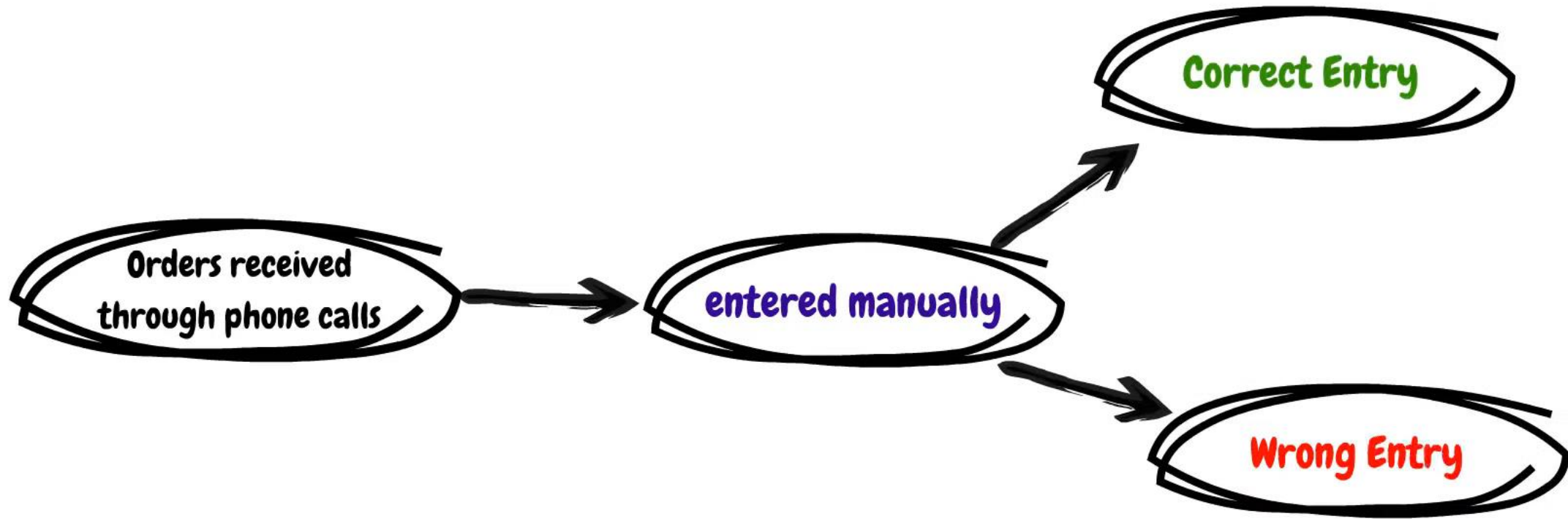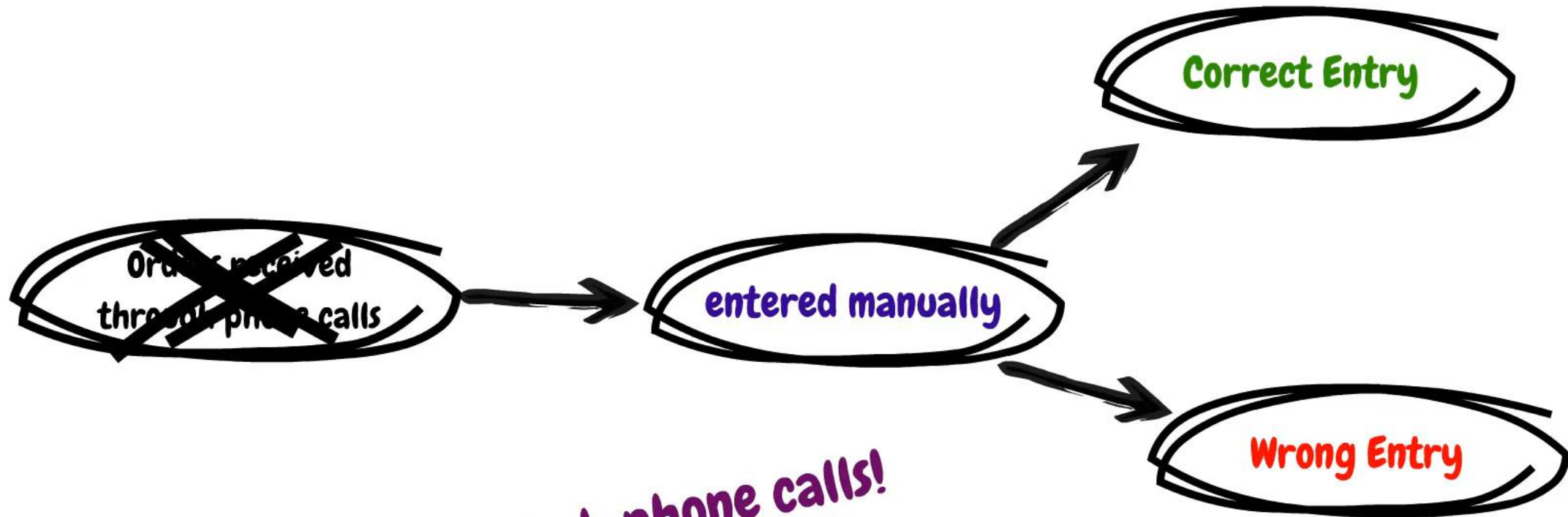
forbid orders through phone calls!

We need to evaluate the idea by this technique.

