2. Define Phase

01 *Project identification*

02 *Voice of the Customer*

03 *Project Management Basics*

04 *Management and Planning Tools*

05 *Business Results for Projects*

06 *Team Dynamics and Performance*

2A. Project Identification

01 Project selection

02 Process elements

03 Benchmarking

04 Process inputs and outputs

05 Owners and stakeholders

Six Sigma Project Selection

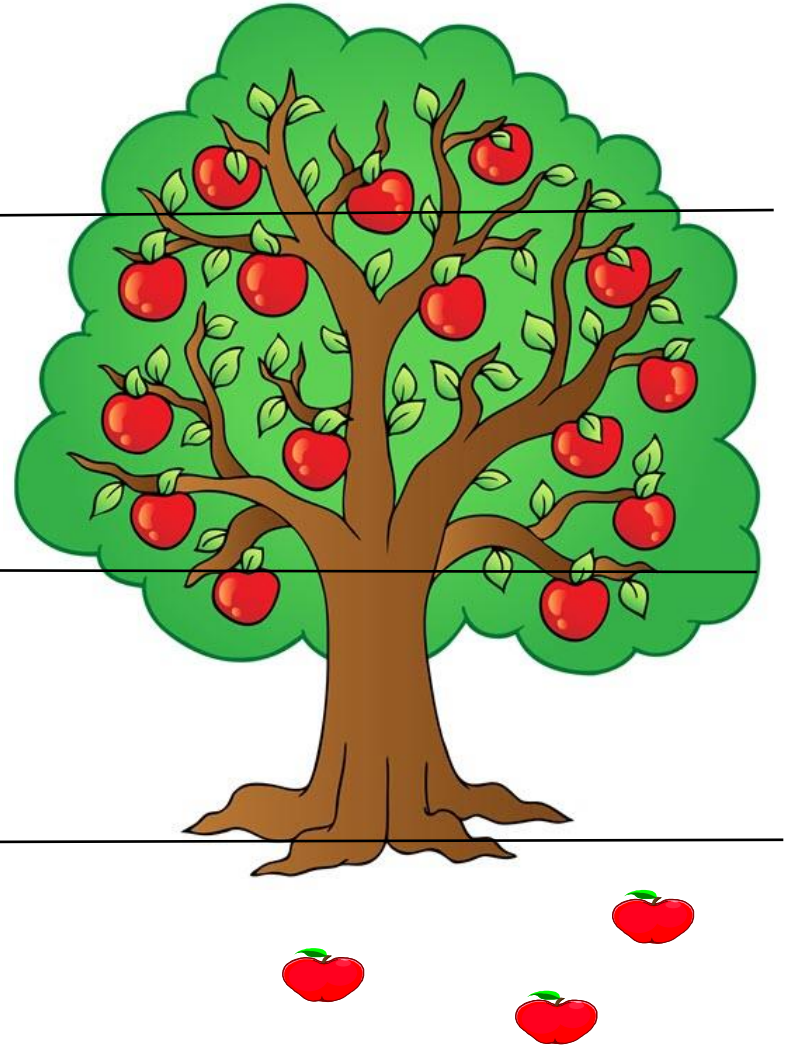
- External Sources:
  - Voice of Customer
    - What are we falling short of meeting customer needs?
    - What are the new needs of customers?
  - Voice of Market
    - What are market trends, and are we ready to adapt?
  - Voice of Competitors
    - What are we behind our competitors?

Six Sigma Project Selection

- Internal Sources:
  - Voice of Process
    - Where are the defects, repairs, reworks?
    - What are the major delays?
    - What are the major wastes?
  - Voice of Employee
    - What concerns or ideas have employees or managers raised?

Six Sigma Project Selection

Sweet Fruit
Design for Repeatability



Bulk of Fruit
Process Optimization

Low Hanging Fruit
Seven Basic Tools

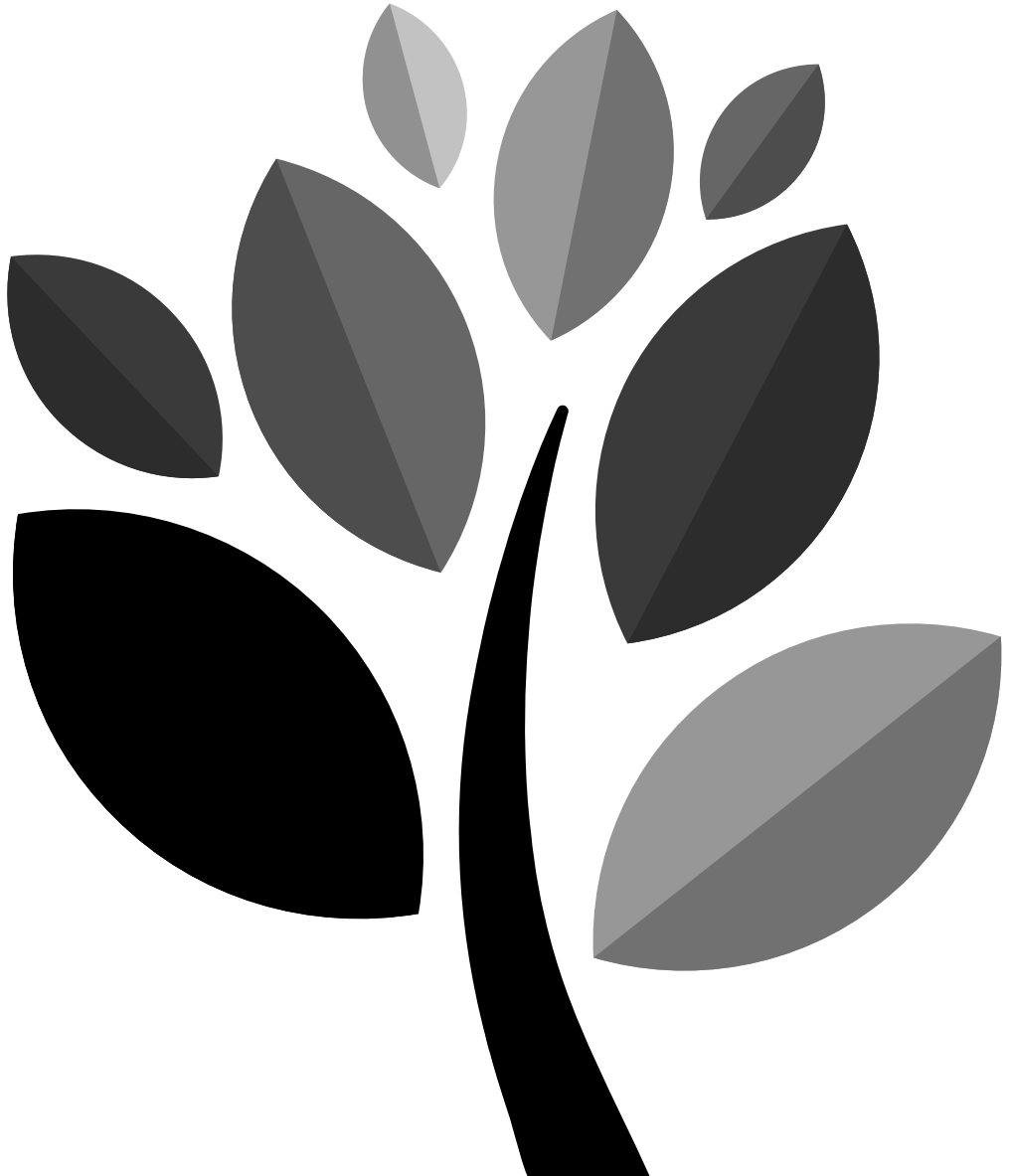
Ground Fruit
Logic and Intuition

Qualifications of a SS Project

1. **There is a gap between current and desired / needed performance.**

2. **The cause of problem is not clearly understood.**

3. **The solution is not pre-determined, nor is the optimal solution apparent.**



2A. Project Identification

01 Project selection

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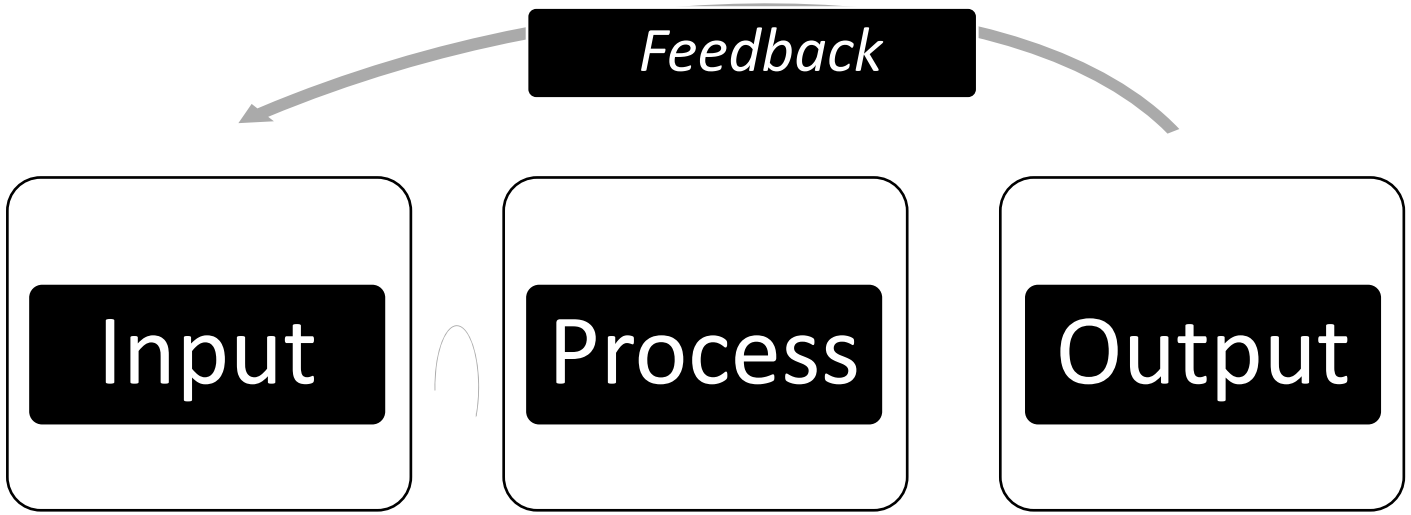
05 Owners and stakeholders

Process

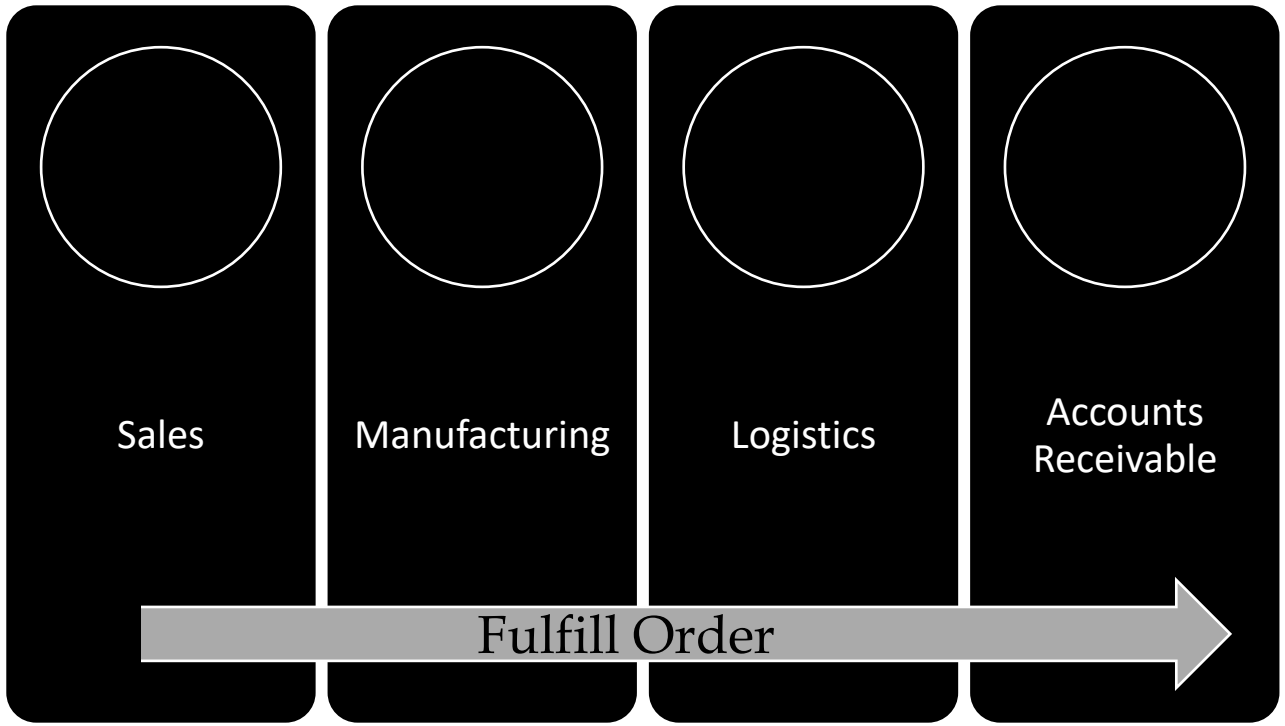
Process: Series of steps to produce a product or service.

Improve processes to improve the organization as a whole.



Y = f(X)

Process



Processes cross various functional areas

2A. Project Identification

01 Project selection

02 Process elements

03 Benchmarking

04 Process inputs and outputs

05 Owners and stakeholders

2A-3 Benchmarking

The process of comparing

one's business processes and performance metrics

to

industry bests and best practices from other companies.

2A-3 Types of Benchmarking

01

Process benchmarking

Example: Delivery process, Billing process

02

Performance benchmarking

Features of products and services e.g. mileage, download speed

03

Strategic benchmarking

How companies compete

2A-3 Types of Benchmarking

01

Internal Benchmarking

Easy access to sensitive information
Less time and resources required
Limited gain because internal benchmark might not be the best in class.

02

External Benchmarking

2A. Project Identification

01 Project selection

02 Process elements

03 Benchmarking

04 Process inputs and outputs

05 Owners and stakeholders

SIPOC

TO FAMILIARIZE WITH THE PROCESS

To identify all relevant elements of a process improvement project before starting the work.

Suppliers	Inputs	Process	Outputs	Customers

2A. Project Identification

01 Project selection

02 Process elements

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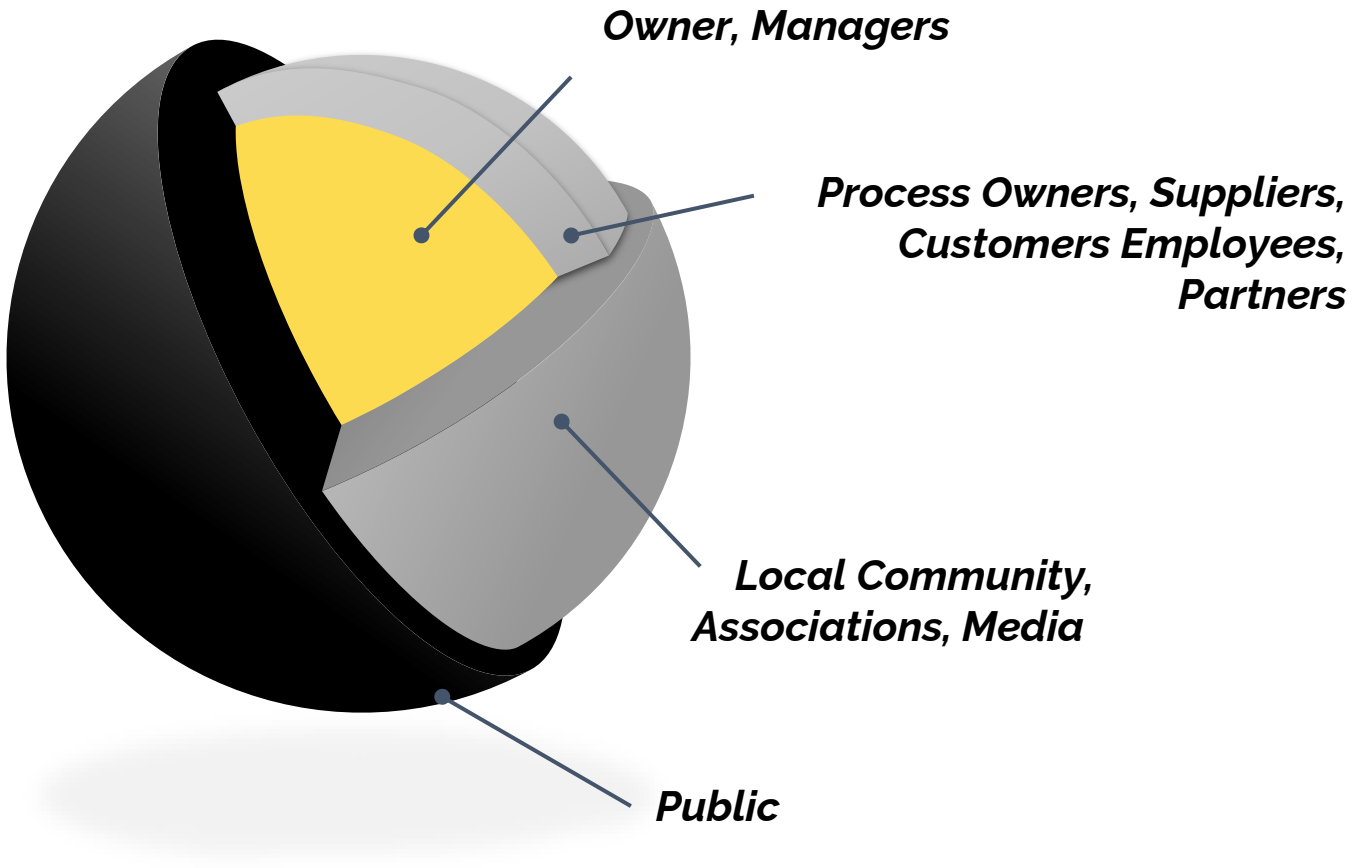
04 Process inputs and outputs

05 Owners and stakeholders

Owners and Stakeholders

TO IDENTIFY THE PROCESS OWNERS AND OTHER STAKEHOLDERS



2. Define Phase

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2B.
Voice of the Customer

01 Customer identification

02 Customer data

03 Customer requirements

Customer Identification

INTERNAL VS EXTERNAL

- Internal Customers
  - The notion of an internal customer was popularized by Joseph Juran
- External Customers
  - Intermediate Customer
  - Customer
  - Consumer

2B.
Voice of the Customer

01 Customer identification

02 Customer data

03 Customer requirements

Customer Data Collection

SURVEYS

Listen to your customers, Mail, Phone, Web surveys, Feedback

FOCUS GROUP

A group of people are asked about their perceptions, opinions, beliefs, and attitudes.

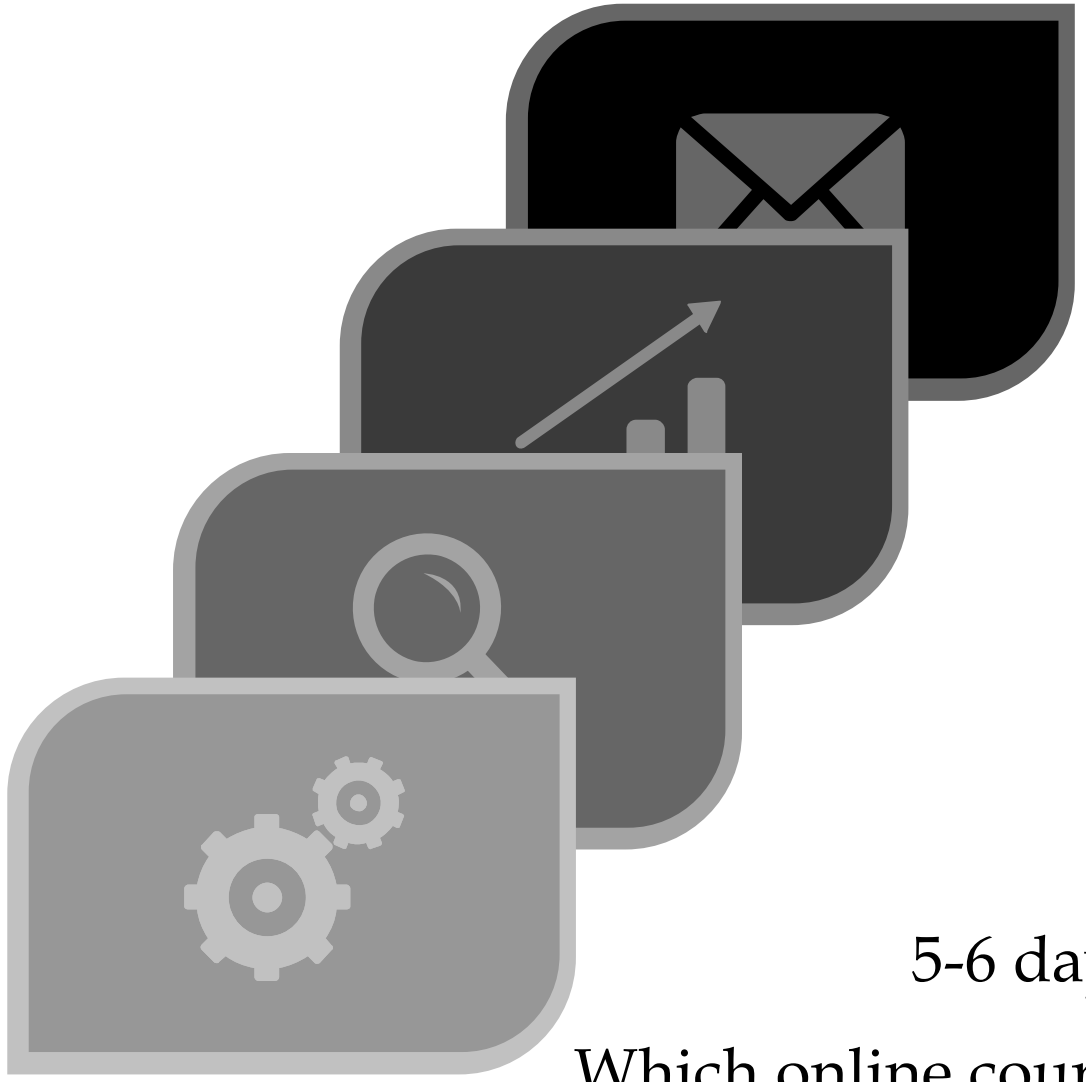
INTERVIEWS / MEETINGS

OBSERVATIONS

Surveys

- What is the goal of the survey?
- Clarity of questions
  - Unambiguous
  - Scale of 1 to 10
  - Historical relevance (to compare year to year change)
  - Open ended questions
- Review the survey
- Send the survey to target audience
- Analyze

Review Surveys Questionnaire



- Eliminate vagueness
- Eliminate ambiguity
- Eliminate unintended biases

- Include NA and Other choices

5-6 days, 4-5 days, 3-4 days and 1-3 days.