1. How do I feel?

2. Is there a better solution based on my feelings?

Emotional

- Save 2 hours a day
- Speed up system updates by 40%
- Less customer complaints
- Customer Satisfaction will increase
- Save $60 K in returns and chargebacks

BENEFIT If we stop taking order through phone call and switch to totally online

Optimistic

Loss of sales

Generate solution to Risk

$+ (- \$50 \text{ K}) + \$60 \text{ K} = \$10 \text{ K}$

for additional communication budget

– Tutorial and training

Creative

Summarizes the discussion and leads
further for an action plan

Managing

Creative Thinking: Probing

Probing is considered the child's method. Children learn more through probing or questioning their parents, family and friends. Questions that you could ask for your process

- ✓ Why do we have this process step?
- ✓ Who else could be doing it?
- ✓ How can we change this step?
- ✓ What can be altered?
- ✓ When else can the activity be performed?
- ✓ Can we remove or replace this activity with something else?
- ✓ Can we combine some tasks?
- ✓ Can we apply some learning from other sources?
- ✓ Can we minimize the impact of certain aspects?
- ✓ Can we maximize impact of certain aspects?
- ✓ Can we rearrange sequence of tasks?

Process Benchmarking

It is used when the focus is on improving detailed critical processes and operations. Partners are sought either internally or externally from best practice organizations that do similar work or deliver comparable services

Select the problem	Select the problem which we want to solve in the process.
Map the process	Map the actual present process .
Who to Benchmark	Check and find out which are the companies or competitors doing same type of business and doing better.
Plan the Benchmark	Plan for the benchmark visit in the industries selected by the above process.
Analyze and Act	Analyze the process of benchmark company & good points in own process, finalize targets.

Evaluate Solutions

Multi-Voting

Multi-voting activity allows a group to narrow their list or options into a manageable size for sincere consideration or study. It may not help the group make a single decision but can help the group narrow a long list of ideas into a manageable number that can be discussed and explored. It allows all members of the group to be involved in the process and ultimately saves the group a lot of time by allowing them to focus energy on the ideas with the greatest potential.

When should we use Multi-voting?

✓ When the group has a long list of possibilities and wants to narrow it down to a few for analysis and discussion

✓ When a selection process needs to be made after brainstorming

* (Refer to the Green Belt Preparatory Module for detailed procedure)

Multi-Voting

✓ Used to prioritize a list of options

✓ Team members "vote" on options

✓ Drives team engagement and consensus

✓ Works well with large groups and many options

Multi-Voting: How To

1. Number each idea/suggestion

2. Decide on number of choices for each individual

3. Each member selects choices and ranks in priority; the highest number is given to the highest priority item

4. Tally Results

5. Identify top choices

Multi-Voting: Example

How can we improve sales?

	Jill	Kate	Joe	John	Total
1.Reduce price	1	1	3	2	7
2.Offer discounts		3	2		5
3.Give-aways	2				2
4.Better service	3	2	1	3	9
5.BOGO sale				1	1
6.Free delivery					0

Delphi Technique

✓ The Delphi technique, was mainly developed by Dalkey and Helmer (1963) at the Rand Corporation in the 1950s

✓ The Delphi technique is a widely used and accepted method for gathering data from respondents within their **domain of expertise**

✓ It builds consensus (on solutions) by using a series of questionnaires delivered using multiple iterations to collect data from a panel of selected experts

✓ It also ensures **anonymity** as one expert does not know who's the other expert involved in the activity. For this reason, Delphi Technique is also known as a '**Secret Ballot**'

✓ Delphi technique's application is observed in program planning, needs assessment, policy determination, resource utilization, marketing & sales and multiple other business decision areas.

# What is the Delphi technique?

- Way to reach consensus of experts
  - *Involves interviews subject matter experts*

- Involves a series of questionnaires:
  - *Responses are summarised and recirculated to experts for further comment.*

- Has a wide range of applications:
  - *Determine the range of opinions*
  - *Test questions*
  - *Explore or achieve consensus on disputed topics*
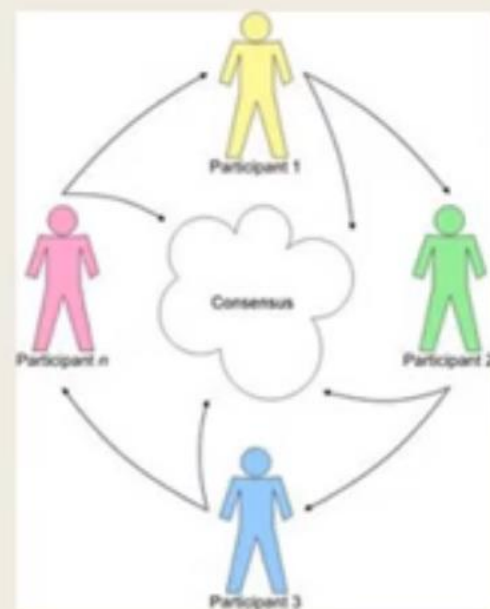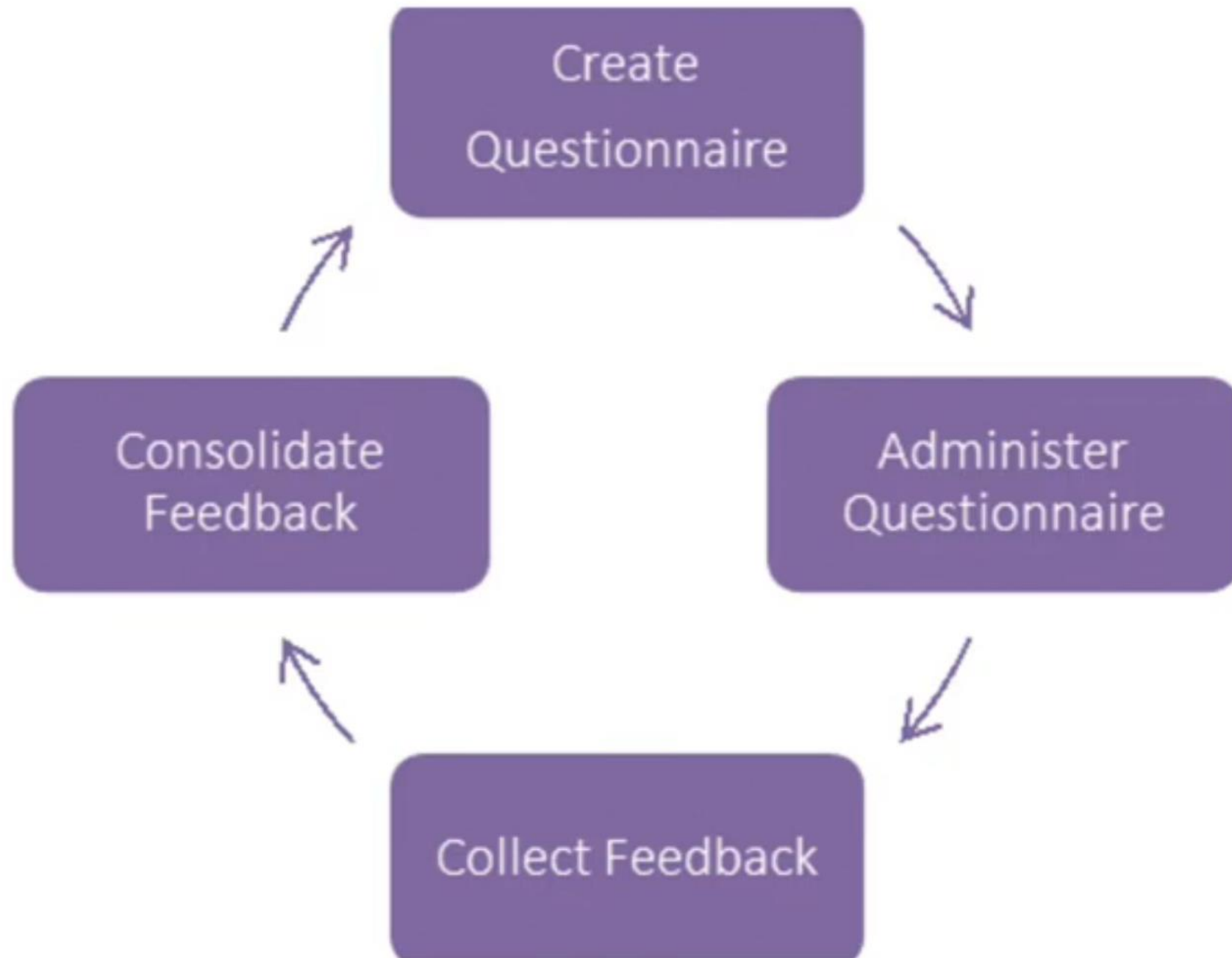
Characteristics of the Delphi technique