Which online course would you take to prepare for CSSGB exam?

Focus Group

- A group of people are asked about their perceptions, opinions, beliefs, and attitudes.
- Generally 6-10 people having open discussion with skilled moderator.

Focus Group

- Engagement questions
  - Start discussion to make participants comfortable with the process.
- Exploration questions
  - Main questions
- Exit question
  - Anything else members want to add

2B.
Voice of the Customer

01 Customer identification

02 Customer data

03 Customer requirements

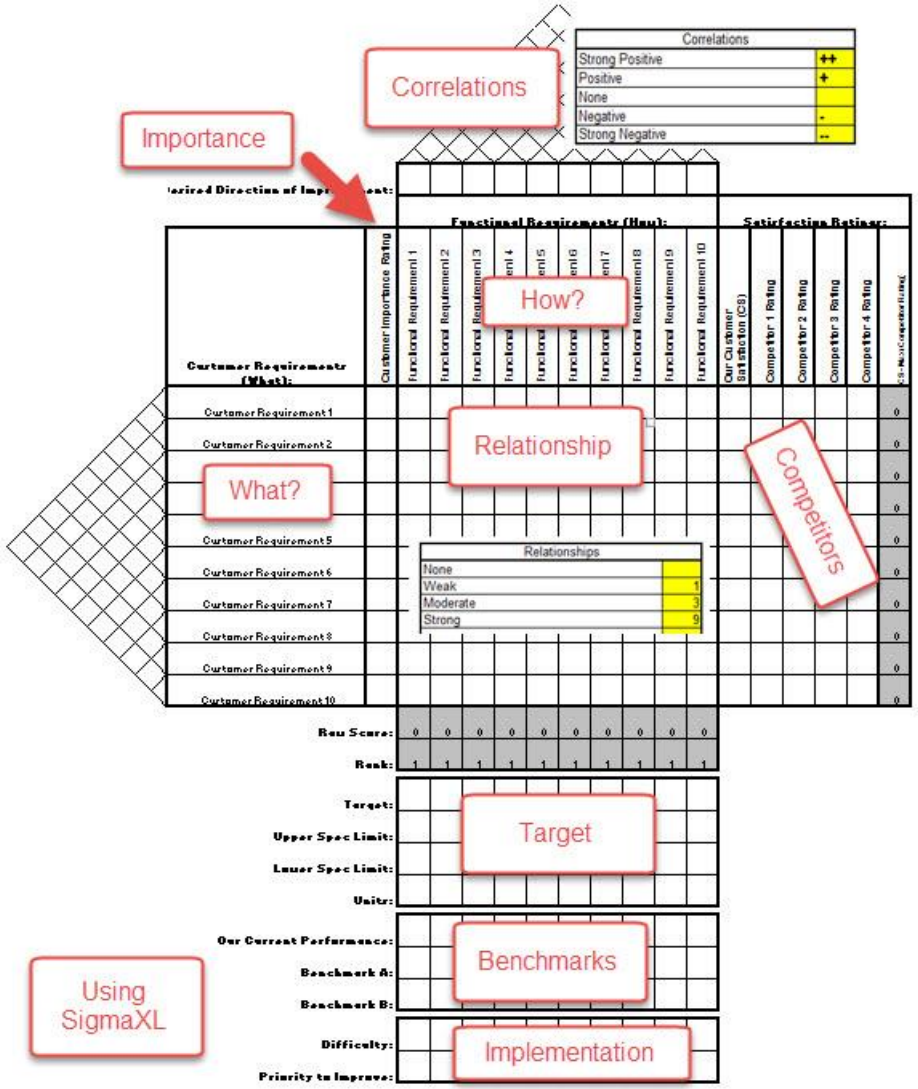
Customer Requirements

USING QFD

- **Developed by Yoji Akao in 1970s.**
- **Quality Function Deployment (QFD)** is a method to acquire and analyze the voice of the customer and then transform it into product requirements and quality assurance measures throughout the design, build, test, commercialization, and even product retirement process.

Customer Requirements

USING QFD



2022 – Changes in the BoK – 2B

	B. Voice of the customer (VOC)	
2014 BoK	**2022 BoK Details**	**Notes**
II.B.1	1. Customer identification Identify the internal and external customers of a project, and what effect the project will have on them. (Apply)	
II.B.2	2. Customer data Collect feedback from customers using surveys, focus groups, interviews, and various forms of observation. Identify the key elements that make these tools effective. Review data collection questions to eliminate vagueness, ambiguity, and any unintended bias. (Apply)	
II.B.3	3. Customer requirements Use quality function deployment (QFD), Critical to X (CTX when 'X' can be quality, cost, safety, etc.), Critical to Quality tree (CTQ), and Kano model to translate customer requirements statements into product features, performance measures, or opportunities for improvement. Use weighting methods as needed to amplify the importance and urgency of different kinds of input; telephone call vs. survey response; product complaint vs. expedited service request. (Apply)	Added CTX, CTQ, and Kano model

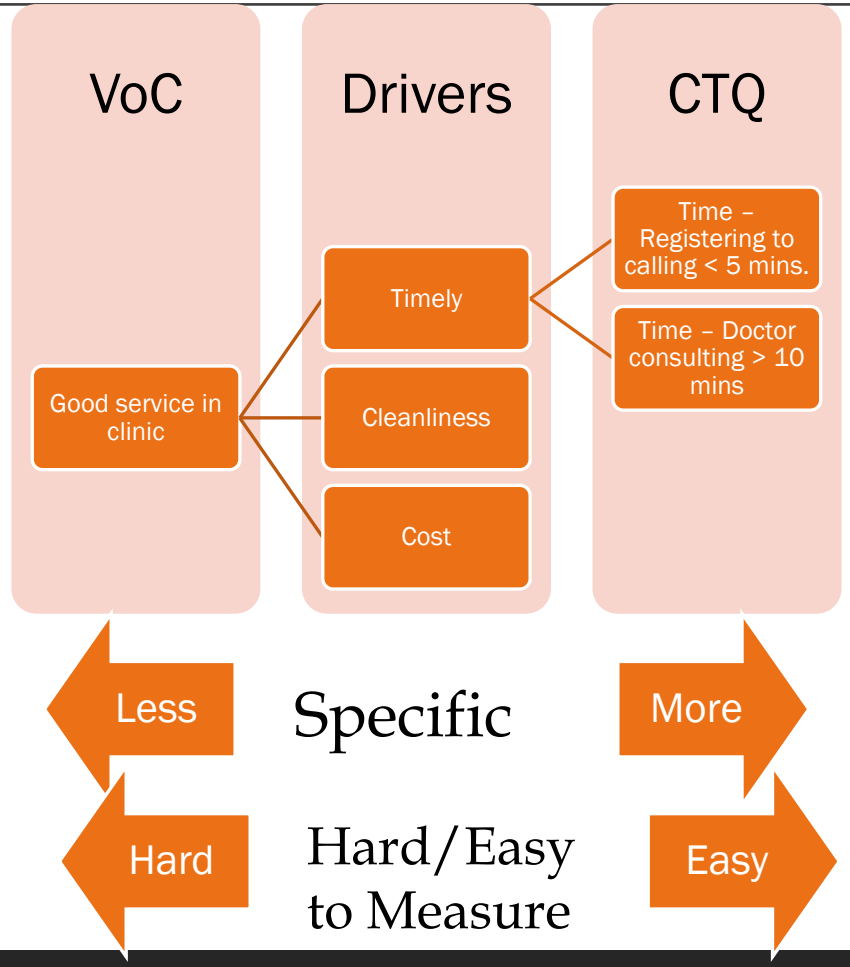
Voice of the customer (VOC)

- Voice of the customer (VOC) is a term used to describe the in-depth process of capturing a customer's expectations, preferences and aversions. (stated and unstated)

Critical to Quality (CTQ)

- VOCs can be vague and difficult to define, that's where CTQs come in.
- The customer may identify a requirement that is difficult to measure directly so it will be necessary to break down what is meant by the customer into identifiable and measurable terms

Critical to Quality (CTQ)



Critical to X (CTX)

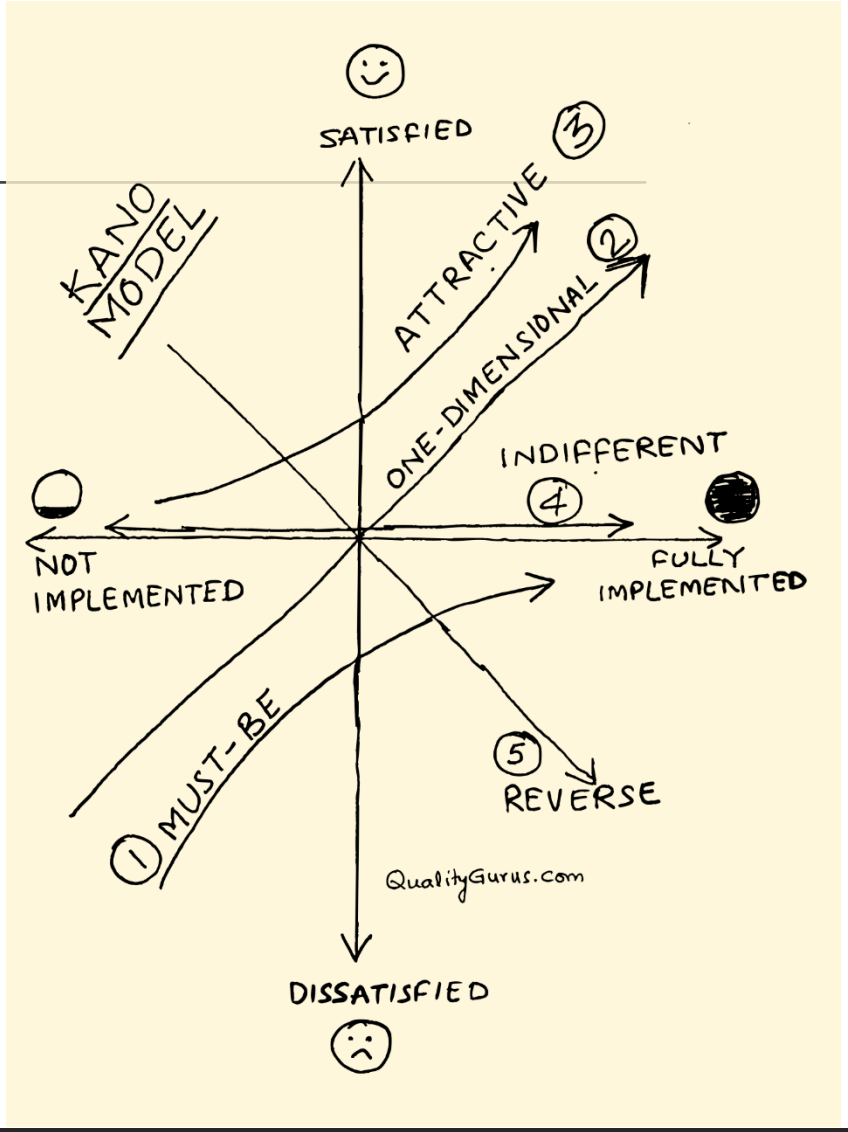
- Here X can be:
  - Quality
  - Safety
  - Cost
  - Etc.

Kano Model

- The Kano model is a theory of product development and customer satisfaction developed in the 1980s by Professor Noriaki Kano, which classifies customer preferences into
  - Must-be quality (basic)
  - One-dimensional quality (expected, performance needs)
  - Attractive quality (delighter)
  - Indifferent quality
  - Reverse quality

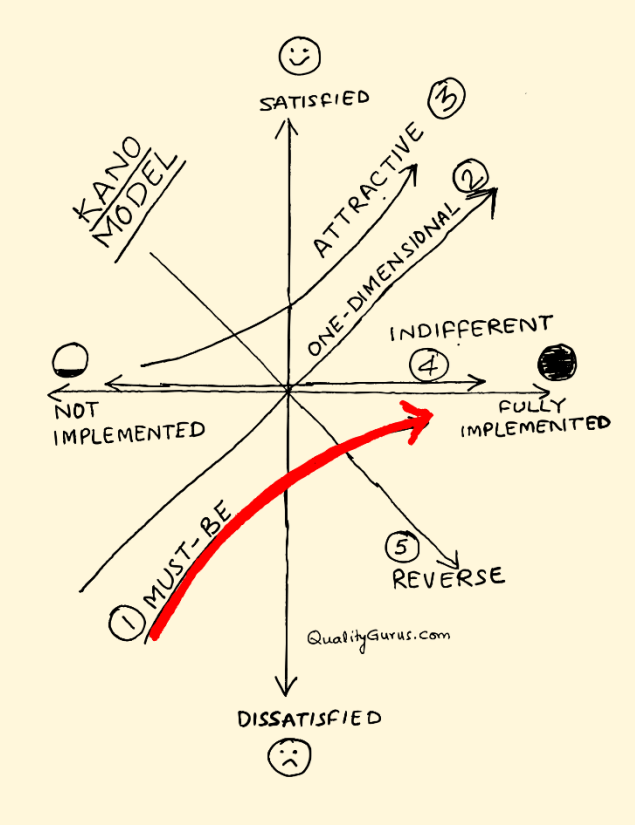
Kano Model

- Must-be quality (basic)
- One-dimensional quality (expected, performance needs)
- Attractive quality (delighter)
- Indifferent quality
- Reverse quality



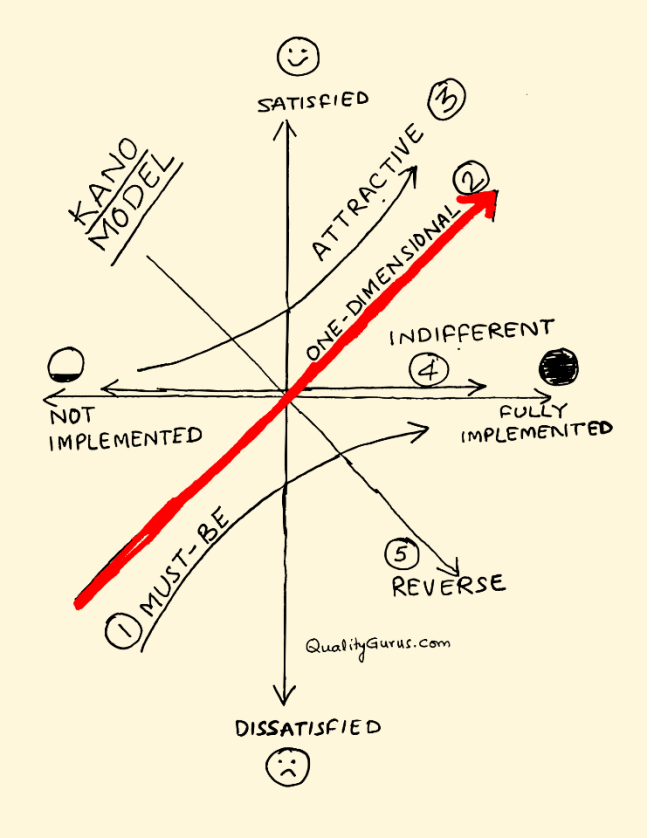
1. Must-be

- Basic requirements of a product or service
- The absence of these lead to high dissatisfaction



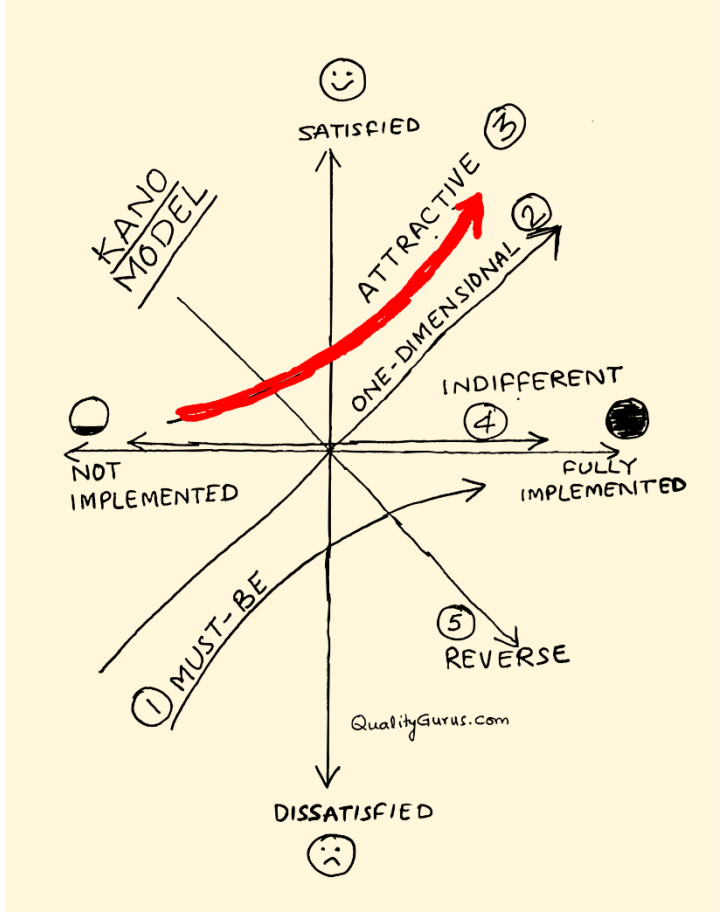
2. One-dimensional

- These features lead to a proportional increase in customer satisfaction



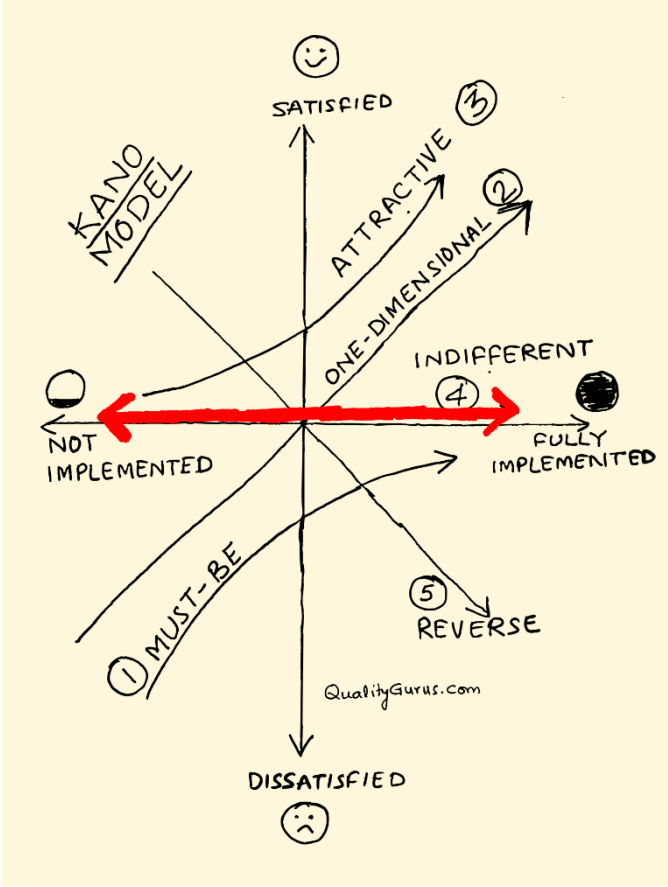
3. Attractive

- These features lead to disproportional increase in customer satisfaction
- If you do not include them, customer might not even notice that
- But if you include them the customer will be excited



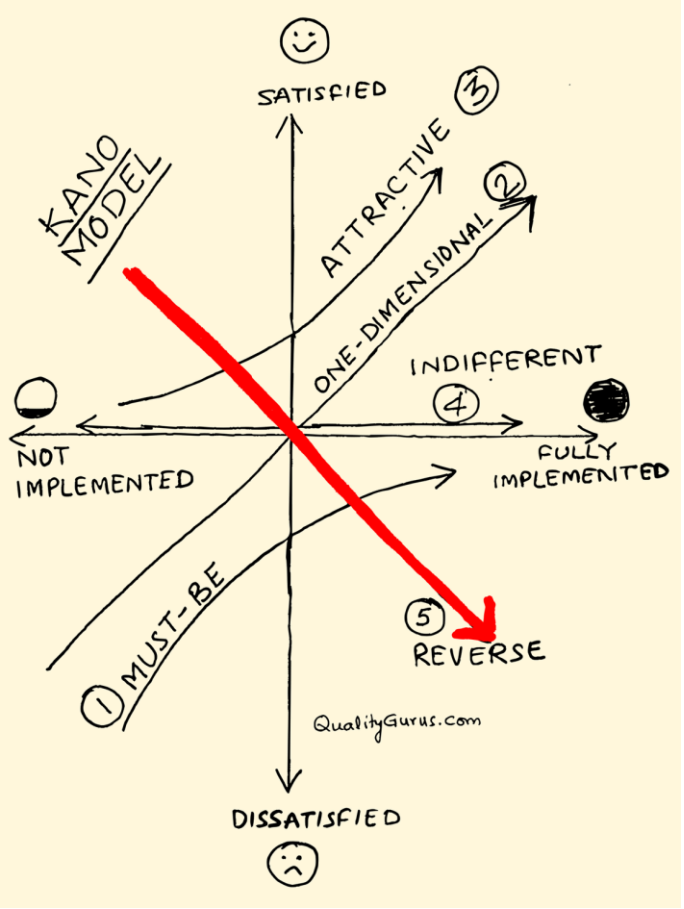
4. Indifferent

- These features do not have any effect on the customer satisfaction.
- It really does not make any difference if you add them or not add them.



5. Reverse

- Presence of these features lead to extreme dissatisfaction, and the absence of them leads to the customer satisfaction



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2C. Project Management Basics

01 Project charter

02 Project scope

03 Project metrics

04 Project Planning Tools

05 Project documentation

06 Project risk analysis

07 Project closure

Project Charter

THE CONTRACT

- Key Elements of Charter
  - **Problem Statement**
  - **Project Scope**
  - **Goals and Objectives (metrics)**
  - **Project Plan – DMAIC start/end**

Problem Statement

What is the problem? Magnitude of the problem, where, when etc.

- ✗ Poor weld quality leading to losses.
- ✗ In our welding shop the average weld repair rate for last 3 months has been 4.5% as against the maximum target of 1%. Poor quality welders are adding to the cost and delaying production.
- ✓ In our welding shop the average weld repair rate for last 3 months has been 4.5% as against the maximum target of 1%. This is adding to the cost and delaying production.

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Project Charter

THE CONTRACT

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  - **Problem Statement**
  - **Project Scope**
  - **Goals and Objectives (metrics)**
  - **Project Plan – DMAIC start/end**

Project Scope

- Just the right size:
  - Not too big – “solving world hunger issue”
  - Not too small
- Is it doable in 2-3 months?
- Depth and width of scope:
  - Depth is vertical – from purchase>receiving inspection>production> assembly>dispatch
  - Width is horizontal – production > machine 1, 2, 3, 4 … / Location a, b, c, d …

Project Scope

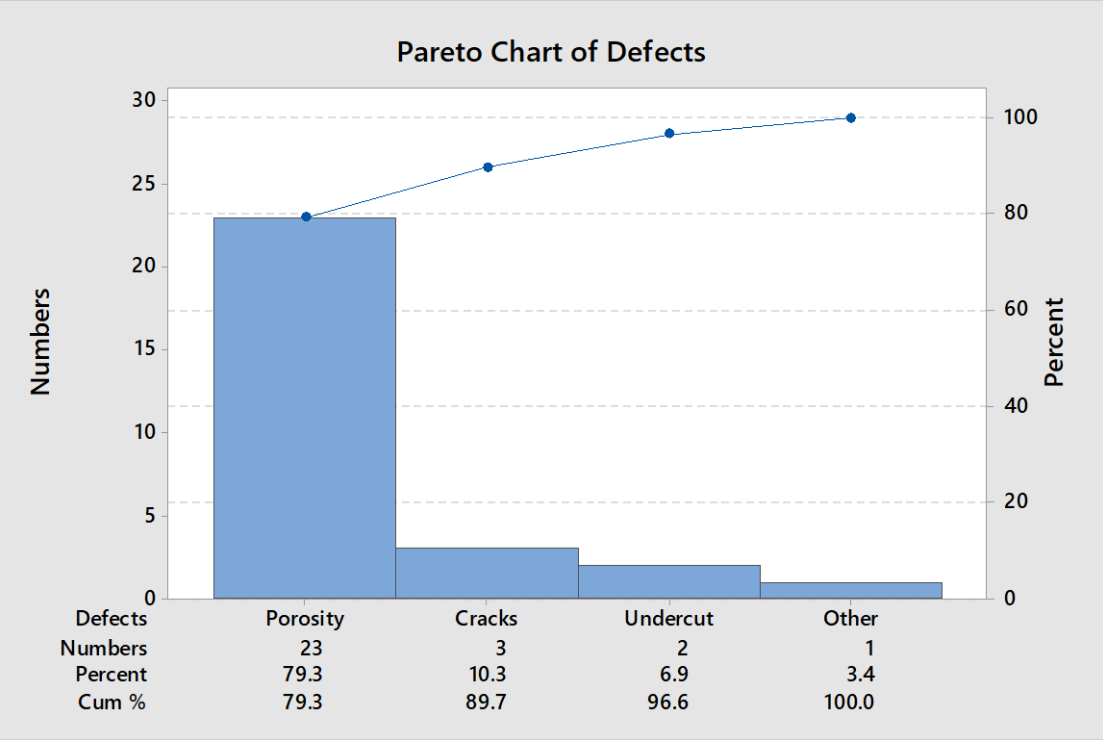
- If scope is too wide then you might consider doing Pareto Analysis and select the “vital fews”.
- It defines the project starting point and ending point.

  “From receiving of welding consumables - to the testing of weld”
- Defines in and out of scope.

  In scope: Welding at weld shop

  Out of scope: Welding done during assembly

Project Scope



Stat > Quality Tools > Pareto Chart …

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  - **Problem Statement**
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  - **Project Plan – DMAIC start/end**

Project Metrics

- Needs to be aligned with the Problem Statement.

- Problem Statement:

  In our welding shop the average weld repair rate for last 3 months has been 4.5% as against the maximum target of 1%. This is adding to the cost and delaying production.

- Metrics:

  weld repair rate

Project Metrics

- Monetary Benefits
  - Increased sale and revenue
  - Reduce cost
  - Avoid cost
  - Avoid investment
  - Cycle time reduction
  - Reduced inventory

- Nonmonetary Benefits
  - Customer satisfaction
  - Employee satisfaction
  - Reputation

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  - **Problem Statement**
  - **Project Scope**
  - **Goals and Objectives (metrics)**
  - **Project Plan – DMAIC start/end**

Project Planning Tools

- Gantt Charts
- Critical Path Method (CPM)
- Program Evaluation and Review Technique (PERT)

Gantt Charts

- A Gantt chart is a type of bar chart,
- Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project.

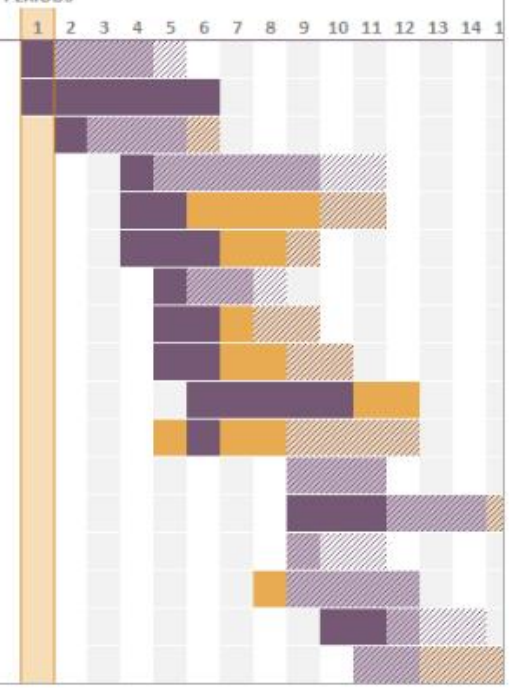
Gantt Charts

Project Planner

Period Highlight: 1 | Plan | Actual

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Activity 01	1	5	1	4	25%
Activity 02	1	6	1	6	100%
Activity 03	2	4	2	5	35%
Activity 04	4	8	4	6	10%
Activity 05	4	2	4	8	85%
Activity 06	4	3	4	6	85%
Activity 07	5	4	5	3	50%
Activity 08	5	2	5	5	60%
Activity 09	5	2	5	6	75%
Activity 10	6	5	6	7	100%
Activity 11	6	1	5	8	60%
Activity 12	9	3	9	3	0%
Activity 13	9	6	9	7	50%
Activity 14	9	3	9	1	0%
Activity 15	9	4	8	5	1%
Activity 16	10	5	10	3	80%
Activity 17	11	2	11	5	0%

PERIODS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 1



Gantt project planner

Provided by: Microsoft Corporation

Use this project planner to track your project b
unique activities using the Gantt chart model.
see where each activity is according to plan.

Create

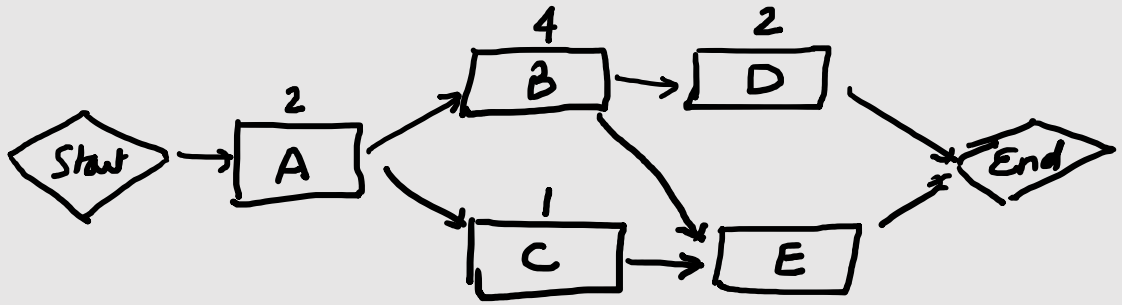
Critical Path Method (CPM)

- CPM is commonly used with all forms of projects
- It includes:
  - A list of all activities required to complete the project
  - The time (duration) that each activity will take to complete,
  - The dependencies between the activities and,
  - Logical end points such as milestones or deliverable items.

Critical Path Method (CPM)

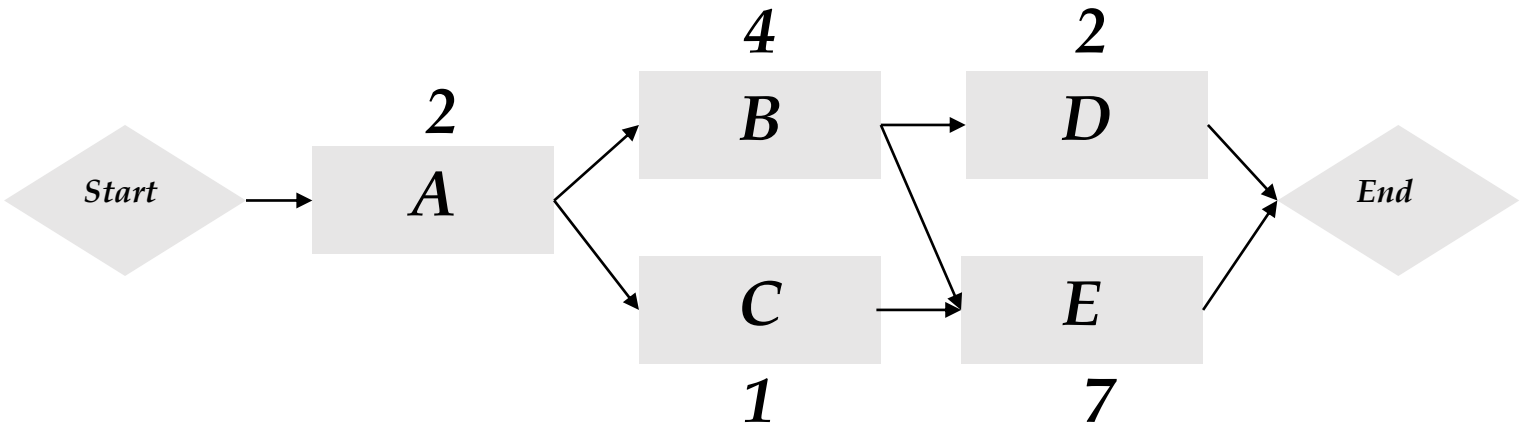
- Predecessor and Successor?
- A predecessor is an activity whose start or finish controls start or finish of another activity.
- A successor is an activity whose start or finish is controlled by start or finish of another activity.

Activity	Duration	Depends on (Predecessor)
A	2	
B	4	A
C	1	A
D	2	B
E	7	B, C

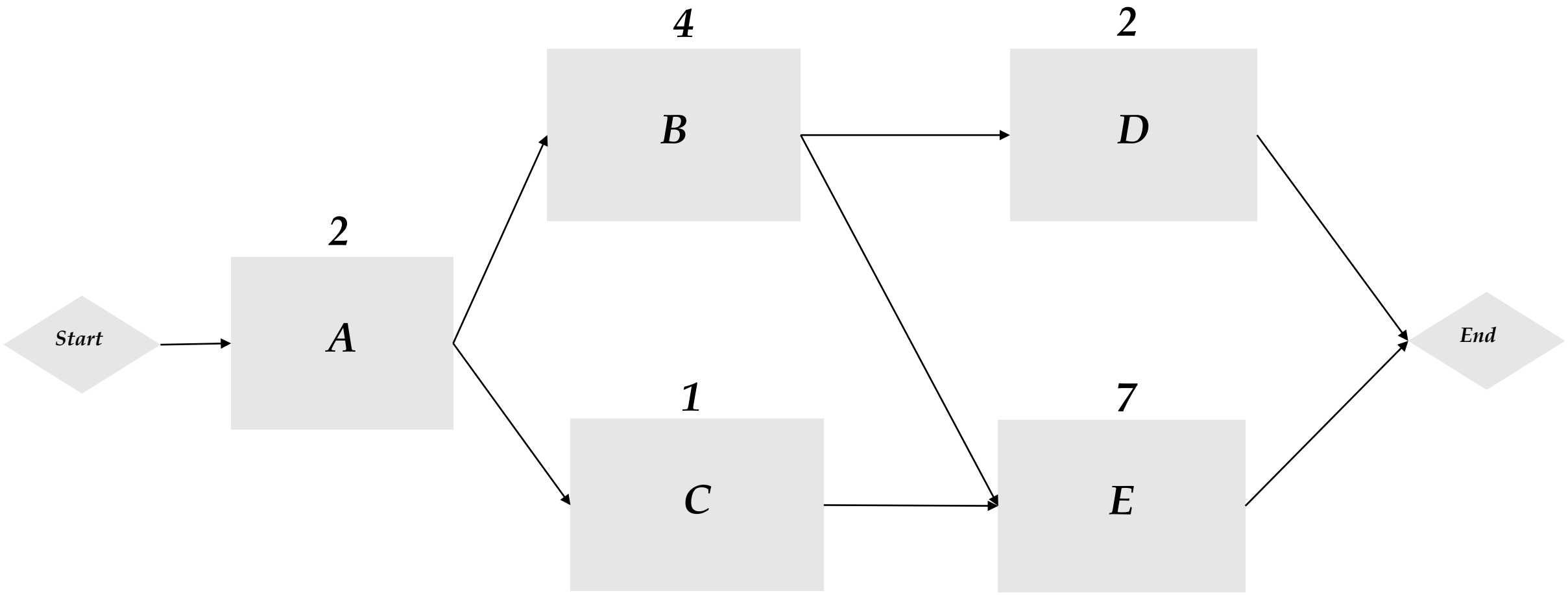


CRITICAL PATH METHOD (CPM)

Activity	Duration	Depends on (Predecessor)
A	2	
B	4	A
C	1	A
D	2	B
E	7	B, C

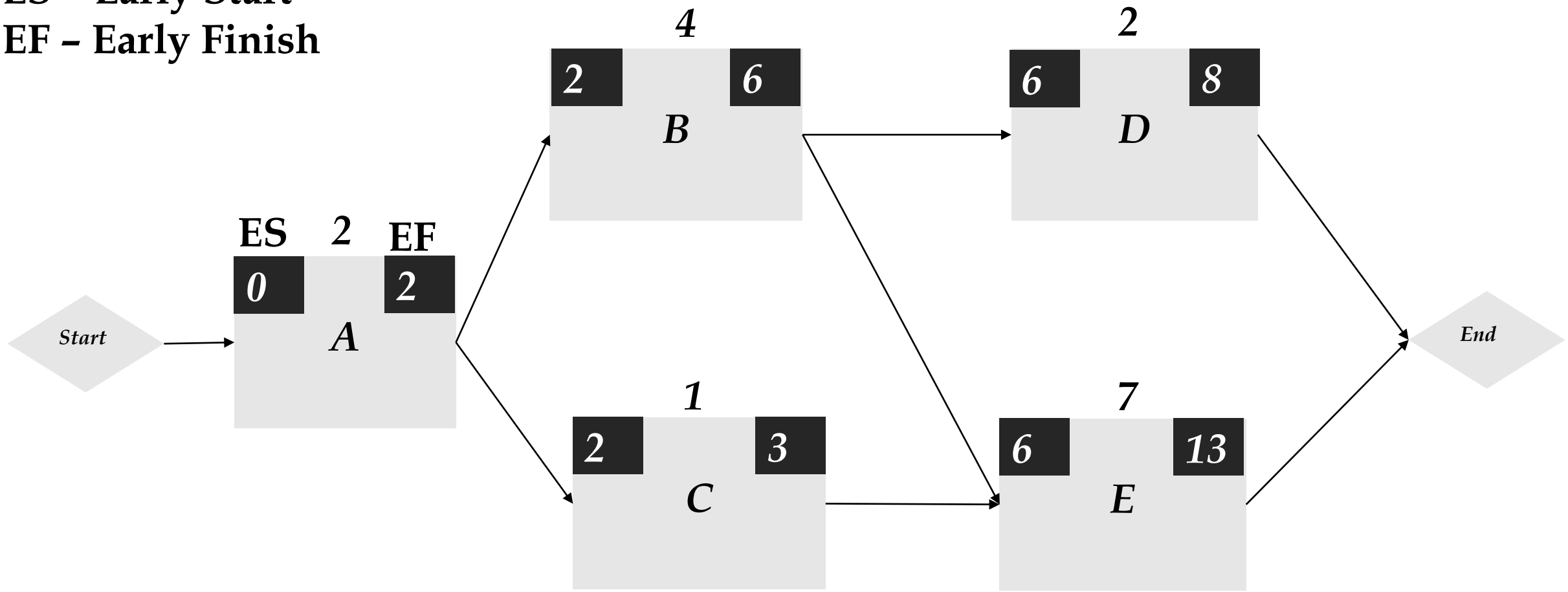


CRITICAL PATH METHOD (CPM)



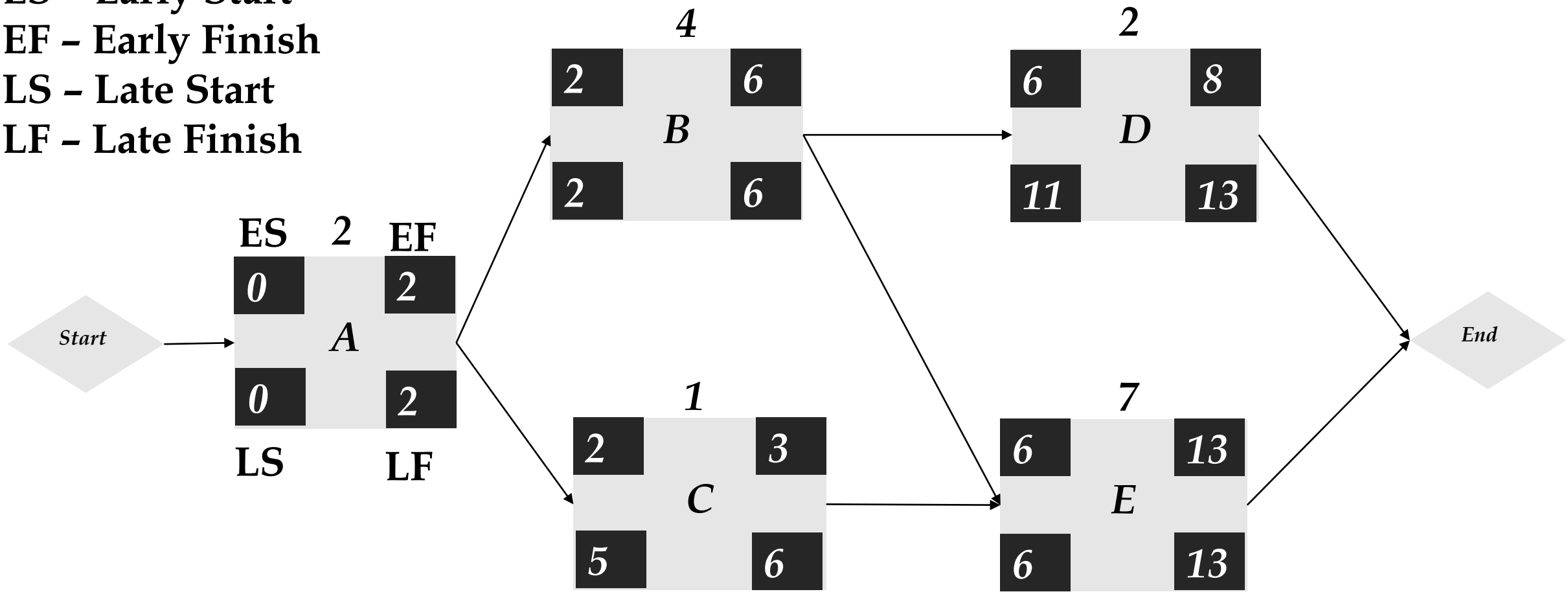
CRITICAL PATH METHOD (CPM)

ES – Early Start
EF – Early Finish



CRITICAL PATH METHOD (CPM)