- Group of participants are specially selected for their expertise on a topic.

- Conducted across a series of two or more sequential questionnaires known as 'rounds'.

- Ideas from Round 1 are collated to construct the surveys distributed in subsequent rounds.

- Evaluation phase: panellists are provided with the panel's responses and asked to re-evaluate their original responses.

- Interested in the formation or exploration of consensus.
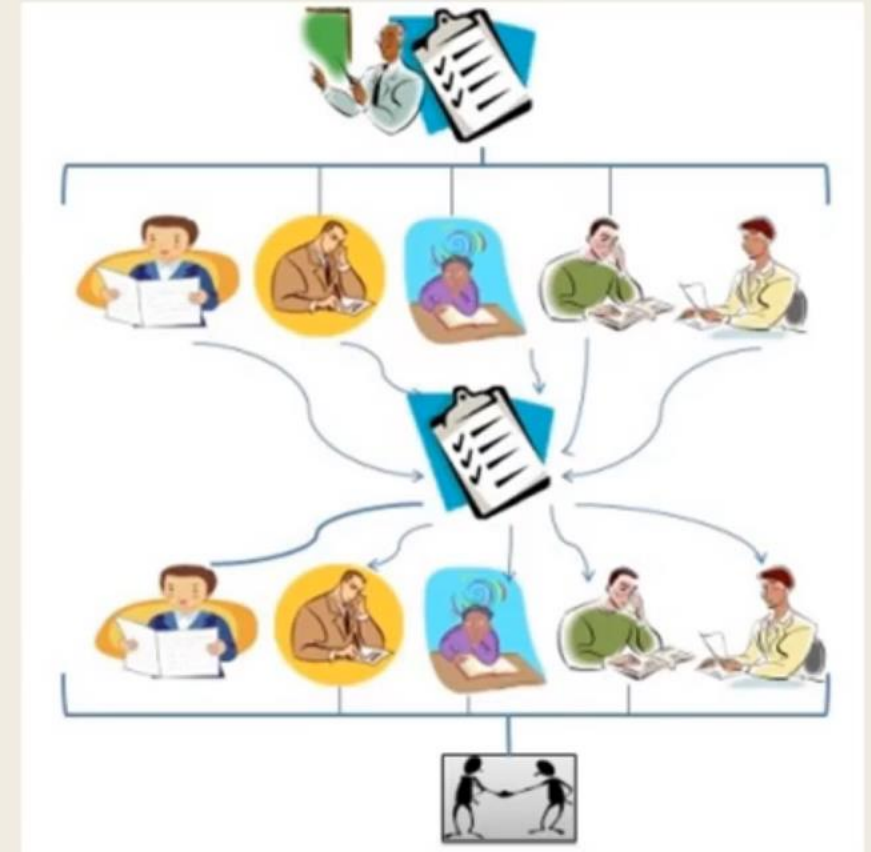
Preparation phase:
Establish the questions and topics, recruit participants, design questionnaires.

Round 1:
Administer 1st questionnaire, collect and analyse the data, design the 2nd questionnaire

Round 2:
Prepare 2nd questionnaire based on the 1st, collect the relative data

Likert scales

Delve deeper into topic

Clarify issues

Advantages of the Delphi technique

- Enables virtual meetings.

- Panellists can participate anonymously.