ES – Early Start
EF – Early Finish
LS – Late Start
LF – Late Finish

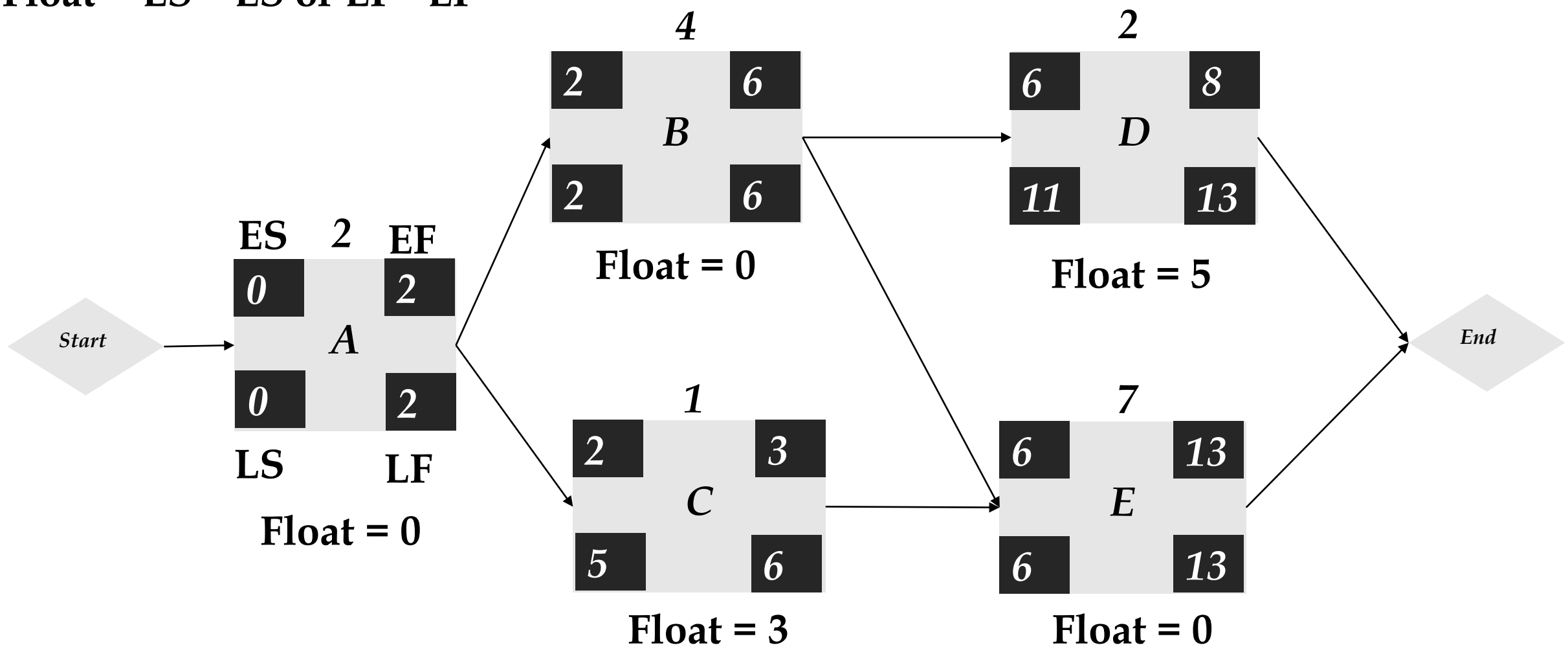


CRITICAL PATH METHOD (CPM)

Critical Path Method (CPM)

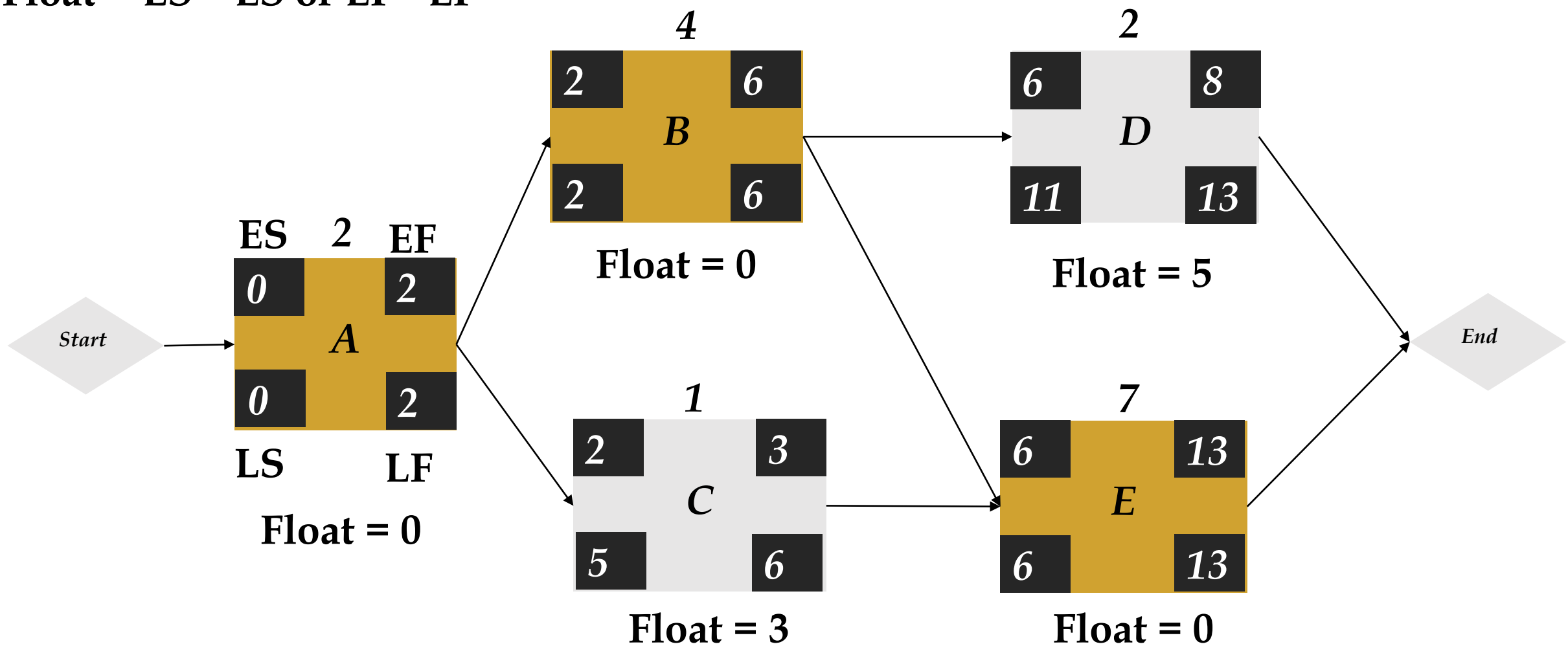
- Float
  - Float or slack is the amount of time that a task in a project network can be delayed without causing a delay
- Critical Path
  - An activity on critical path has "zero free float"

Float = LS – ES or LF - EF



CRITICAL PATH METHOD (CPM)

Float = LS – ES or LF - EF



CRITICAL PATH METHOD (CPM)

Program Evaluation and Review Technique (PERT)

- The PERT Network acknowledges that there will be a time variance (due to uncertainty) in the completion of each activity
- PERT Network uses a probabilistic approach to estimating for each activity.
- To estimate for an activity, the following formula is used:

$$Expected\ Time = \frac{Optimistic + 4.Most\ Likely + Pessimistics}{6}$$

$$Activity\ Standard\ Deviation = \frac{Pessimistic\ - Optimistic}{6}$$

Program Evaluation and Review Technique (PERT)

2C. Project Management Basics

01

02 Project scope

03 Project metrics

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07 Project closure

Project Documentation

.

- Level of documentation will depend on the type and complexity of the project.
- Key Documents
  - **Project Charter**
  - **Working documents – data, analysis, action plans etc.**
  - **Gate review reports**
  - **Final presentation – summary of results/recommendations, storyboard**

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Process / Requirement	Failure Mode	Failure Effect	Severity (1-10)	Cause(s) of failure mode	Occurrence (1-10)	Current Controls (KPIVs)	Detection (1-10)	RPN	Recommended actions
Perfume Making • Receiving	• Wrong ingredients	• Inconsistent quality	(1-10) 8	• Unclear specification	(1-10) 3	• Review and approve specification by design	4	96	
				• Substandard material supplied by supplier	6	• Third party certification • In house test lab	4	192	
• Mixing									

PROJECT RISK ANALYSIS (FMEA)

PROJECT RISK ANALYSIS

Qualitative Risk Analysis

- Quick and easy to perform
- Subjective

Quantitative Risk Analysis

- Detailed and time consuming
- Analytic

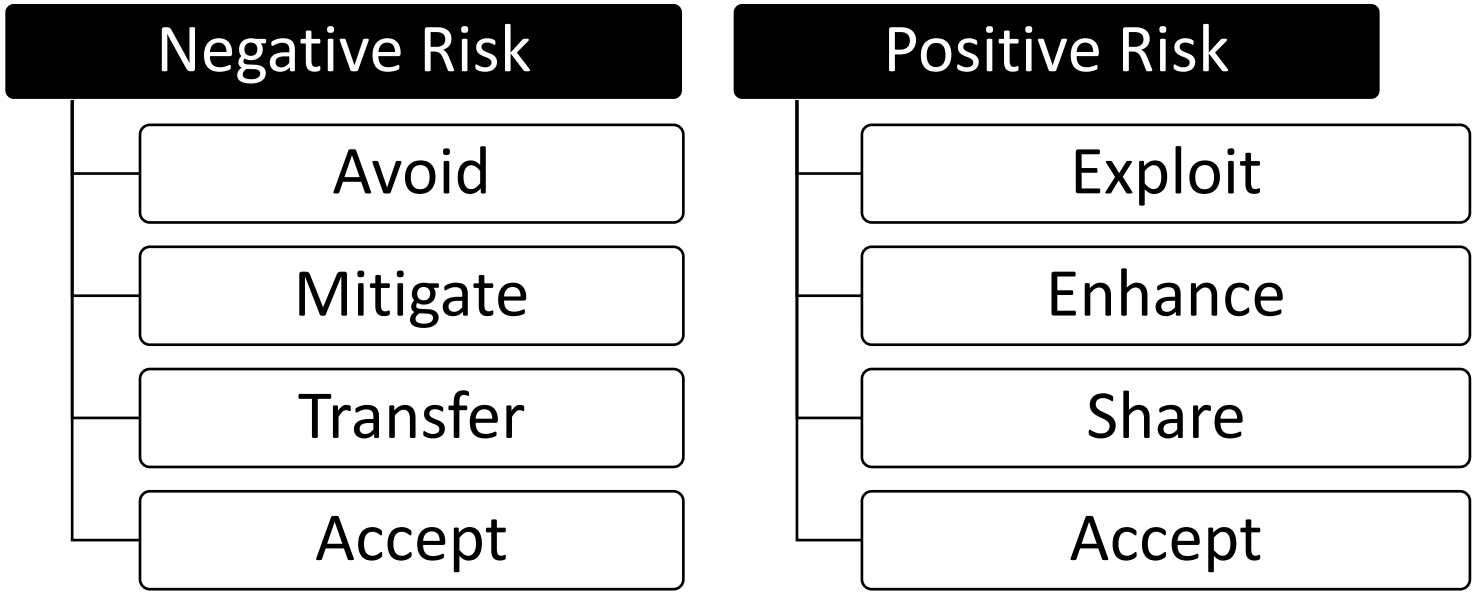
Probability and Impact Matrix	**Expected Monitory Value Analysis** **Monte Carlo Analysis** **Decision Tree**

Probability and Impact Matrix

Probability \ Impact	Very Low	Low	Medium	High	Very High
Very High	Medium	Medium	High	High	High
High	Low	Medium	Medium	High	High
Medium	Low	Medium	Medium	Medium	High
Low	Low	Low	Medium	Medium	Medium
Very Low	Low	Low	Low	Low	Medium

In FMEA
RPN = Severity x Occurrence x Detection

Risk Responses



2C. Project Management Basics

01 Project charter

02 Project scope

03 Project metrics

04 Project Planning Tools

05 Project documentation

06 Project risk analysis

07 Project closure

Project Closure

- Have you achieved the objectives identified in the Project Charter?
- Are documents archived for future reference?
- Are Lessons Learned documented?
  - What went well, which you would repeat on the next project?
  - What went wrong, which you will avoid on your next project?
  - Is there a need to revise any process?

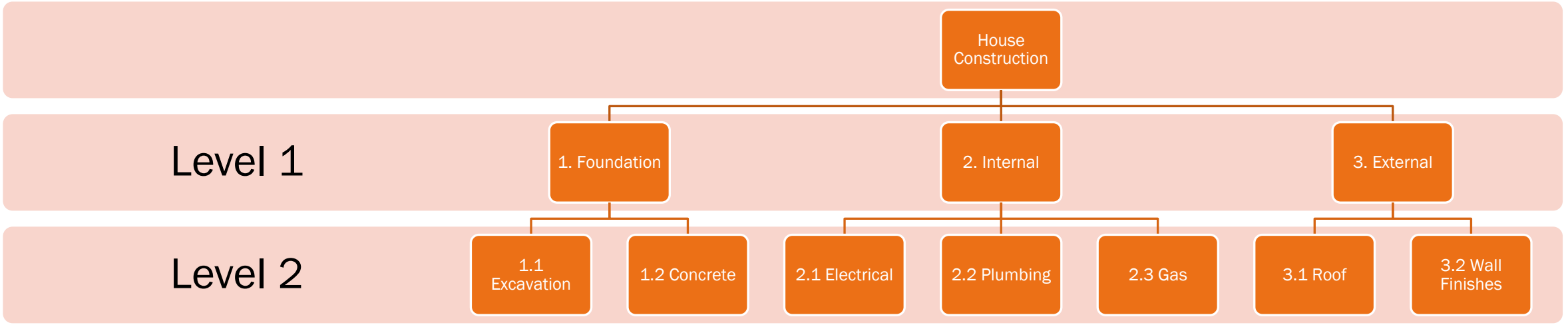
2022 – Changes in the BoK – 2C

	C. Project management basics	
NEW	1. Project methodology Define and apply agile and top-down management methods. (Apply)	
II.C.1	2. Project charter Define and describe elements of a project charter and develop a problem statement that includes baseline data or current status to be improved and the project's goals. (Apply)	
II.C.2	3. Project scope Help define the scope of the project using process maps, Pareto charts, and other quality tools. (Apply)	
II.C3.	4. Project metrics Help develop primary metrics (reduce defect levels by x-amount) and consequential metrics (the negative effects that making the planned improvement might cause). (Apply)	
II.C.4	5. Project planning tools Use work breakdown structures (WBS), Gantt charts, critical path method (CPM),and program evaluation and review technique (PERT) charts, and toll-gate reviews to plan projects and monitor their progress. (Apply)	Added work breakdown structure (WBS), and toll-gate reviews
2014 BoK	**2022 BoK Details**	**Notes**
II.C.5	6. Project documentation Describe the types of data and input needed to document a project. Identify and help develop appropriate presentation tools (storyboards, spreadsheet summary of results) for phase reviews and management updates. (Apply)	
II.C.6	7. Project risk analysis and management Describe the elements of project risk analysis, including feasibility, potential impact, risk priority number (RPN), and risk management. Identify the potential effect risk can have on project goals and schedule, resources (materials and personnel), business continuity planning, costs and other financial measures, and stakeholders. (Understand)	Revised subtopic name; added risk management and business continuity planning
II.C.7	8. Project closure Review with team members and sponsors the project objectives achieved in relation to the charter and ensure that documentation is completed and stored appropriately. Identify lessons learned and inform other parts of the organization about opportunities for improvement. (Apply)	

Work Breakdown Structure (WBS)

- WBS is used to break down a project into manageable components.
- It involves subdividing the major project activities or sub-activities into smaller, more manageable activities.
- 100% Rule - WBS includes 100% of the work defined by the project scope and captures all deliverables (internal, external, and interim) in terms of work to be completed.

Work Breakdown Structure (WBS)



Toll Gate Review

- Checkpoint to confirm if the work has progressed as per plan, and
- Does it make sense to move to the next phase of the project?
- Review is conducted if the required steps are completed and deliverable prepared.
- Review by Sponsor and Stakeholders.

Toll Gate Review

Risk - Definition

Risk Management steps are Already covered in 2C

Risk: Effect of uncertainties on objectives

- Organizations and people must strive for a balance between risk and reward.
- Generally, more risks lead to more rewards. But that is not always true.
  - People and organizations want more rewards with less risk.
  - Risk management helps maximize the benefit of risk by managing the consequences (impact) and likelihood (probability) of risk events.

Risk Management - Definition

- Coordinated activities to direct and control an organization with regard to risk. (ISO 31000:2018)
- Risk management is the identification, evaluation, and prioritization of risks (positive or negative) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities. (Wikipedia)

Risk Management - Definition

Identification of risks

Assessment of risks

Prioritization of risks

Resources

minimize

monitor

control

probability and/or impact of unfortunate events

maximize

realization of opportunities

Business Continuity Planning

- The process of creating systems of prevention and recovery to deal with potential threats to a company.
- Potential threats and recovery steps are included in the BCP.
- Common treats include – Fire, flood, strike, earthquake, war, outages, cyber attack, terrorist attack etc.

Contingency Planning

- A contingency plan is a plan devised for an outcome other than in the usual (expected) plan.
- Events covered in the contingency plan are not as extreme as the Business Continuity Plan.
- Examples: Supplier going out of business, bankruptcy, price/currency fluctuations

2D. Management and Planning Tools

01 *Affinity diagrams*

02 *Interrelationship digraphs*

03 *Tree diagrams*

04 *Prioritization matrices*

05 *Matrix diagrams*

06 *Process decision program charts*

07 *Activity network diagrams*

1. Affinity Diagrams

Grouping ideas

- To organize large number of ideas into natural groups
  - After brainstorming
  - Interviews/surveys – open ended questions

- Also known as K-J Method after Kawakita Jiro who developed this tool.

More quizzes

interactive

To the point

Flash cards

Easy to understand

Small videos

Detailed coverage

slides

notes

Cover the BoK

practice

AFFINITY DIAGRAMS

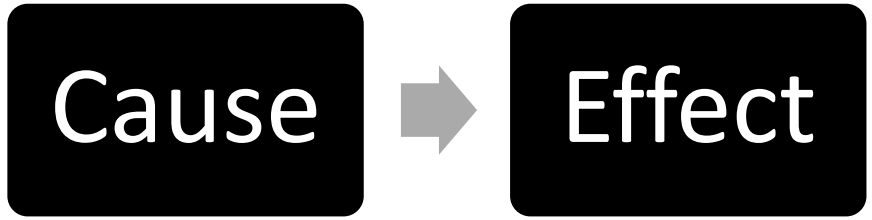
Contents	Presentation	Practice
Detailed coverage	Small videos	Interactive
To the point	Slides	More quizzes
Easy to understand	Notes	Flash cards
Cover the BoK		Practice

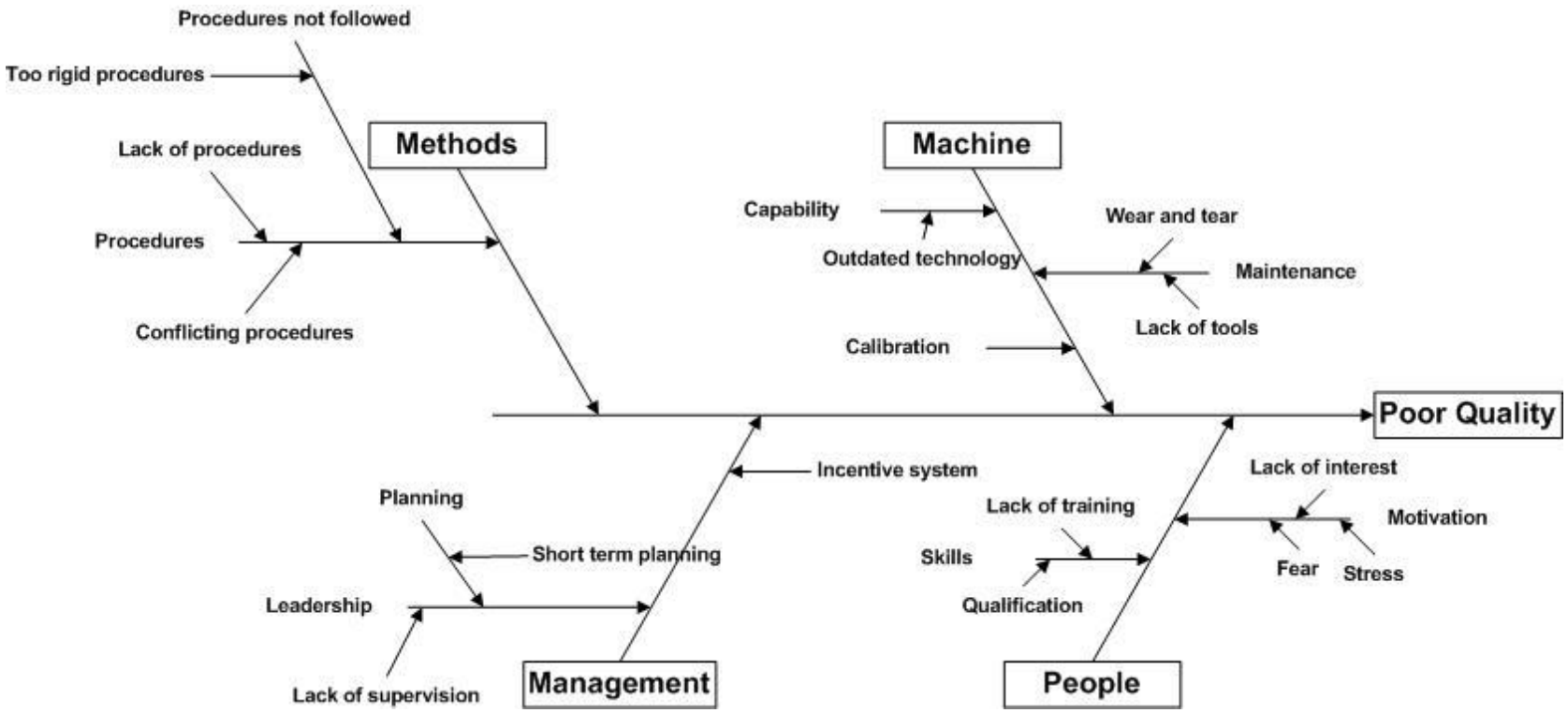
AFFINITY DIAGRAMS

2. Interrelationship Digraphs

Connecting ideas

- Interrelationship digraphs show cause-and-effect relationships, and help analyze the natural links between different aspects of a complex situation.