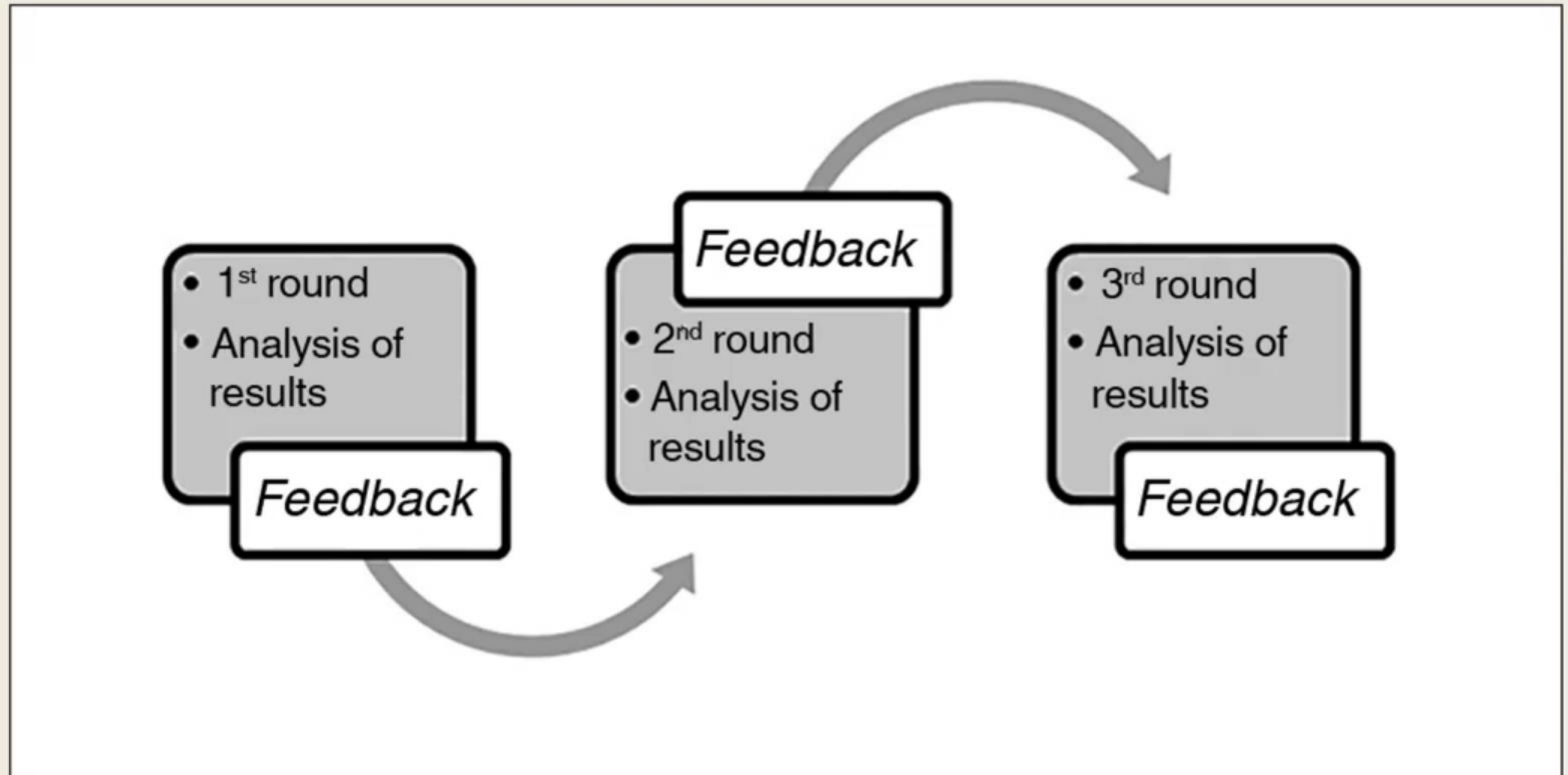- Avoids the effect of group influence on the final decision.
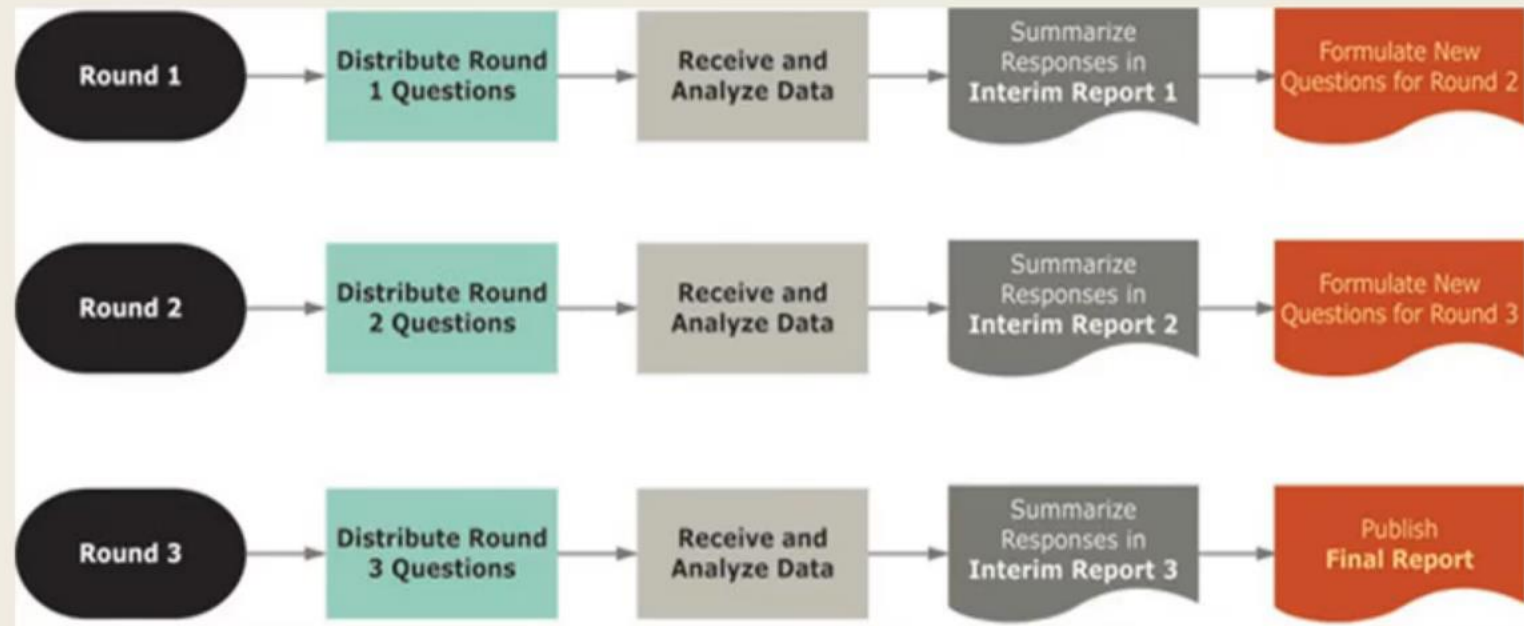
Disadvantages of the Delphi technique