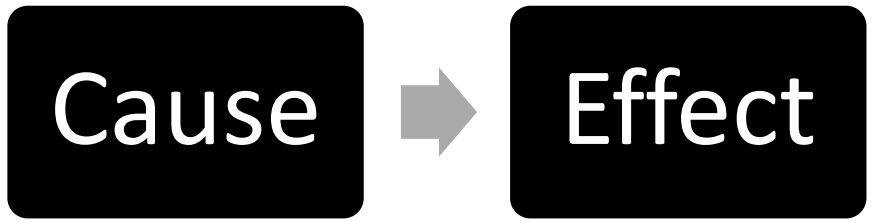


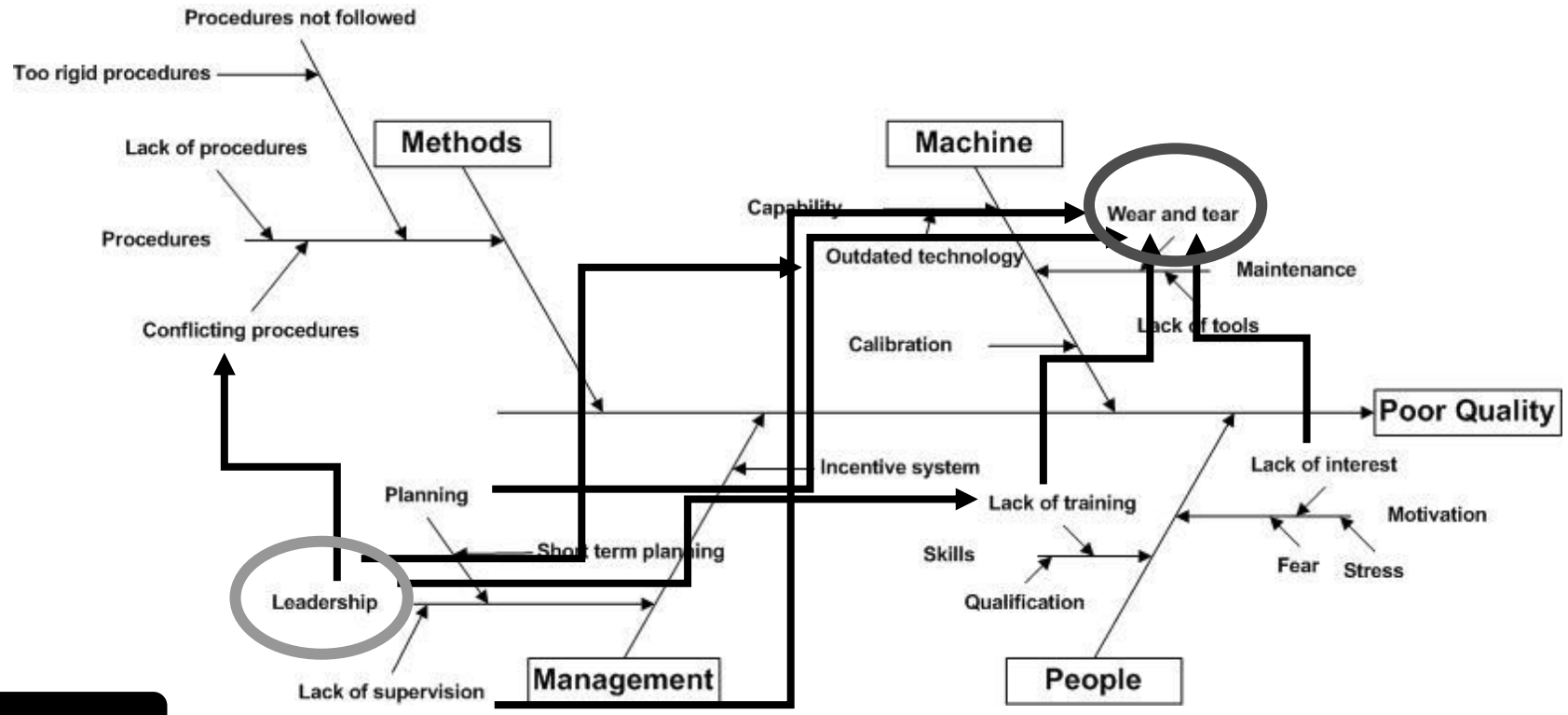
INTERRELATIONSHIP DIGRAPHS

2. Interrelationship Digraphs

Connecting ideas

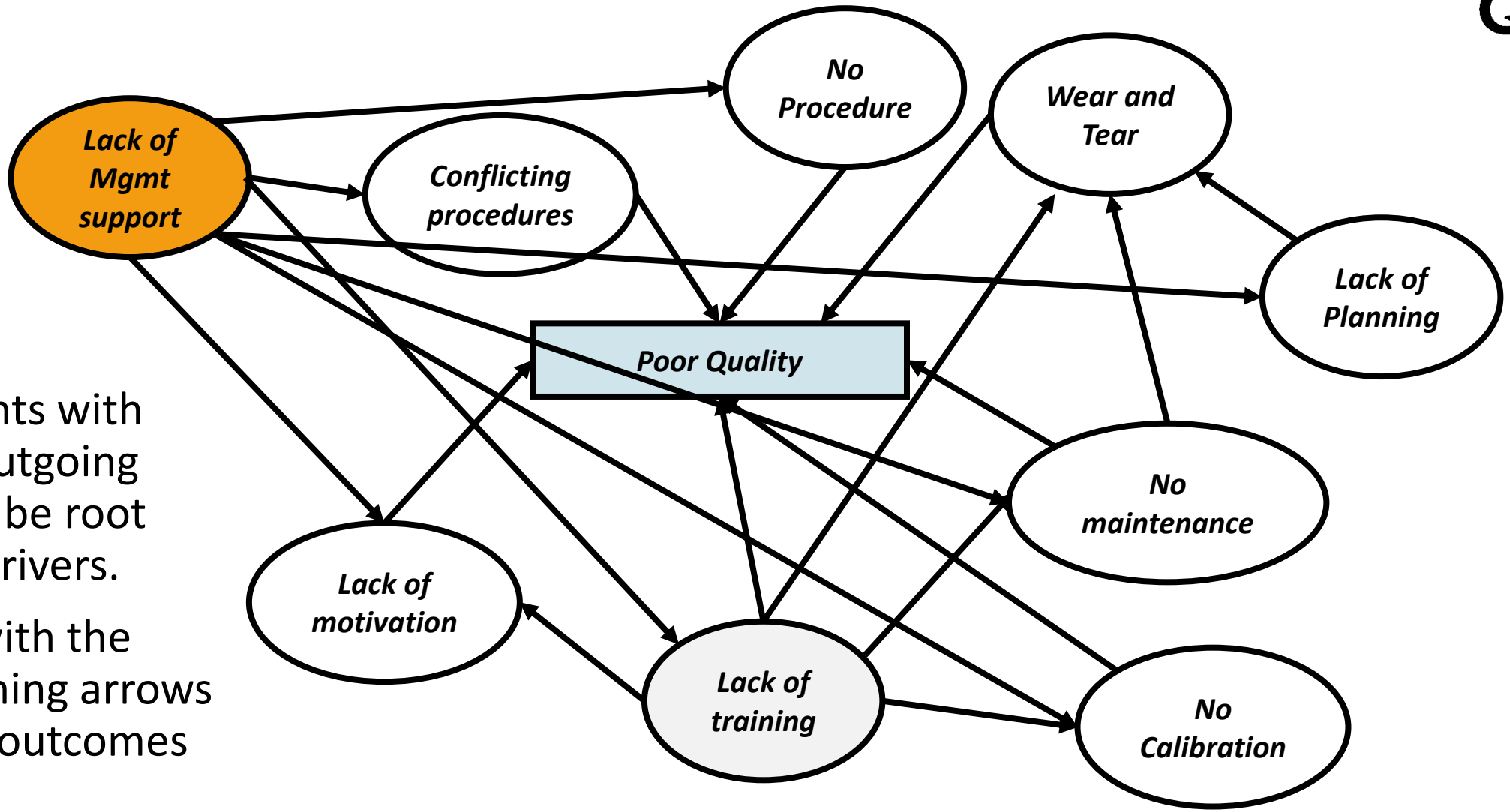
- High number of outgoing arrows > Root cause or driver
- High number of incoming arrows > Key effect or outcome





Cause → Effect

INTERRELATIONSHIP DIGRAPHS

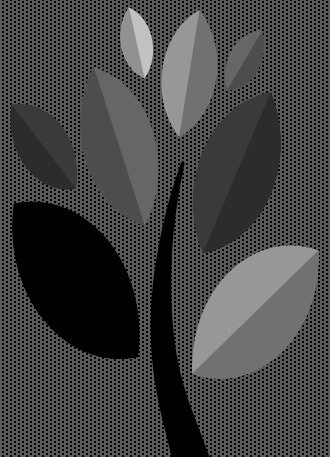


- The elements with the most outgoing arrows will be root causes or drivers.
- The ones with the most incoming arrows will be key outcomes or results.

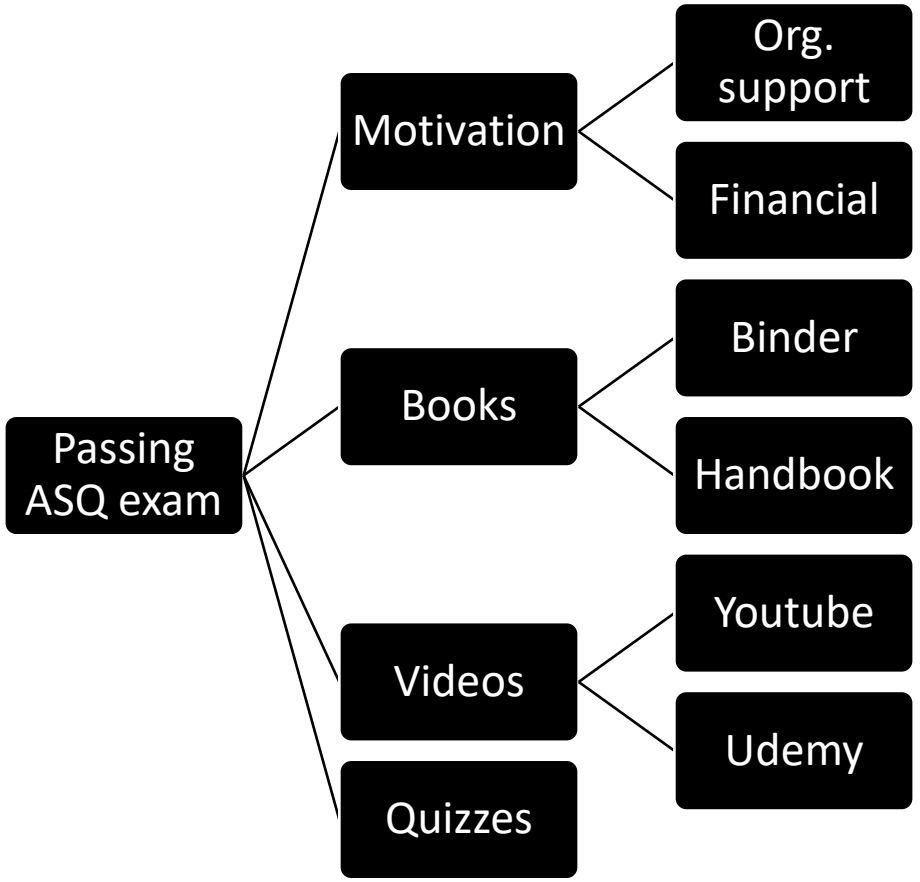
INTERRELATIONSHIP DIGRAPHS

3. Tree Diagrams

Breaking to finer detail



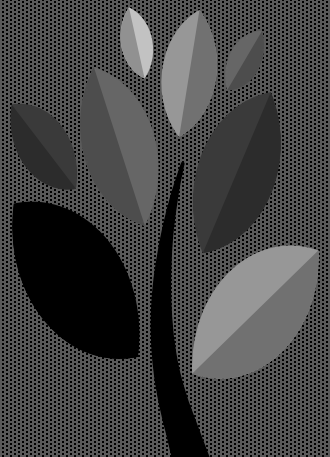
- To breakdown a goal or broad category into fine level of details
- Finer details of activities that contributes to the issue.
- Results of cause-and-effect diagram and affinity diagram can assist in creating the Tree Diagram.



TREE DIAGRAMS

4. Prioritization Matrices

Make a choice



- It is used to compare choices
- Or to select a project

	IMPORTANCE	Product 1	Product 2	Product 3	Product 4	Product 5
Efficiency	0.3	2	3	5	2	1
Pickup	0.1	1	3	4	5	3
Look	0.4	1	2	5	4	4
Comfort	0.2	2	1	4	2	3
Total	**1.0**	**1.50**	**2.2**	**4.7**	**3.1**	**2.8**

PRIORITIZATION MATRICES

	IMPORTANCE	Project 1	Project 2	Project 3	Project 4	Project 5
Easy to do	0.3	2	3	5	2	1
Project sponsorship	0.1	1	3	4	5	3
Makes profit	0.4	1	2	5	4	4
Team availability	0.2	2	1	4	2	3
Total	**1.0**	**1.50**	**2.2**	**4.7**	**3.1**	**2.8**

PRIORITIZATION MATRICES

2D. Management and Planning Tools

01 *Affinity diagrams*

02 *Interrelationship digraphs*

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04 *Prioritization matrices*

05 *Matrix diagrams*

06 *Process decision program charts*

07 *Activity network diagrams*

5. Matrix Diagrams

Show Relationship

- Shows the relationship between two or more groups.

	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6
Difficulty Level	1	5	3	2	1	1
Conceptual Knowledge	4	3	2	1	1	1
Statistical Knowledge	1	1	1	1	5	5
Business Application	2	4	5	4	2	2

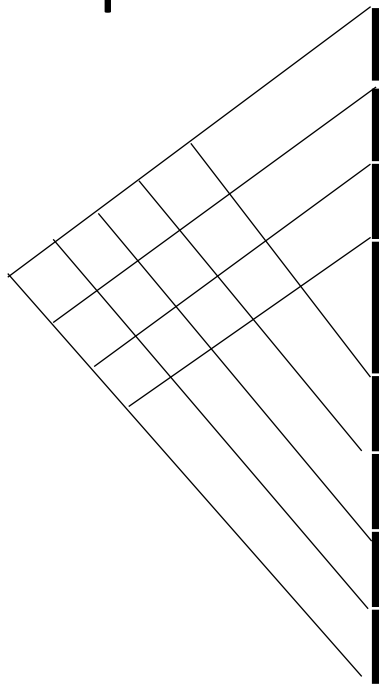
Similar to Prioritization Matrices

L SHAPED MATRIX

Returns	5	3	1	1	3
Complaints	5	4	1	3	2
Sale	1	2	5	4	5
	Product 1	Product 2	Product 3	Product 4	Product 5
Efficiency	2	3	5	2	1
Pickup	1	3	4	5	3
Look	1	2	5	4	4
Comfort	2	1	4	2	3

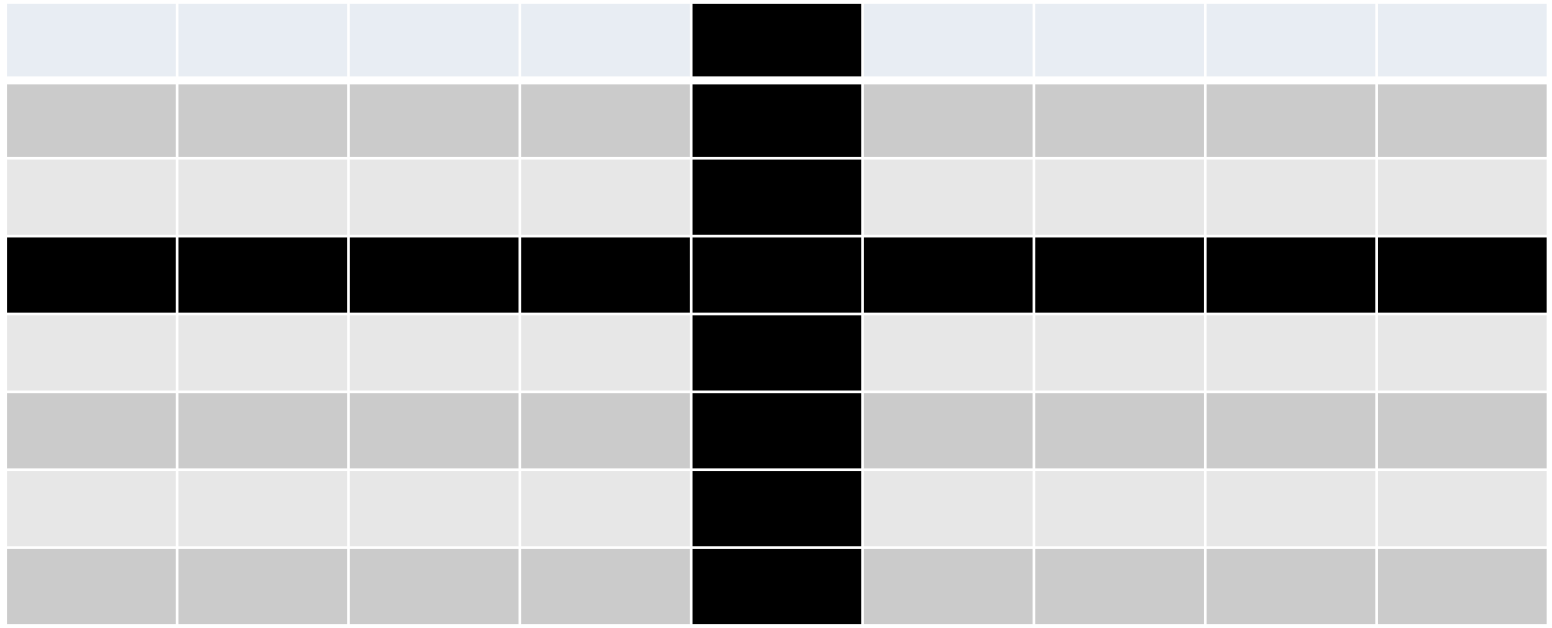
T SHAPED MATRIX

Y Shaped

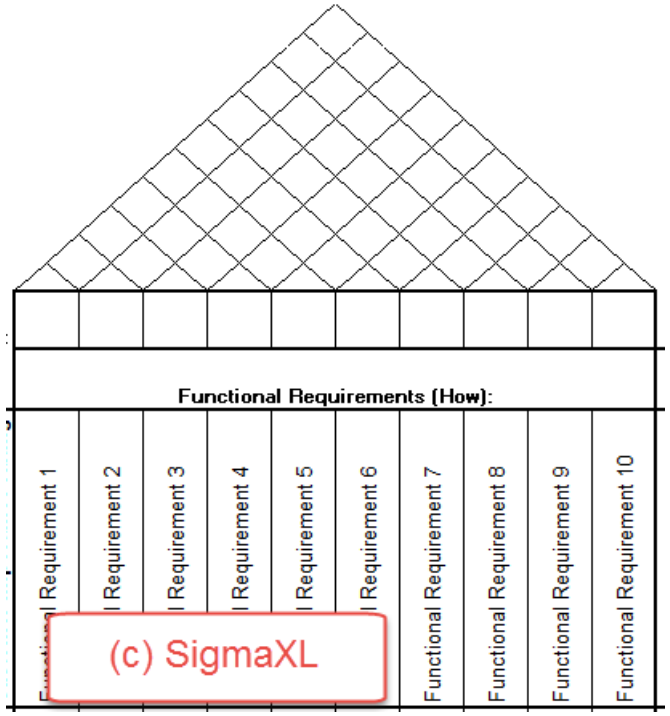


Returns	5	3	1	1	3
Complaints	5	4	1	3	2
Sale	1	2	5	4	5
	Product 1	Product 2	Product 3	Product 4	Product 5
Efficiency	2	3	5	2	1
Pickup	1	3	4	5	3
Look	1	2	5	4	4
Comfort	2	1	4	2	3

Y SHAPED MATRIX



X SHAPED MATRIX



Efficiency
Pickup
Look
Comfort

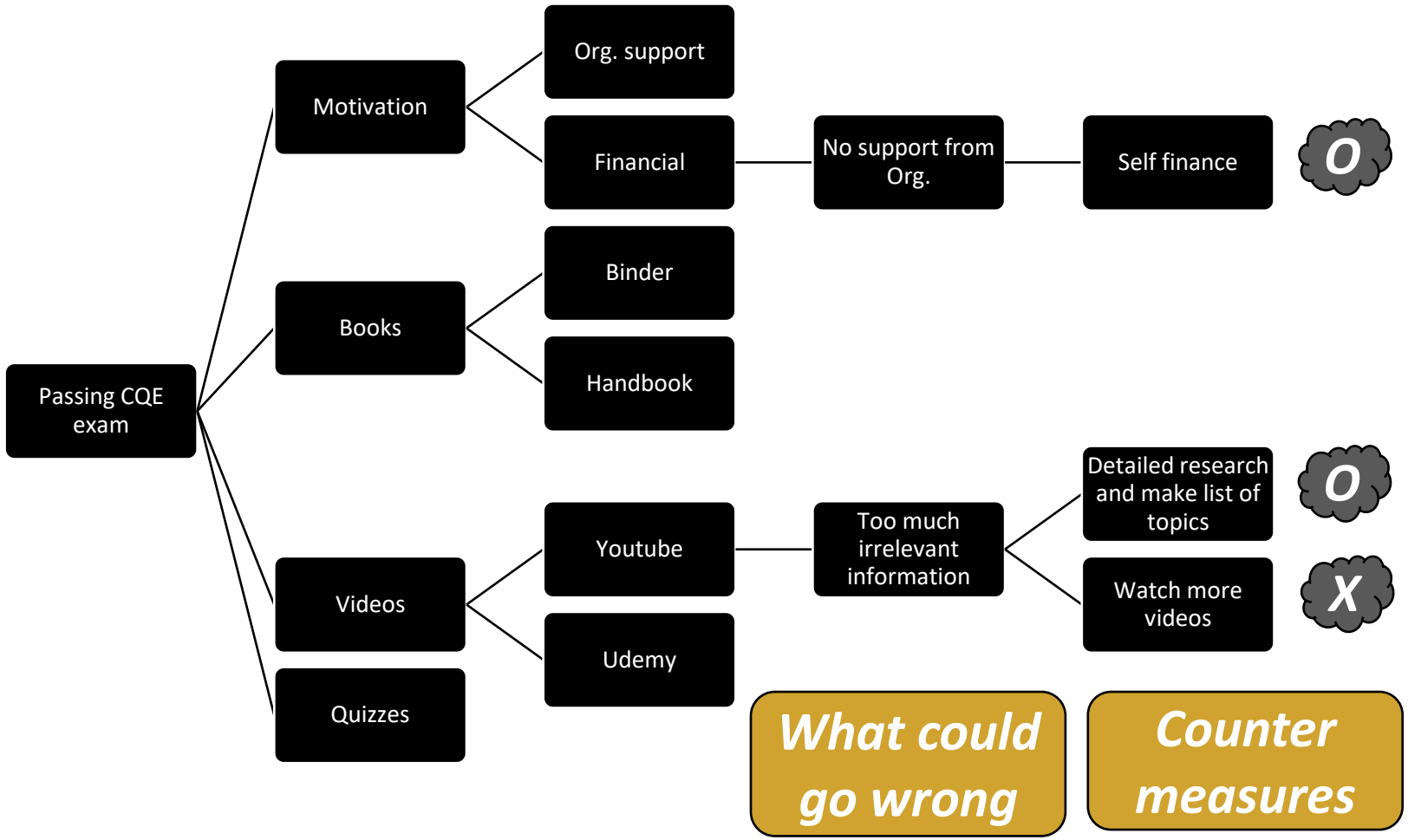
ROOF SHAPED MATRIX

6. Process Decision Program Charts

PDPC

What could go wrong?