- Slower than a face-to-face meeting.

- Can be difficult to get people to respond:
    - *Particularly if panellists don't see any personal gain from the exercise.*

In summary

In summary

An Example

- Scenario: You designed and implemented an innovative online program that assisted students (grade 10-12) learning remotely at home during Covid Pandemic. You need to find out the program pros and cons for improvement. You adapted Delphi Method for to collect information. Here are the steps.

- Step 1: Send an email to all the stakeholders asking for their inputs on
  - Five reasons to like the program.
  - Five reasons to improve the program.

- Step 2: Synthesize the answers collected from the stakeholders and you have two lists of reasons to like the program and to improve the program.

An Example Continued - 1

- Step 3: Send the first synthesized lists out to all the people asking them to rank their top five items from each list.

- **20 Reasons You Like the program:**
  1. The program is fun and interactive.
  2. The program is well designed for the students.
  3. The program uses video instruction that looks appealing to kids.
  4. This is a timely program that support student learning math.
  5. The program distinguishes our school from others in helping students learning during the Pandemic.
  18. **..... ..... (other statements are omitted to save space.)**
  19. The program has increased learning time online.
  20. The explanations are short and concise.
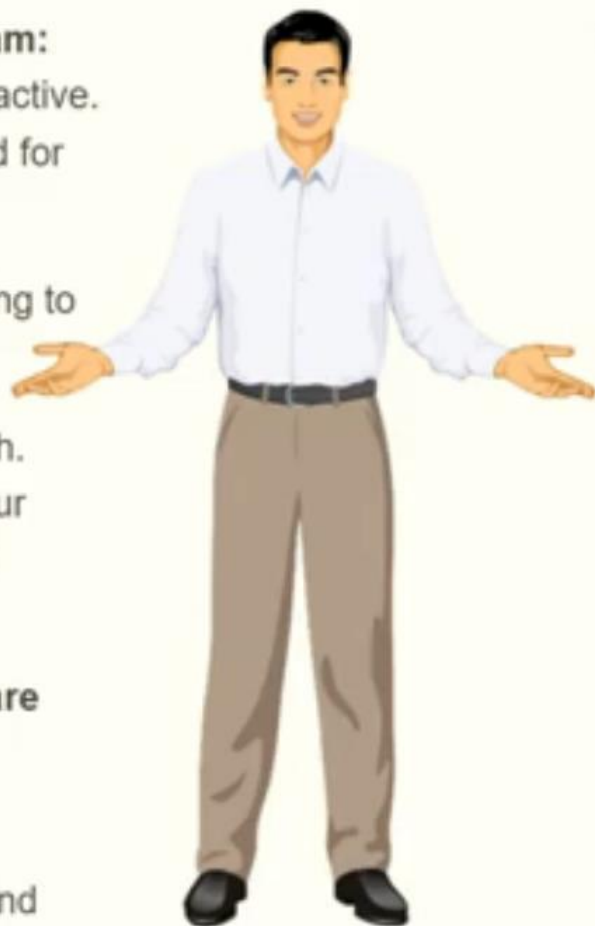
- **15 Reasons to Improve the Program**
  1. The program takes too much of our family time.
  2. No tech. support is available in the evening when I cannot help my kid.
  3. It takes too much time to provide individual feedback on student learning.
  4. I don't know if my students are learning.
  5. The kids often get distracted from learning tasks by some links that take them outside the program.
  6. The program is very slow on my computer.
  7. The program is very expensive with all the needed technology and personnel supports.
  8. I have to buy a new computer for my kid to run the program.
  9. .... (other statements are omitted.)
  15. **No one really helped me with the new program but I have to figure it out all by myself.**

An Example Continued - 2

- Step 4: Synthesized the information of top-five items collected. Select the most popular 8-10 items to form two new lists.

- Step 5: Share the new lists with all stakeholders asking them to rank their top three items and providing an explanation for each item they select.

- Step 6: Synthesize the information with an explanations.

- Step 7: Share with all the stakeholders the synthesized information of two lists and give an ample time for stakeholders to comprehend the information.

An Example Continued - 3

- Step 8: Host an online focus group meeting with all the stakeholders.
  - Explain briefly each item in the new lists.
  - Ask if these items well represent their thoughts and concerns about the program. If an item or statement did not correctly express the idea, ask them to discuss it and then revise it together.
  - After group discussions, ask them to re-rank top five out of 8-10 items for each list.
  - Finalize the list of reasons that people like the program and the list of reasons to improve the program with explanations.

- Step 9: Share with all the stakeholders the procedure and the results of these two lists.

Pugh Matrix

Pugh Matrix was introduced by Stuart Pugh the **decision-matrix method**, also **Pugh method**. It compares alternative solutions against the Datum (the current situation) as per the defined criteria.

The basic steps of the Pugh Concept Selection Process are

✓ Brainstorm criteria that is important to the customer. List them down rows of sheet along with their weightages

✓ List the alternatives across columns of sheet. Identify the "Datum" or status quo choice

✓ Begin filling in '1' or '+', '0' or 's', or '-1' or '-' ratings in the main area of sheet, based on whether that alternative is better, equivalent, or worse than the datum for that criteria

✓ Look at what the spreadsheet tells you is the best choice. Do you and the group feel good about that decision? If so, you're done.

✓ If not, look again to verify that you have a complete set of criteria? Was something important missed? Are the weights you've assigned accurate?

Pugh Matrix - Template

Expectation	Importance	Datum (Status Quo)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Criteria 1							
Criteria 2							
Criteria 3							
Criteria 4							
Criteria 5							
Sum of Same							
Sum of Positives							
Sum of Negatives							
Weighted Sum of Positives							
Weighted Sum of Negatives							

PUGH Concept Selection – Decision Matrix

Step #1 : List important criteria

Step #2 : Select Datum / Baseline

Step #3 : List all alternatives

Step #4 : Ranks {"+", "-" or "0"}

Step #5 : Aggregating Total Score

Step #6 : Selection based on Final Score

Criteria	Baseline/ Datum	Option# 1	Option# 2	Option# 3
	0	-1	+1	-1
	0	-1	0	+1
Total		**-2**	**+1**	**0**
Rank			**1st**	

➕ means better that baseline.

➖ means worse than baseline.

0️⃣ means about the same.

PUGH (Concept Selection) – Decision Matrix

Objective:

To evaluate which car to choose ? (Sports/ Luxury/ SUV/ Vintage)

(Sports Car / Luxury Car / SUV Car / Vintage car).

Objective: To evaluate which car to choose ? (Sports / Luxury / SUV / Vintage)

Criteria				
Mileage				
Style				
Safety				
Cost				
Spacious				

Objective: *To evaluate which car to choose ?* (Sports / Luxury / SUV / Vintage)

Criteria	Baseline/ Datum	Sports Car	Luxury Car	Family Car	Vintage Car
Mileage	0	-1	-1	0	0
Style	0	+1	+1	+1	+1
Safety	0	+1	0	+1	0
Cost	0	-1	-1	-1	-1
Spacious	0	-1	0	+1	0
Total		-1	-1	+2	+1
Rank				1st	2nd

Nominal Group Technique

Nominal (meaning in name only) group technique (NGT) is a structured variation of a small-group discussion to reach consensus.

NGT helps in solution generation as it gathers information by asking individuals to respond to questions posed by a moderator.
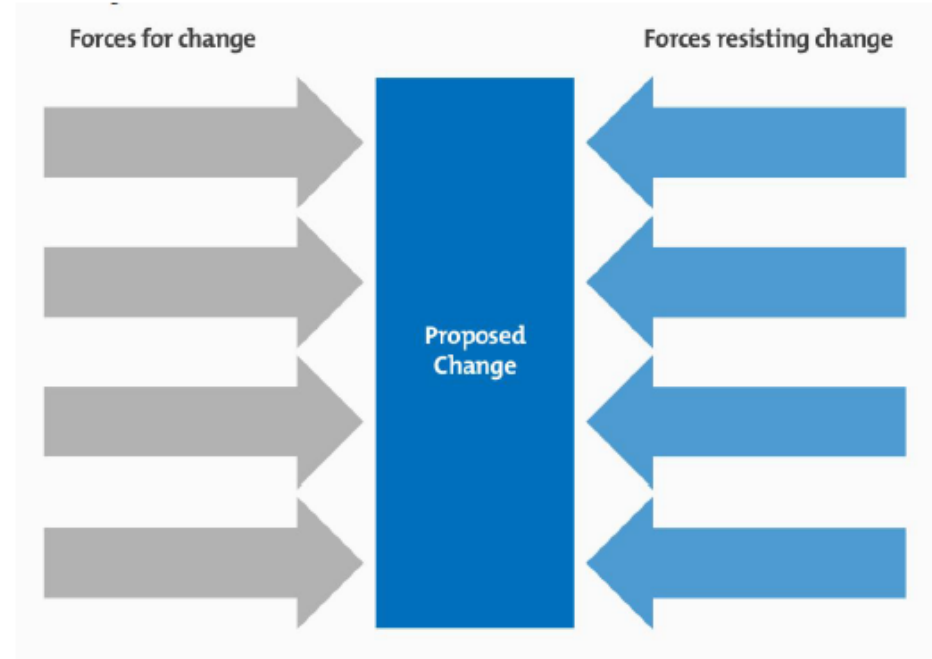
It also helps in evaluation of solutions by asking participants to rate the solutions of all group members. Thus it prevents the domination of the discussion by a single person, encourages all group members to participate, and results in a set of prioritized solutions or recommendations that represent the group's preferences.

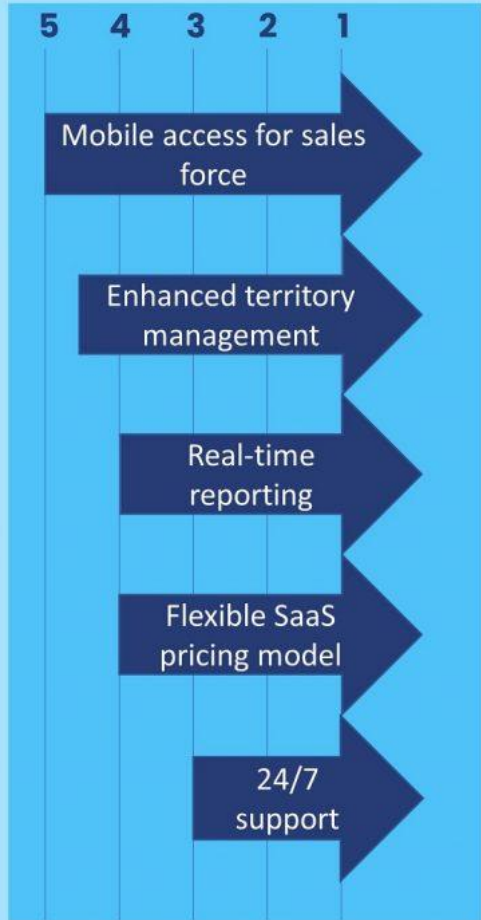**When should we use Nominal Group Technique?**

Nominal Group Technique is a good method to use to gain group consensus, for example, when various people (program staff, stakeholders, community residents, etc.) are involved in constructing a logic model and the list of outputs for a specific component is too long and therefore has to be prioritized.