- PDPC is used to identify what may go wrong in a new plan.
- This tool is some what similar to FMEA
- You start with a tree diagram to break down the objective into tasks.
- Draw the next level as what could go wrong, and at the end the countermeasures to address issues.



O – Practical
X - Impractical

PROCESS DECISION PROGRAM CHARTS (PDPC)

7. Activity Network Diagrams

Manage Tasks

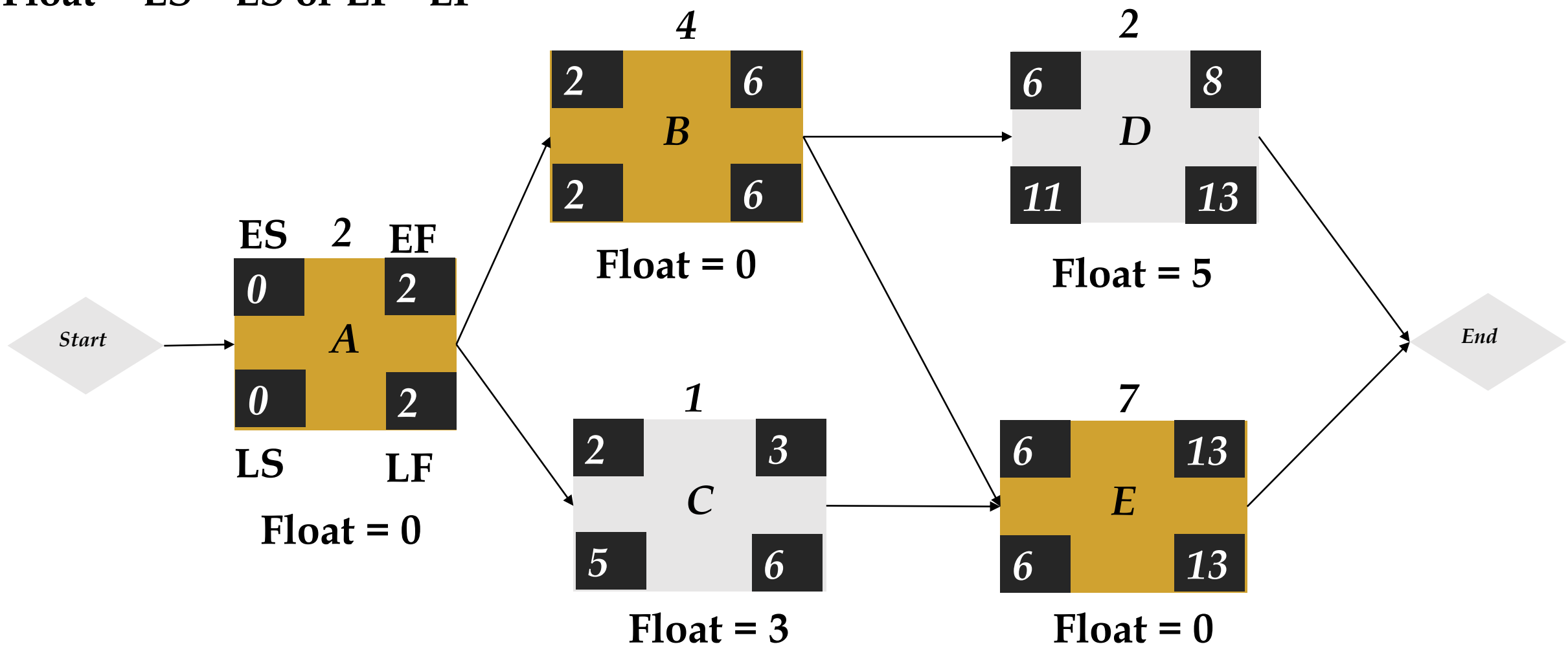
- To manage number of tasks in a sequence.
  - List down tasks
  - Time for each task
  - Predecessor and successor tasks
  - Identify bottlenecks

7. Activity Network Diagrams

Manage Tasks

- Float
  - float or slack is the amount of time that a task in a project network can be delayed without causing a delay
- Critical Path
  - An activity on critical path has "zero free float"

Float = LS – ES or LF - EF



CRITICAL PATH METHOD (CPM)

2022 – Changes in the BoK – 2D

II.D	**D. Management and planning tools** Define, select, and apply these tools: 1) affinity diagrams, 2) interrelationship digraphs, 3) tree diagrams, 4) prioritization matrices, 5) matrix diagrams, 6) process decision program charts (PDPC), 7) activity network diagrams, and 8) SWOT analysis. (Apply)	Added SWOT analysis

SWOT Analysis

	HELPFUL	HARMFUL
INTERNAL	- Industry experience - Quality Management knowledge	- Accent
EXTERNAL	- Cost of other courses is very high ($600 to $1000+) - Some concepts are difficult to understand by reading books	- More competitors in future

STRENGTHS

Characteristics of the business or project that give it an advantage over others.

WEAKNESSES

Characteristics of the business that place the business or project at a disadvantage relative to others.

OPPORTUNITIES

Elements in the environment that the business or project could exploit to its advantage.

THREATS

Elements in the environment that could cause trouble for the business or project.

2E. Business Results For Projects

01 Process Performance

02 Communication

2E. Process Performance

01 *Defects per unit (DPU)*

02 *Rolled throughput yield (RTY)*

03 *Cost of poor quality*

04 *Defects per million opportunities*

05 *Sigma levels*

06 *Process capability indices (3F-3)*

1. Defects Per Unit

DPU

- Number of Defects / Number of Units
- In 3,000 welds defects observed were:
  - 10 Cracks
  - 15 Porosity
  - 5 Undercut
- DPU = (10+15+5)/3,000 = 30/3,000
  = 1/100 = 0.01

Defect vs Defective

- A nonconforming unit is a defective unit

- Defect is nonconformance on one of many possible quality characteristics of a unit that causes customer dissatisfaction.

2. Rolled Throughput Yield

RTY

- Units entering a process = P
- Defective Units = D
- Yield = (P-D)/P
- Y1 = 0.99, Y2 =0.95, Y3=0.98
- RTY = Y1 . Y2 . Y3 = 0.99x0.95x0.98
  =0.92169

3. Cost of Poor Quality

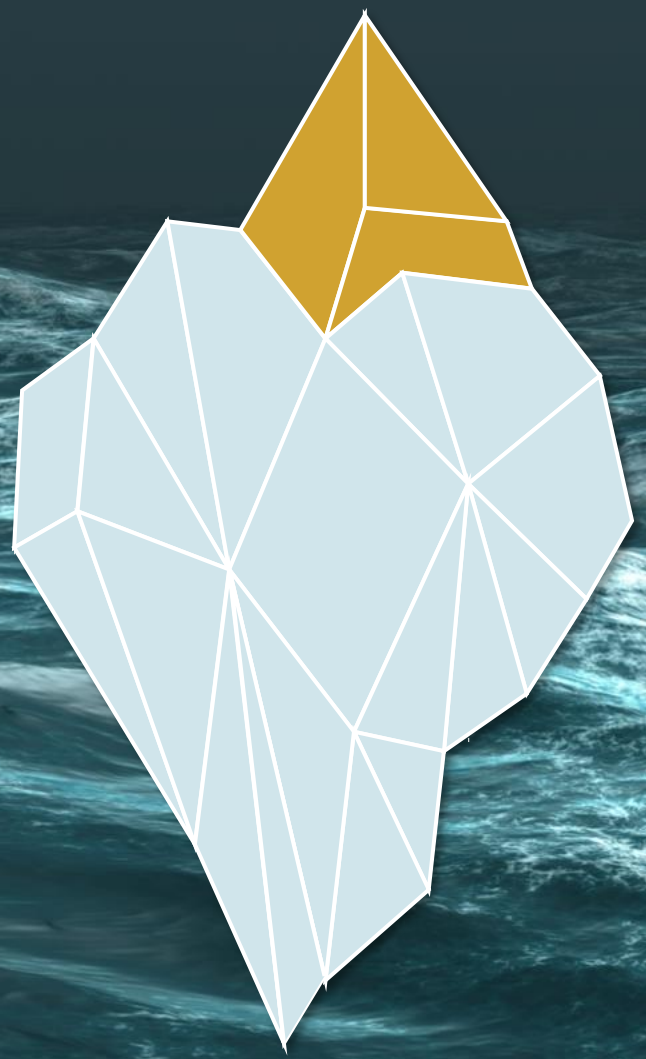
CoPQ

- Visible cost
- Invisible cost

Cost of Poor Quality

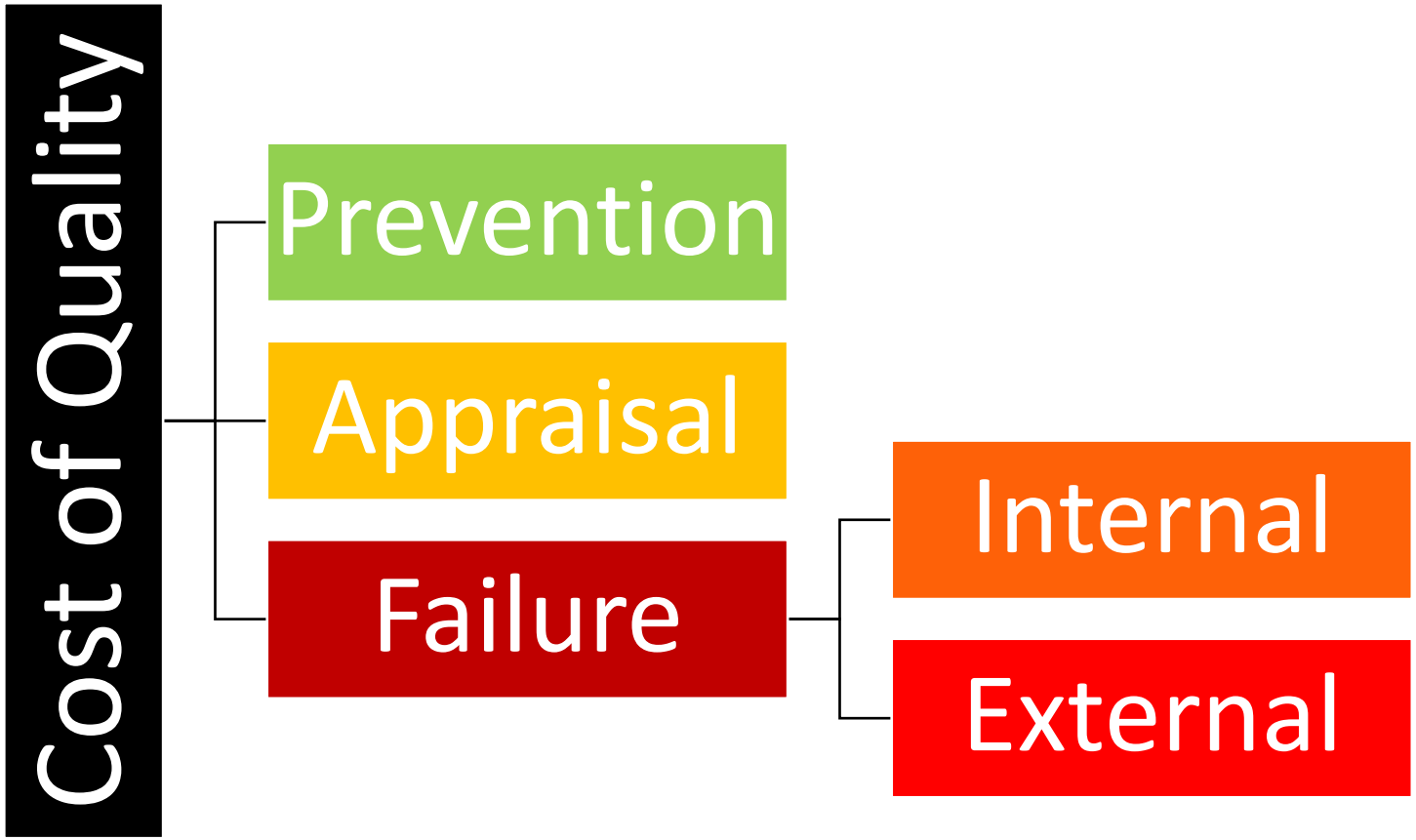
Visible

rejection, rework, repair cost and the cost of inspection



Invisible

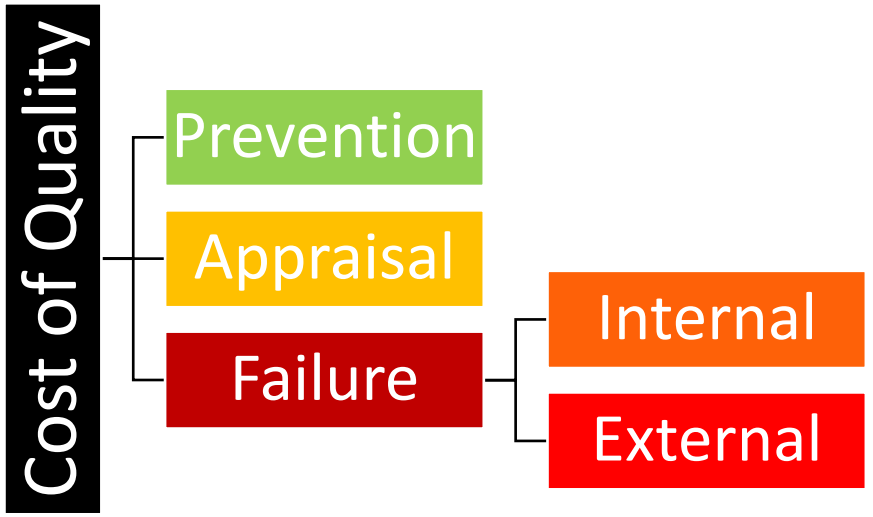
Lost sales, excess inventory, additional controls and procedures, complaint investigation, fines, legal fee etc.



COST OF POOR QUALITY

Cost of Poor Quality

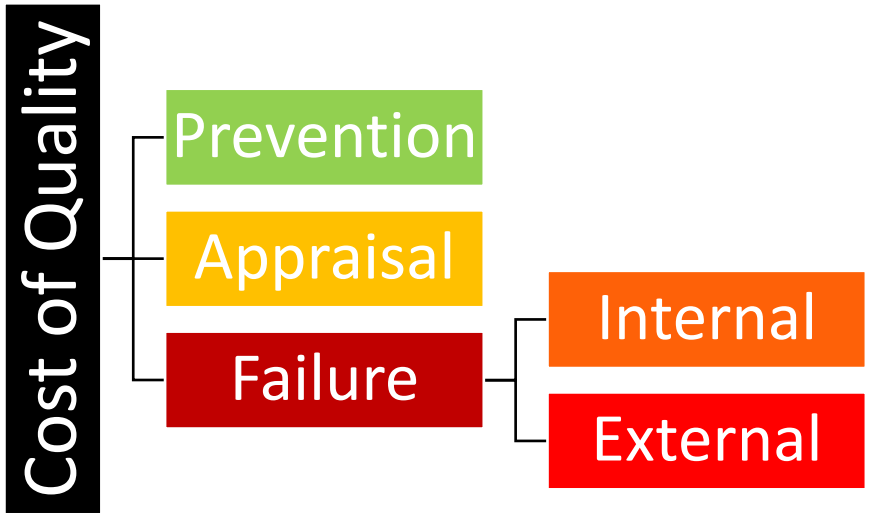
CoPQ



- **PREVENTION COSTS**
- Quality planning
- Education and training
- Conducting design reviews
- Supplier reviews and selection
- Quality system audits
- Process planning and control

Cost of Poor Quality

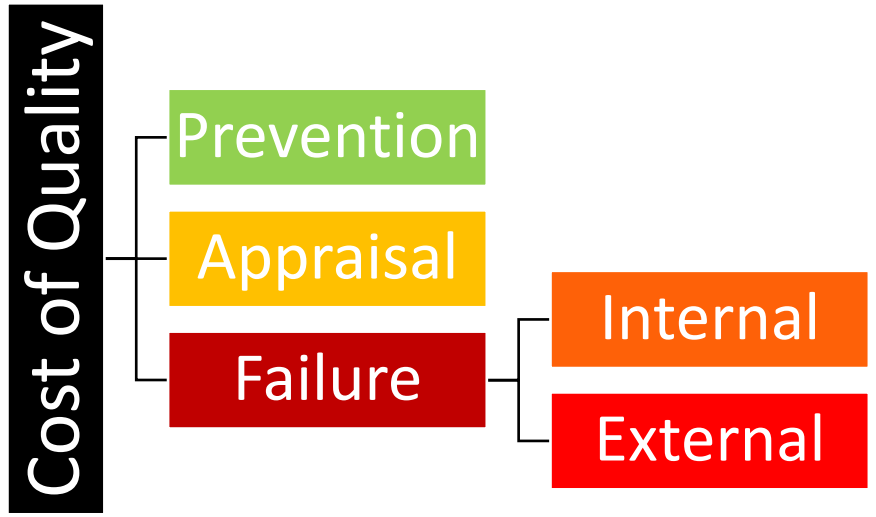
CoPQ



- **<u>APPRAISAL COSTS</u>**
- Test and inspection (receiving, in-process and final)
- Supplier acceptance sampling
- Product Audits
- Calibration

Cost of Poor Quality

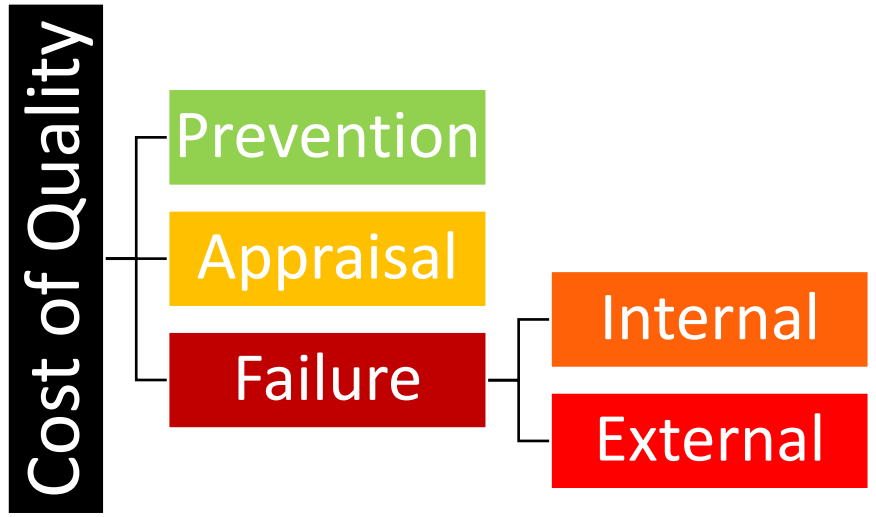
CoPQ



- **<u>INTERNAL FAILURE COSTS</u>**
- In-process scrap and rework
- Troubleshooting and repairing
- Design changes
- Inventory required to support poor process yields and rejected lots
- Re-inspection / retest of reworked items
- Downgrading

Cost of Poor Quality

CoPQ



- **<u>EXTERNAL FAILURE COSTS</u>**
- Sales returns and allowances
- Service level agreement penalties
- Complaint handling
- Field service labor and parts costs incurred due to warranty obligations
- Recall / Legal claims
- Lost customers and opportunities

4. Defects per Million Opportunities

DPMO

- Defect Opportunities
- Defects per Opportunity
- Defects per Million Opportunities

Defect Opportunity

- Circumstances in which the product or service can fail to meet the requirement
- Number of defect opportunities relate to complexity of unit.
- Complex units – Greater opportunities of defect than simple units
- Examples:
  - A units has 5 parts, and in each part there are 3 opportunities of defects – Total defect opportunities are 5 x 3 = 15

Defects per Opportunity (DPO)

- Number of defects divided by number of defect opportunities
- Examples:
- In previous case (15 defect opportunities), if 10 units have 2 defects.

- DPO = 2 / (15 x 10) = 0.0133333

Defects per Million Opportunities (DPMO)

- DPO multiplies by one million
- Examples:
- In previous case (15 defect opportunities), if 10 units have 2 defects.