Force Field Analysis

➢ Force Field Analysis helps us think about the pressures for and against a decision or a change. It was developed by Kurt Lewin.

➢ To carry out a Force Field Analysis, we describe our plan or proposal in the middle of a piece of paper or whiteboard. Then we list all of the forces **for** change in a column on the left-side, and all of the forces **against** change in a column on the right-side.

➢ We can use our analysis to think about how we can strengthen the forces that support the change and weaken the forces opposing it, so that the change is more successful.

Forces for change

Forces resisting change

Proposed Change

Select and Optimize the best Solution – DoE

Design of Experiments (DoE) is a structured and controlled method used to vary inputs (factors) in order to find the best combination of inputs to deliver the desired output.

During process analysis, experiments are often used to evaluate **which process inputs have a significant impact** on the process output, and **what the target level of those inputs should be** to achieve a desired result (output). Designed Experiments are also powerful tools to achieve cost savings by minimizing process variation, reducing rework and the need for inspection.
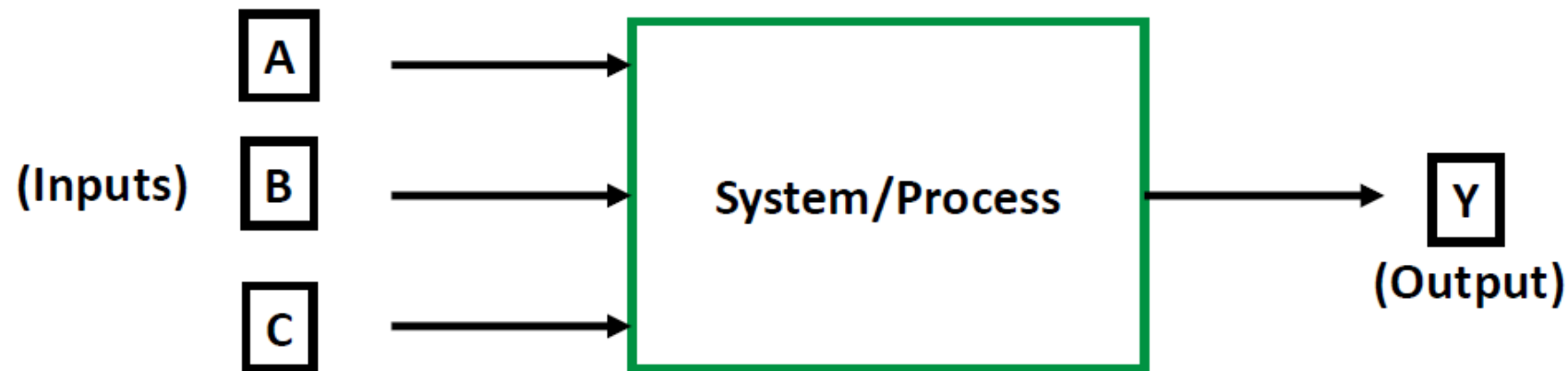
DOE

Parameters in DOE

1. A, B, C (inputs) and Y (output) must be expressed in numbers

2. A, B, and C must be controllable and measurable

3. We must have a reasonable level of confidence that the input parameters chosen have a significant influence on affecting the output (Y) – hence the need for process knowledge

Learning from DOE

1. Best (optimum) settings of input levels

2. How the inputs affect the output. That is, which inputs, if any, have the most influence on the output – Sensitivity Analysis

Factors and Levels (DOE)

Factors (f): These are the process parameters or the critical causes (X's)

Level (l): These are the selected possible values for the factors

For example, if temperature has two possible values 20 degrees and 30 degrees, these (20 and 30) shall be called two levels for the factor – temperature

No. of outcomes (experiments) = (levels) ^{factors} = (l)^f

In a 2 level, 4 factor experiment the number of outcomes will be:
$(2)^4 = 16$

DOE is also is also known as Designed Experiments or Experimental Design and begins by identifying the major factors that could cause process variance. The Designed Experiments tool contains three elements. For example, if the DOE were used on the process of making a pizza the elements would include the following:

Factors – These are inputs to the process. Factors are considered as either controllable or uncontrollable variables. Factors in the pizza example include the ***oven, dough, sauce, and toppings.***

Levels – These are the potential settings of each factor. The **levels** in the pizza making process are the ***temperature of the oven***, ***the cooking time and the amount of sauce and toppings used***.

Response – This is the output of the experiment. DOE strives for a measurable output that is influenced by the factors and their differing levels. The response or output from the example is how the pizza tastes.

Pilot Implementation & Validation
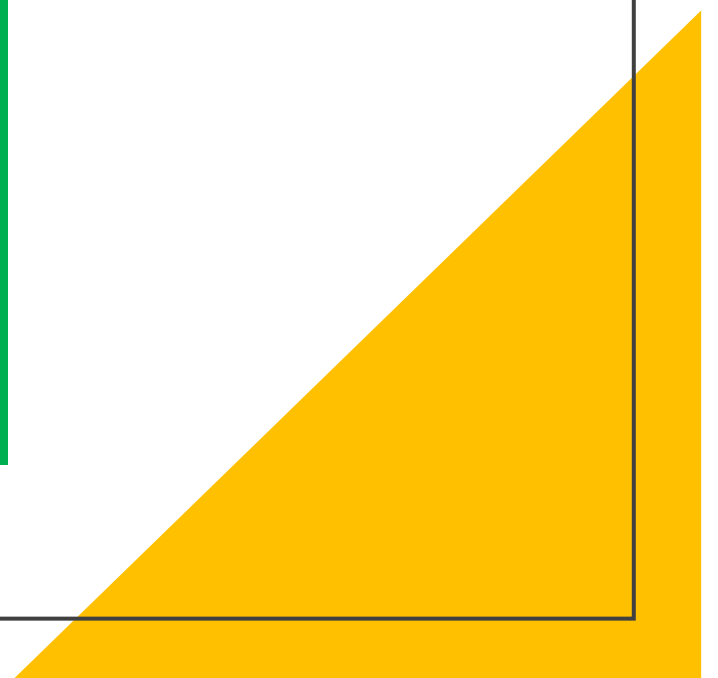
Pilot, Implement and Validate the Solution

A pilot is a **test of a proposed solution.** It has the following properties:

✓ Performed on a small scale

✓ Used to evaluate both the solution and the implementation of the solution

✓ Purpose is to make the full scale implementation more effective

✓ Gives data about expected results and exposes issues in the implementation plan

Pilot Examples	
Implementation at a single location	Release in a test market
Implementation for one work area	Product/Service mock-ups or models
Implementation for a select customer group	Walkthroughs, dry runs, or dress rehearsals
Limited time offers	Early evaluation by end users

Benefits of Pilot and Steps involved in a Pilot

✓ Improve the solution

✓ Understand risks

✓ Validate expected results

✓ Smooth implementation

✓ Facilitate buy-in

✓ Identify previously unknown performance problems

8 Step Pilot Roadmap

1. Create a Pilot Plan	2. Ensure strong leadership support
3. Communication the plans to key stakeholders	4. Train the Pilot group
5. Implement the pilot	6. Collect and Analyze feedback
7. Diagnose gap and revise solutions	8. Implement the solution

When to Pilot?

- You need to confirm the expected results and practicality of the solution

- You want to reduce the risk of failure

- The scope of the change is large and reversing the change would be difficult

- Implementing the change will be costly

- Changes would have far-reaching, unforeseen consequences

Pilot Completion Review

Once all the pilot data has been collected and the results verified, the team can determine the next steps toward solution implementation.

Some questions a team should ask upon the completion of a pilot to help guide them toward identification of the proper next steps are:

✓ Did pilot have anticipated results?

✓ Was the plan for conducting the pilot effective?

✓ What improvements can we make to the solution?

✓ Can the solution be implemented "as-is"? Should it be?

✓ Can the solution remain in place at the pilot location?

✓ What lessons learned and best practices can we apply during solution implementation?

✓ Did the solution achieve the required design goals?

What Can You Control?

Control Systems

Control System is the complete strategy for

➢ maintaining the improved process performance over time.

➢ Identifying the specific actions and tools required for sustaining the process improvements or gains

The objective is

✓ To ensure that our process stays in control after the solution has been implemented

✓ To quickly detect the out of control state and determine the associated special causes so that actions can be taken to correct the problem before non conformances are produced

Control Plan

Control plan provides a written summary description of the systems used in minimizing process and service variation

➢ Control plans do not replace information contained in detailed instructions

➢ In a grand sense the control plan describes the actions that are required at each phase of the process including receiving, in-process, outgoing, and periodic requirements to assure that all process outputs will be in a state of control

Ultimately, the control plan is a living document reflecting current methods of control and measurement systems used

✓ What is the process that is being controlled?

✓ What measures (numbers) are we monitoring?

✓ For each measure, what are the "trigger point" values where action should be taken?

✓ What action should be taken when a "trigger point" is reached? Who is responsible for taking action?

Elements of a Control Plan

1. Process Documentation

2. Process Ownership

3. Data Collection Plan

4. Risk Mitigation Plan

5. Mistake Proofing Systems

6. Audit / Inspection Plans

7. Response / Reaction Plans

8. Statistical Process Control

"Process owner is accountable to maintain new level of process performance"

Control Plan Checklist

- ✓ Process maps detail process steps and information flow
- ✓ Key service variables identified with importance to customer, desired target value and specification range defined
- ✓ Long and short term capability trend charts track variation reduction progress
- ✓ Key and critical input variables identified with targets, statistically determined control limits & control strategies defined
- ✓ Reaction plan in place for out-of specification processes
- ✓ Measurement systems are capable with calibration requirements specified
- ✓ Sampling, inspection and testing plans include how often, where and to who results reported
- ✓ Operating procedures identify actions, responsibilities, maintenance schedules and service segregation requirements
- ✓ Training materials describe all aspects of process operation and responsibilities
- ✓ Process improvement efforts fully documented and available for reference
- ✓ Control plan is reviewed and updated quarterly and resides in the operating area

Mistake Proofing / Poka Yoke

➢ Mistake Proofing or Poka-Yoke is a method for avoiding errors in a process

➢ It is a technique or a mechanism for

  ○ either eliminating errors by making it impossible to make mistakes in the process - **Prevention**

  ○ or by making the errors obvious at a glance - **Detection**

➢ It is often considered the best approach to process control

It is good to do it right the first time.
It is even better to make it impossible to do it wrong the first time.

Is Mistake Proofing always possible?

Though considered as the best option for controlling X's, mistake proofing is not always possible or economically practical.

What to do if mistake proofing is not possible?

1.   Inspections / Audits

   a.   Source Inspection: Inspection carried out at source or as close to the source of the defect as possible

   b.   Informative Inspection: Inspection carried out to investigate the cause of any defect found, so action can be taken

   c.   Judgment Inspection: Inspection carried out to separate good units from bad units once processing has occurred

2.   Statistical Process Controls or Control Charts