- DPO = 2 / (15 x 10) = 0.0133333
- DPMO = 0.013333333 x 1,000,000
  = 13,333

Sigma Number	DPMO (Defects Per Million Opportunities)
1.5 σ	500,000
2.0 σ	308,300
2.5 σ	158,650
3.0 σ	67,000
3.5 σ	22,700
4.0 σ	6,220
4.5 σ	1,350
5.0 σ	233
5.5 σ	32
6.0 σ	3.4

13,333 DPMO = 3.7 σ

Sigma Level vs DPMO

5. Process Capability Indices

Cp, Cpk

- Process Capability Indices (Cp, Cpk)
- Process Performance Indices (Pp, Ppk)

Will be covered in Section 3F-3 in the Measure Phase

2E. Business Results For Projects

01 Process Performance

02 Communication

Communication

- Top-down communication
  - Message from the top management
  - Issue of filtered information
- Bottom-up communication
  - Needs, perception and opinion of employees
- Horizontal communication
  - Increases efficiency and productivity

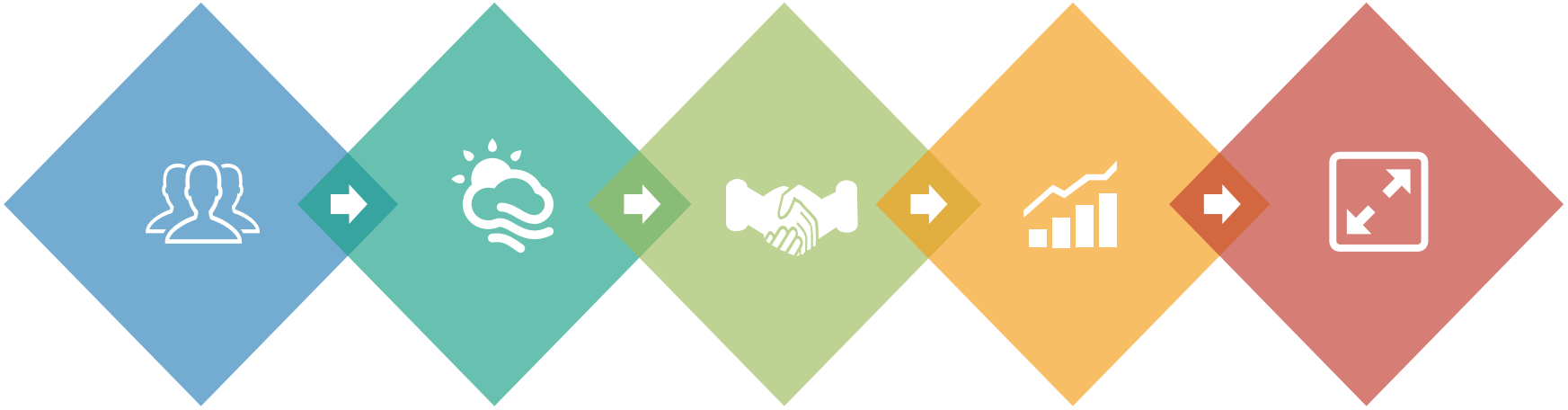
2F. Team Dynamics and Performance

01 Team stages and dynamics

02 Team roles and responsibilities

03 Team tools

04 Team communication



Forming

The forming stage occurs when team members first come together as a team.

Storming

During the storming stage, teams discover teamwork is more difficult than they expected.

Norming

The norming stage begins as the team moves beyond the storming stage and begins to function as a team.

Performing

When a team reaches the performing stage it is functioning as a high performance team.

Adjourning

Breaking up the team when the required task is complete.

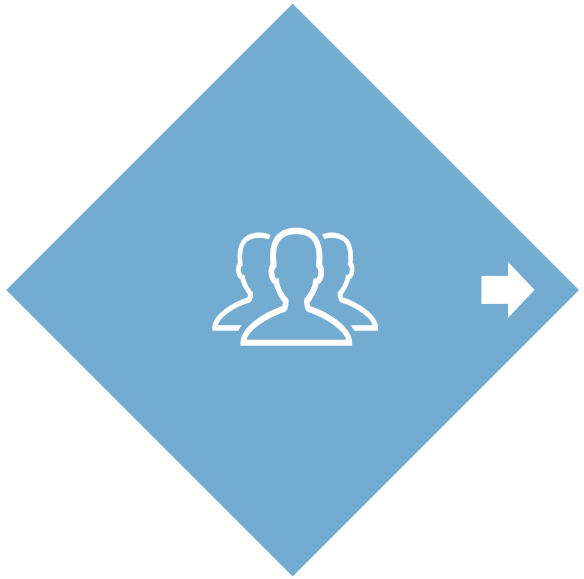
Tuckman's stages of team development

TEAM STAGES

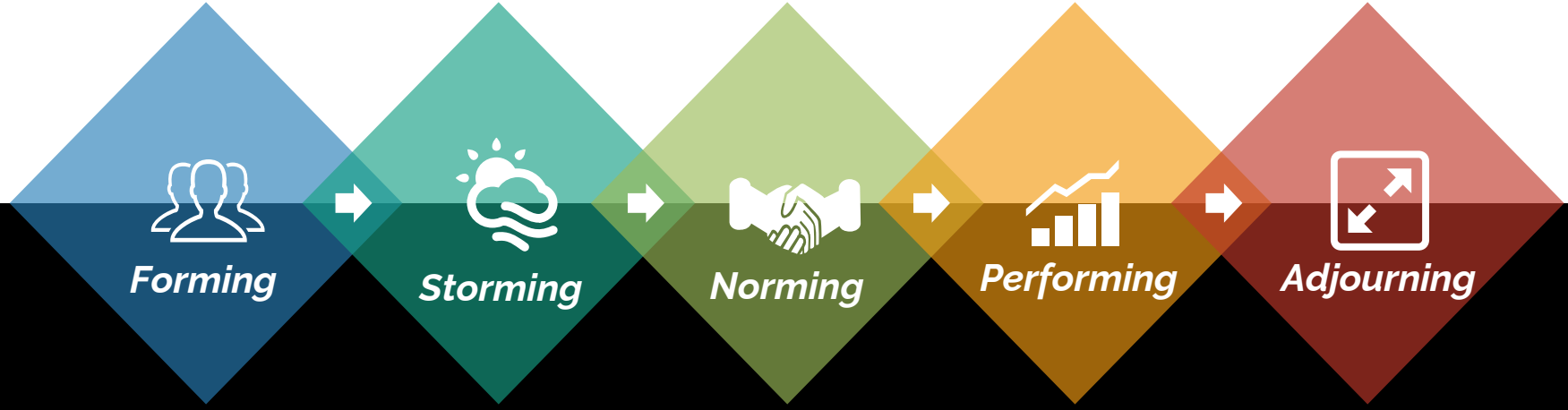
Forming

- Strong dependence on leader
- Simple ideas
- Avoidance of controversy
- Avoidance of serious topics
- Minimum feedback

Leaders Direct



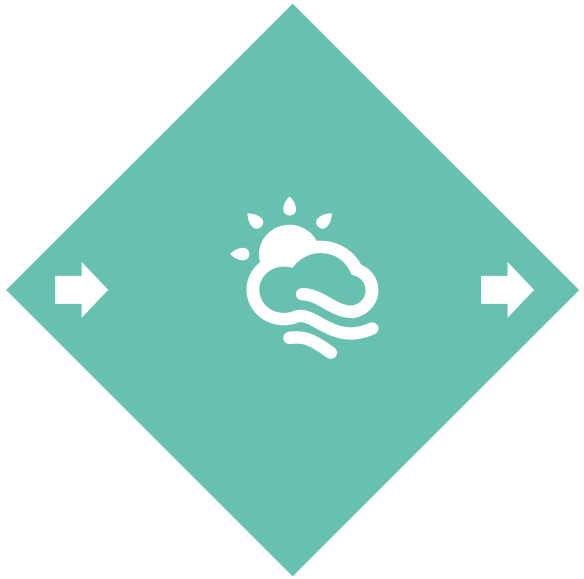
The forming stage occurs when team members first come together as a team.



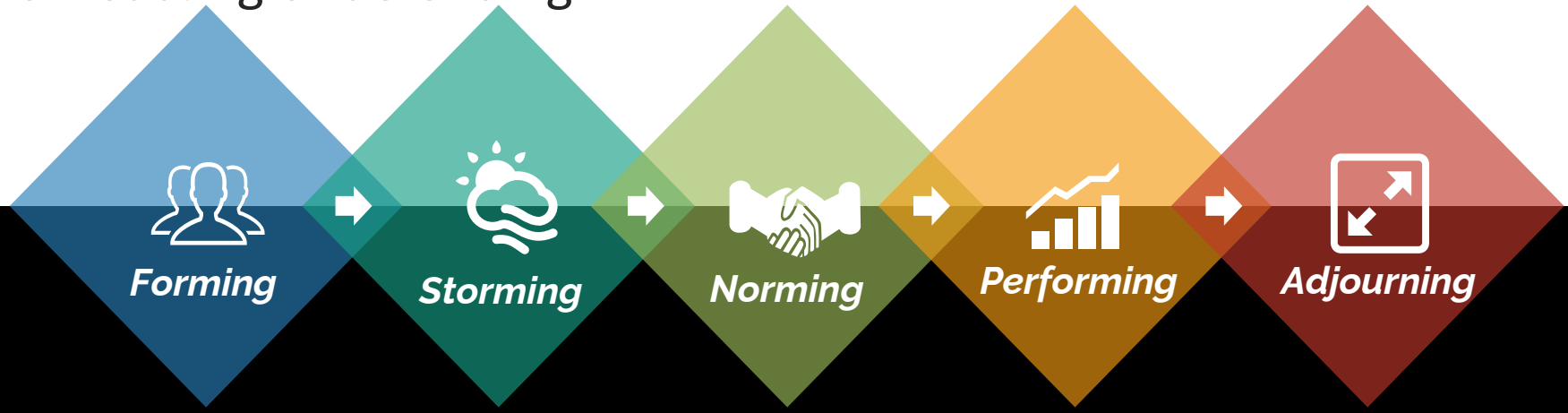
Storming

- Strongly expressed views
- Challenging others' ideas
- Challenging leadership, authority and position
- Withdrawal by some team members
- Lack of collaboration, competing for control
- High level of reacting or defending

Leaders Coach



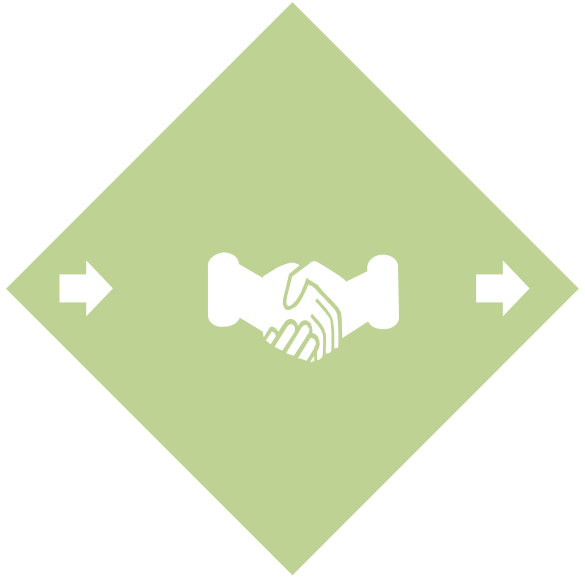
During the storming stage, teams discover teamwork is more difficult than they expected.



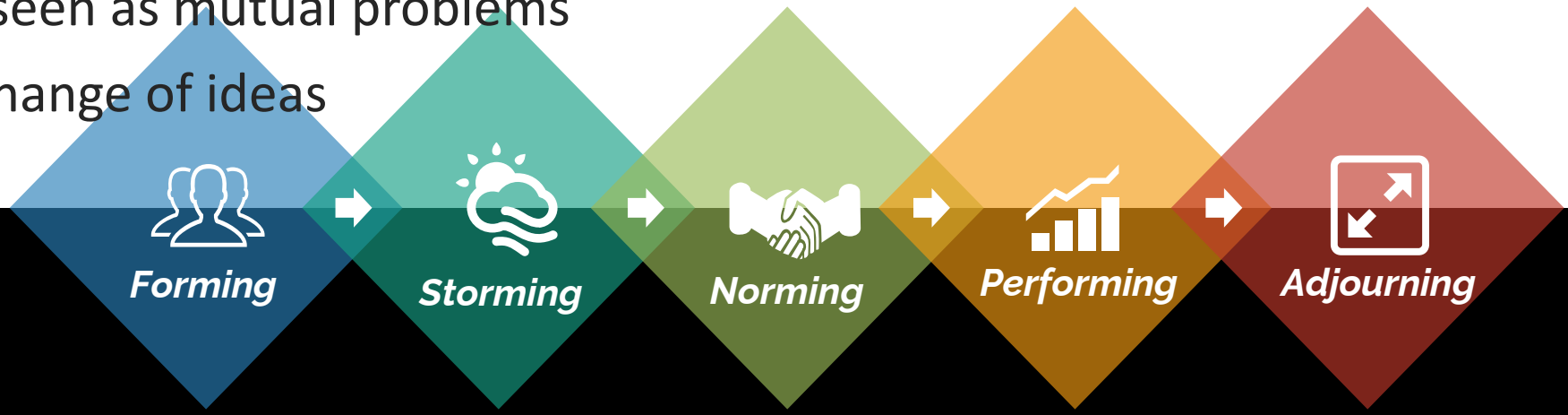
Norming

- Active listening
- Shared leadership
- Methodical systematic ways of working
- Readiness to change preconceived views
- Receptiveness to others' ideas
- Active participation by all
- Conflicts seen as mutual problems
- Open exchange of ideas

Leaders Facilitate



The norming stage begins as the team moves beyond the storming stage and begins to function as a team.

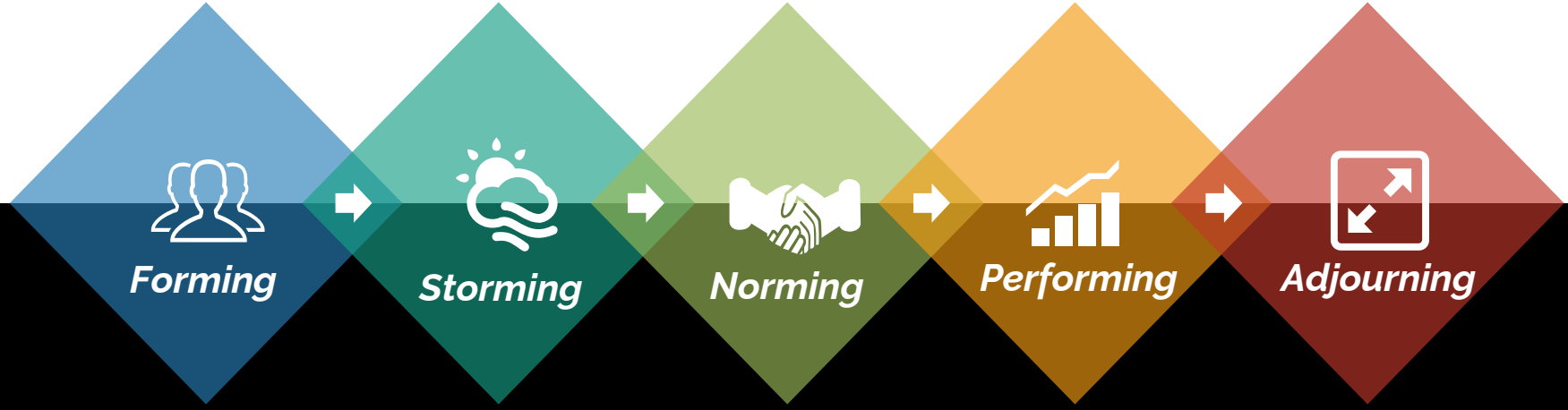


Performing

- High creativity
- Openness and trust
- Strong relationships
- High achievement

Leader Delegate

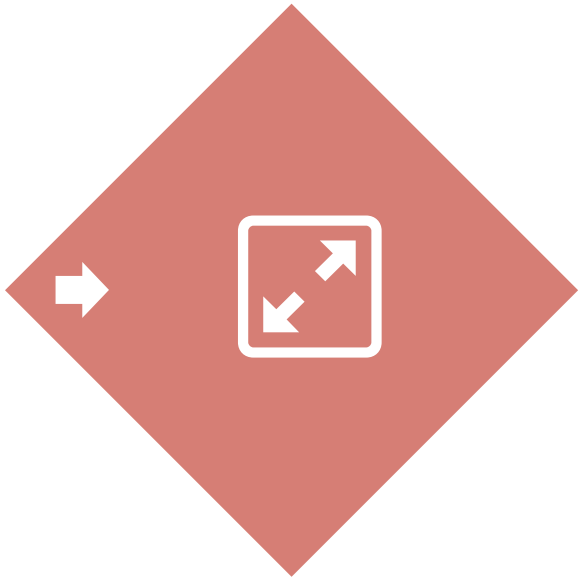
When a team reaches the performing stage it is functioning as a high performance team.



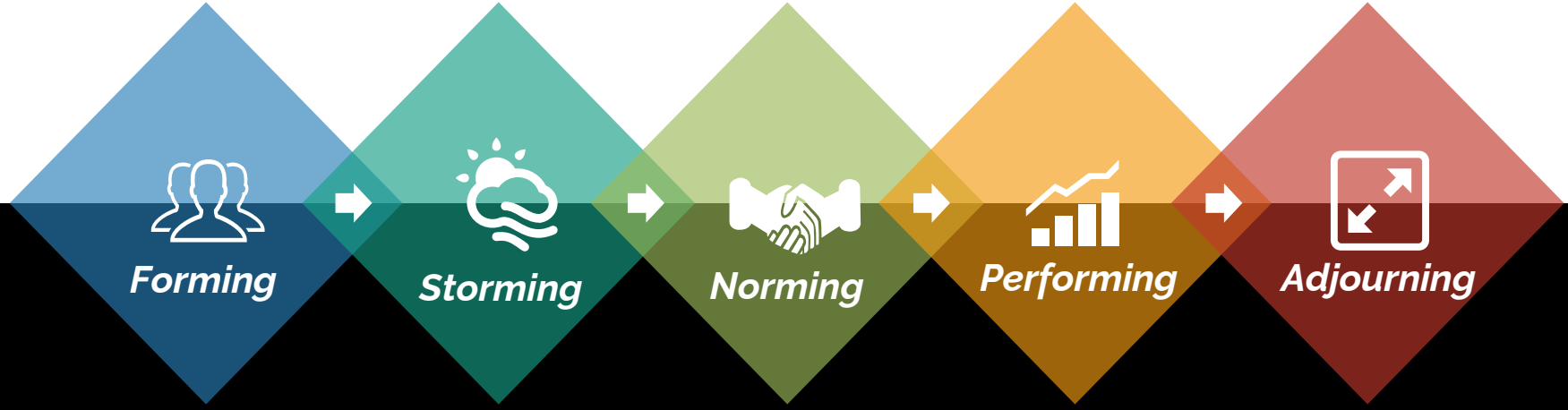
Adjourning

- Adjourning, is the break-up of the group, hopefully when their task is completed successfully, their purpose fulfilled.
- Recognition of and sensitivity to people's vulnerabilities is helpful

Leader reassure and communicate



Breaking up the team when the required task is complete.



Negative Team Dynamics

1. Overbearing participants
2. Dominant participants
3. Reluctant participants
4. Unquestioned acceptance of opinions as facts
5. Group thinking
6. Feuding
7. Floundering
8. The rush to accomplishment
9. Attribution
10. Discounts
11. Digressions and Tangents

Negative Team Dynamics

1. Overbearing participants

- Senior people or experts
- Even thought beneficial to team, they do not allow discussion in their area of expertise.

Team Leader's Role

- Have private discussion and explain that the open discussion is important.

Negative Team Dynamics

2. Dominant participants

- Take disproportionate time in discussion

Team Leader's Role

- Encourage equal participation

Negative Team Dynamics

3. Reluctant participants

- Shy or less confident participants

Team Leader's Role

- Encourage equal participation

Negative Team Dynamics

4. Unquestioned acceptance of opinions as facts

- Team members present their opinion in such strong words, that it is considered as a fact by others

Team Leader's Role

- Ask if there is any data to support this?

Negative Team Dynamics

5. Group thinking

- Members avoid conflict and agree to a point without critical evaluation.
- Unquestioned belief in group
- Group pressure on person opposing group decision.

Team Leader's Role ?

Negative Team Dynamics

5. Group thinking

Team Leader's Role

- ❖Bring in an independent expert
- ❖Encourage diversity
- ❖Reduce time pressure
- ❖Use of Devil's Advocate role

Negative Team Dynamics

6. Feuding

- Feud - a prolonged and bitter quarrel or dispute
- Could result in heated arguments and affect the team morale.

Team Leader's Role

- Offline discussion with both members

Negative Team Dynamics

7. Floundering

- ❖Flounder - struggle mentally; show or feel great confusion.
- ❖Team facing trouble during starting and ending the project.

Team Leader's Role

- ❖Show presence
- ❖Provide direction
- ❖Keep team focused

Negative Team Dynamics

8. The rush to accomplish

- ❖Rushing to conclusion.
- ❖Feeling over-pressurised by time line.

Team Leader's Role

- ❖Follow the process
- ❖Extent the timeline to realistic level

Negative Team Dynamics

9. Attributions

- Attribution - the action of regarding something as being caused by a person or thing.
- Casual remarks about others

Team Leader's Role

- Is there any data to support?

Negative Team Dynamics

10. Discounts

- Opinions are ignored, no feedback is provided on the statement by a team member.

Team Leader's Role

- Give offline feedback
- Promote respect for team members

Negative Team Dynamics

11. Digressions and tangents

- Out of scope discussions
- Distractions

Team Leader's Role

- Keep meeting on track.
- Could suggest to deal with that issue after the meeting.

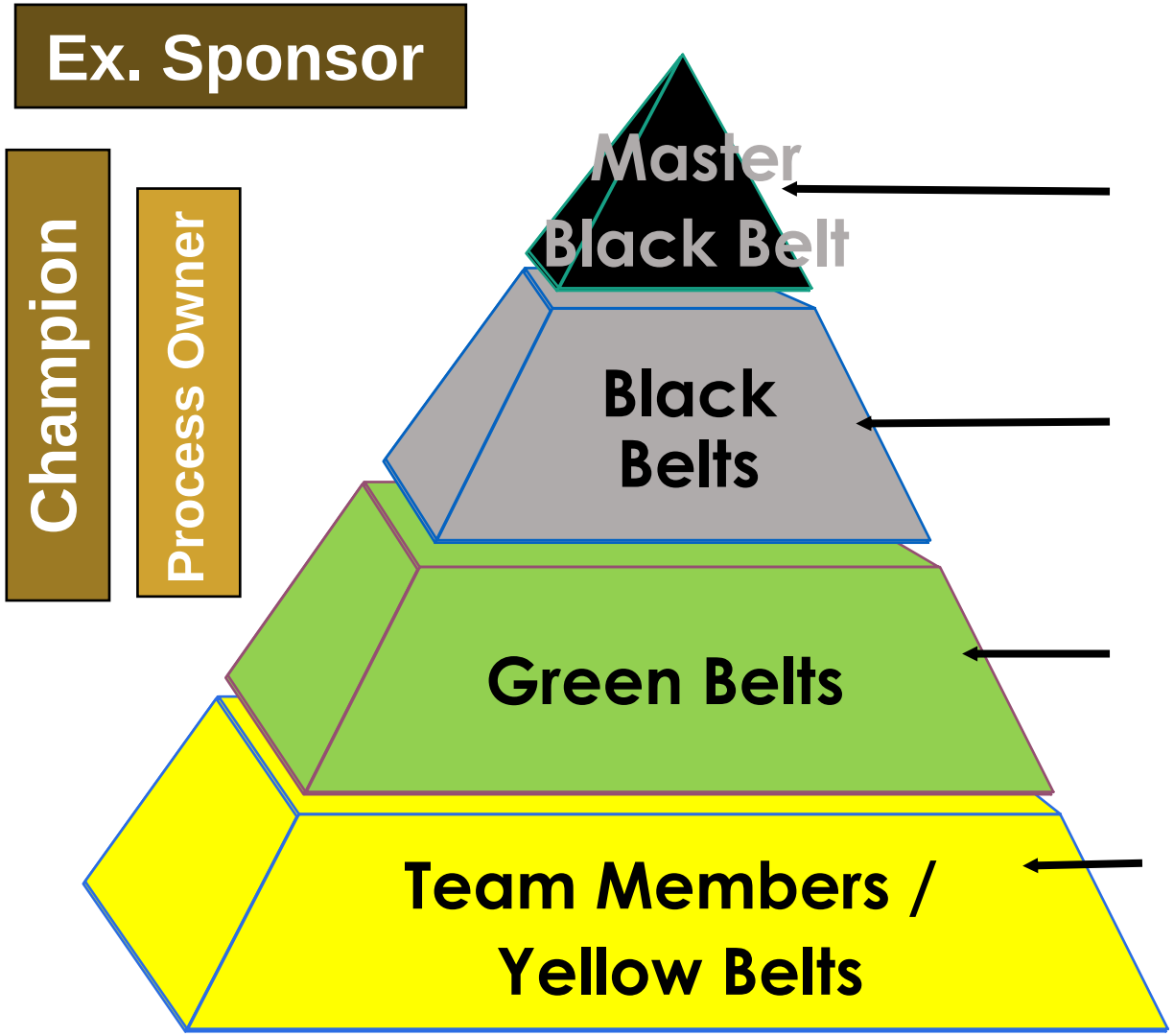
2F. Team Dynamics and Performance

01 Team stages and dynamics

02 Team roles and responsibilities

03 Team tools

04 Team communication



Master Black Belts, identified by champions, act as in-house coaches on Six Sigma.

Black Belts operate under Master Black Belts to apply Six Sigma methodology to specific projects.

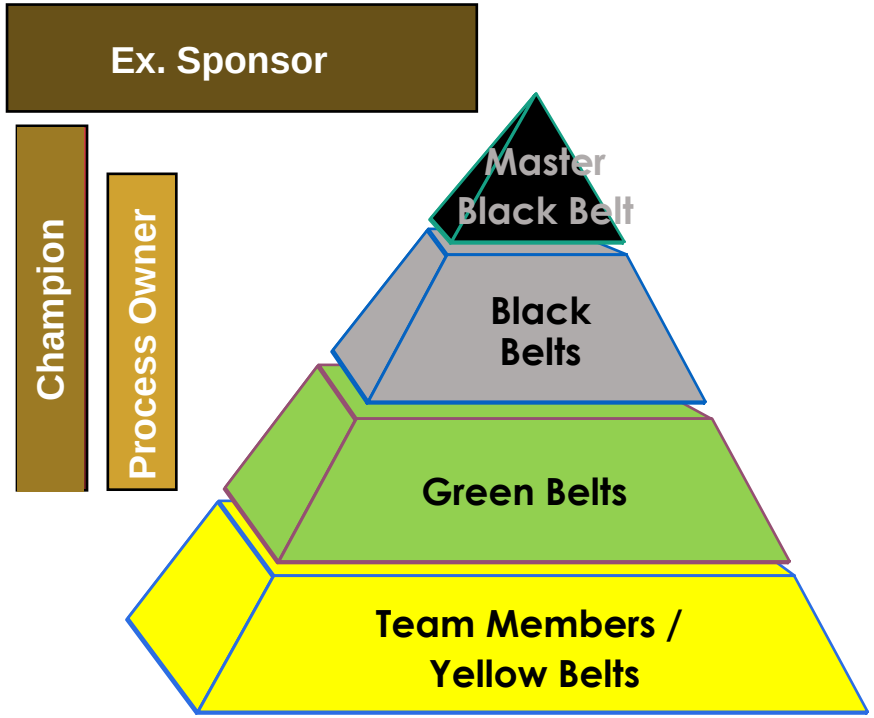
Green Belts are the employees who take up Six Sigma implementation along with their other job responsibilities, operating under the guidance of Black Belts.

Yellow Belts participates on and supports the project teams, typically in the context of his or her existing responsibilities.

SIX SIGMA TEAM ROLES

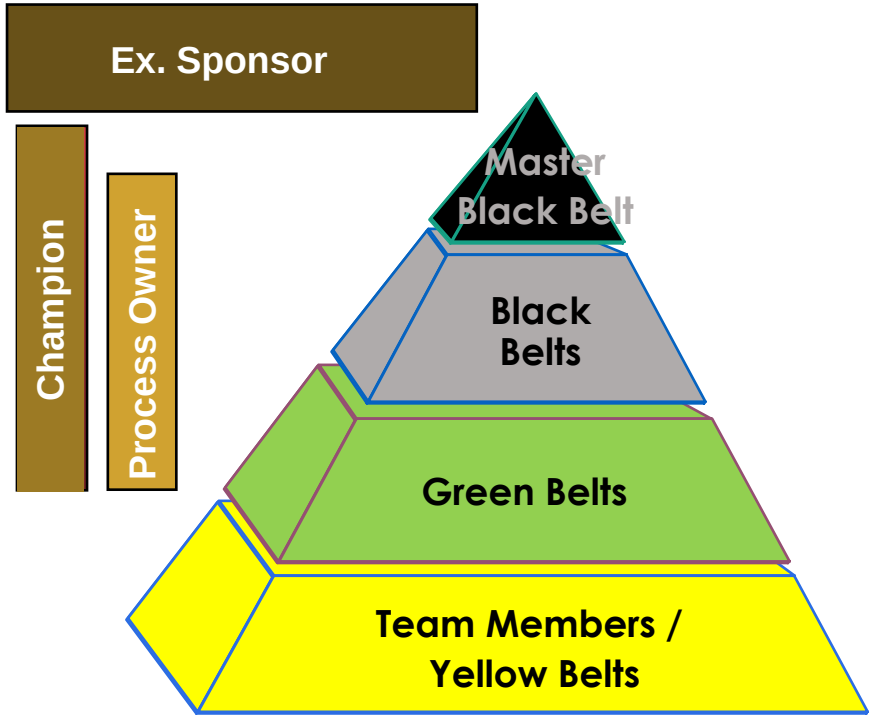
Master Black Belt

- Enterprise Six Sigma expert
- Highly proficient in using Six Sigma methodology
- Identifies high-leverage opportunities for applying the Six Sigma
- Basic Black Belt training
- Green Belt training
- Coach / Mentor Black Belts



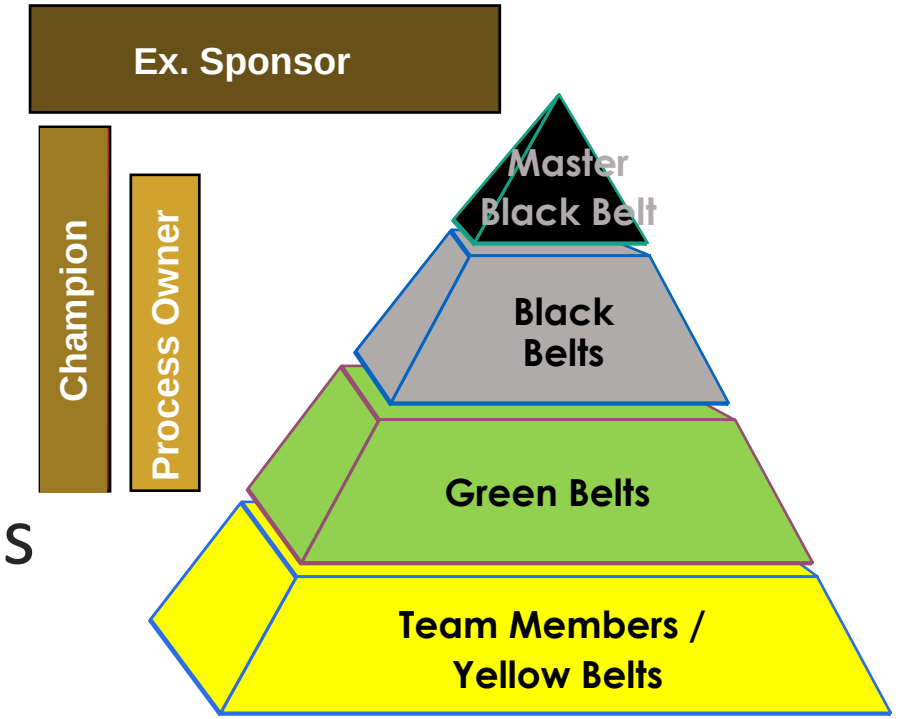
Black Belt

- Six Sigma technical expert
- Temporary, full-time change agent
- Leads business process improvement projects using Six Sigma approach that result in tangible benefits
- Demonstrated mastery of Black Belt body of knowledge
- Coach / Mentor Green Belts



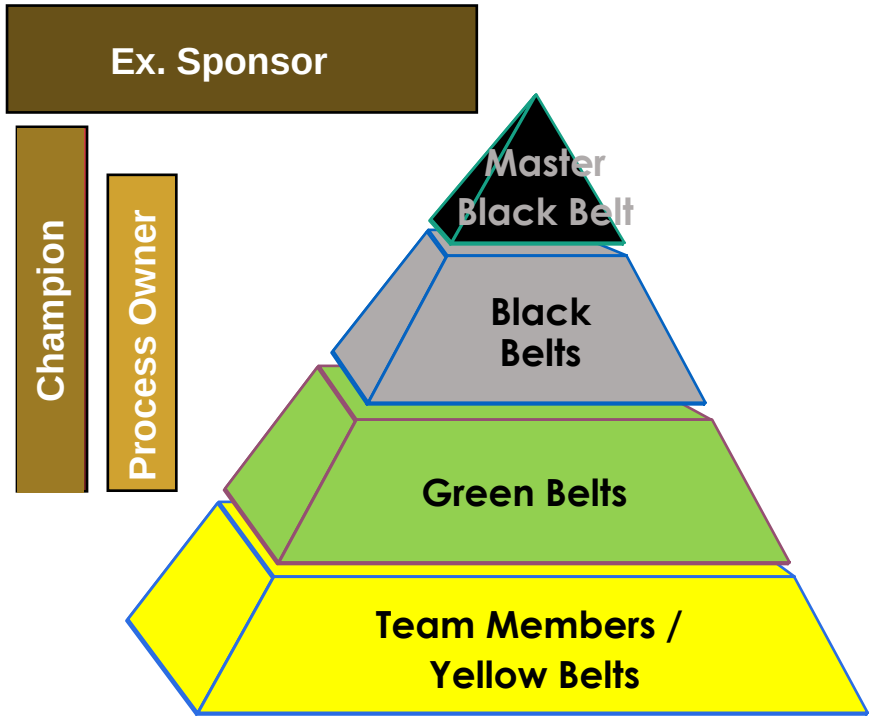
Green Belt

- Part-time Six Sigma change agent.
- Continues to perform normal duties while participating on Six Sigma project teams
- Six Sigma champion in local area
- Participates on Six Sigma project teams
- Lead smaller projects with moderate tangible benefits



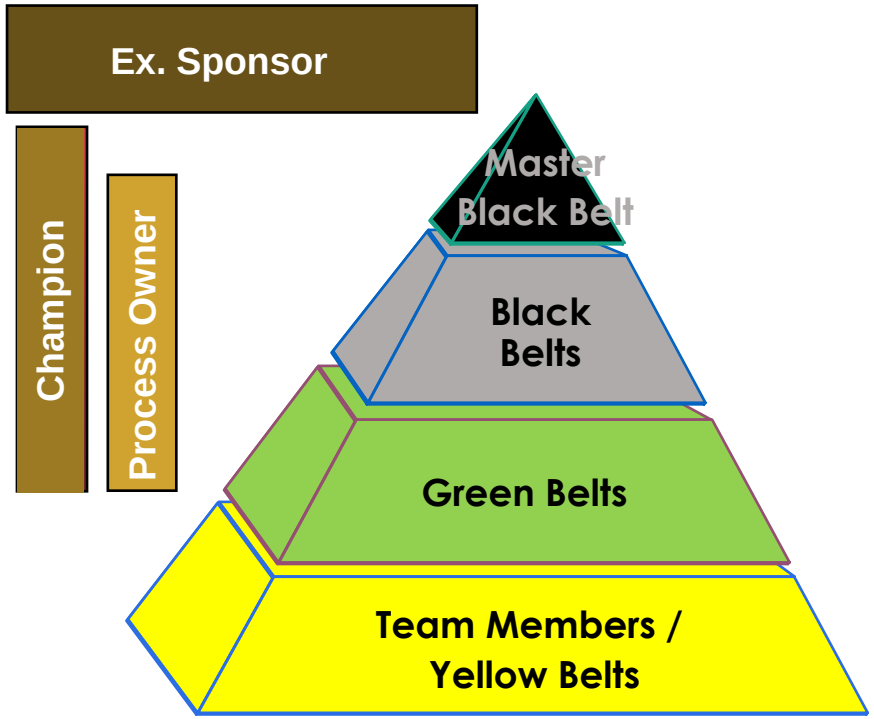
Yellow Belt

- Learns and applies Six Sigma tools to projects
- Actively participates in team tasks
- Communicates well with other team members
- Demonstrates basic improvement tool knowledge
- Accepts and executes assignments as determined by team



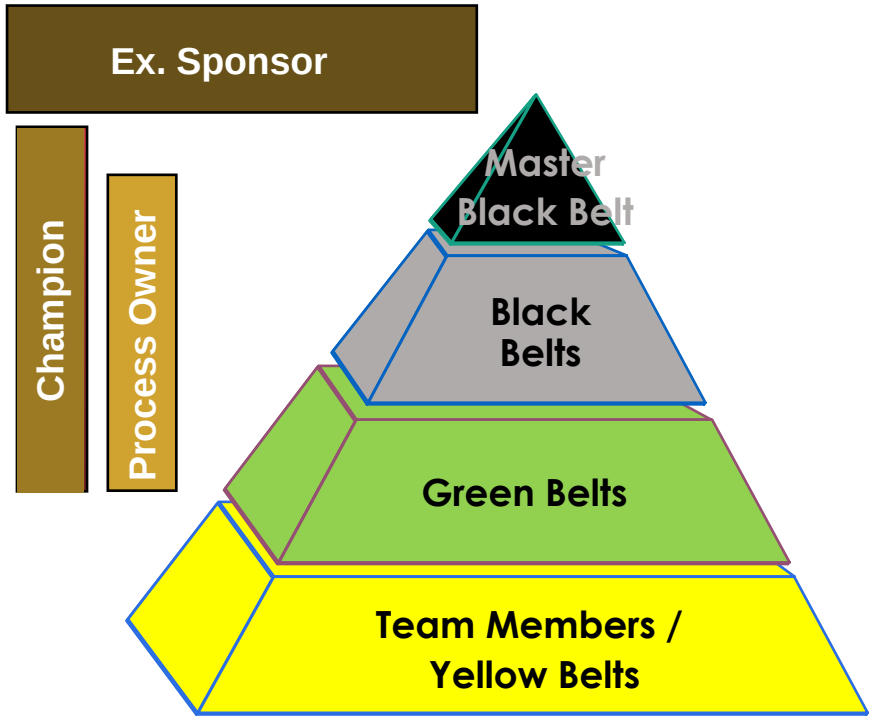
Executive Sponsor

- Business unit leader
- Sets the Six Sigma vision and objective
- Monitors the overall success of the Six Sigma program



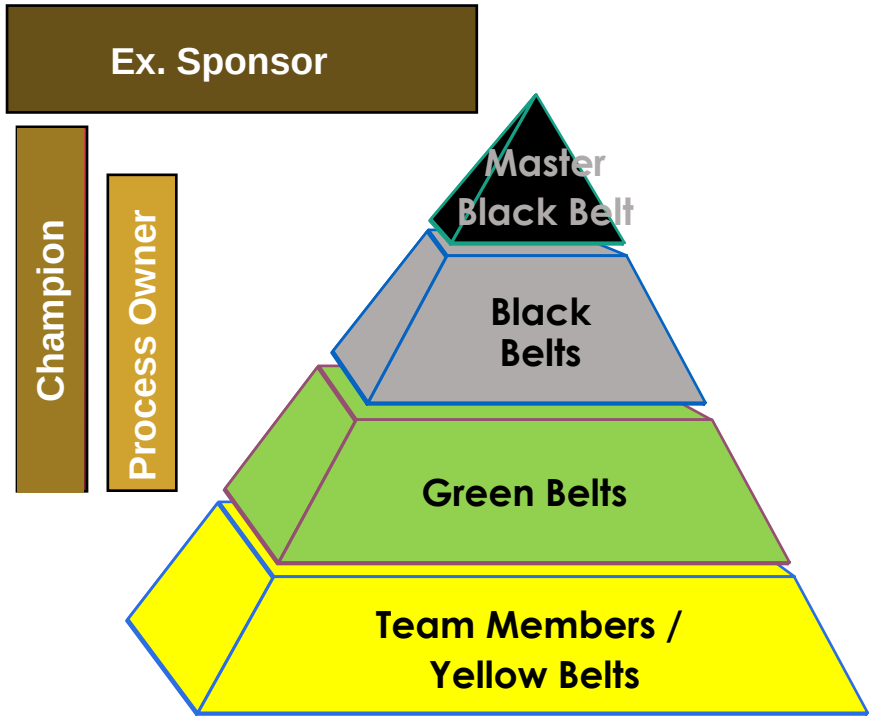
Champion

- Senior Management representative
- Provides resources / budget
- Removes barriers to the success of the project
- Sets up the Project selection criteria
- Regular review of projects
- Approves the charter and project completion
- Rewards and recognition



Process Owner

- Responsible and accountable for the results of the process.
- Provides the process knowledge
- Assigns team members
- Ensures that the changes are implemented and sustained



2F. Team Dynamics and Performance

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TEAM TOOLS

BRAINSTORMING

NOMINAL GROUP TECHNIQUE

MULTIVOTING

Brainstorming

- Brainstorming is a group or individual creativity technique by which efforts are made to find a conclusion for a specific problem by gathering a list of ideas spontaneously contributed by its member.
- Defer judgment,
- Reach for quantity

Brainstorming

Four Rules:

- Focus on quantity
- Withhold criticism
- Welcome unusual ideas
- Combine and improve ideas

NGT

- The nominal group technique (NGT) is a group process involving problem identification, solution generation, and decision making.
- Five Steps
  - Introduction and explanation
  - Silent generation of ideas
  - Sharing ideas
  - Group discussion
  - Voting and ranking

Color	Member A	Member B	Member C	Member D	Member E	SUM
Color 1		2				2
Color 2	3		2		1	6
Color 3		1		2		3
Color 4			3		2	5
Color 5	2	3		3	3	11
Color 6			1			1
Color 7	1			1		2

NOMINAL GROUP TECHNIQUE (NGT)

Multi-voting

- Brainstorming generates a long list of ideas
- Multi-voting technique is used to reduce /narrow down this list with group consensus.

Multi-voting

- Assign a letter code to each idea
- Each member gets number of votes equal to 1/3 (or half) of the number of ideas
- If 5 or less members in the team then eliminate all ideas with 0, 1 or 2 votes.

Idea Code	Member A	Member B	Member C	Member D	Member E	SUM
A	1			1	1	3
B	1	1	1		1	4
C						0
D	1	1	1	1	1	5
E			1			1
F	1	1		1	1	4
G						0
H	1	1	1	1	1	5
I						0
J		1		1		2
K						0
L			1			1
M						0
N						0

Idea Code	Member A	Member B	Member C	Member D	Member E	SUM
A	1			1	1	3
B	1	1	1		1	4
D	1	1	1	1	1	5
F	1	1		1	1	4
H	1	1	1	1	1	5

Multi-voting – 1st Round

Idea Code	Member A	Member B	Member C	Member D	Member E	SUM
A	1			1	1	3
B	1	1	1			3
D		1	1	1	1	4
F						0
H						0

Multi-voting – 2nd Round

Idea Code	Member A	Member B	Member C	Member D	Member E	SUM
A	1			1	1	3
B	1	1	1			3
D		1	1	1	1	4

Multi-voting – 2nd Round

Multi-voting

Number of team members	Eliminate ideas with
5 or less	0, 1, or 2 votes
6 to 15	3 or fewer votes
More than 15	4 or fewer votes

2F. Team Dynamics and Performance

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Communication Methods

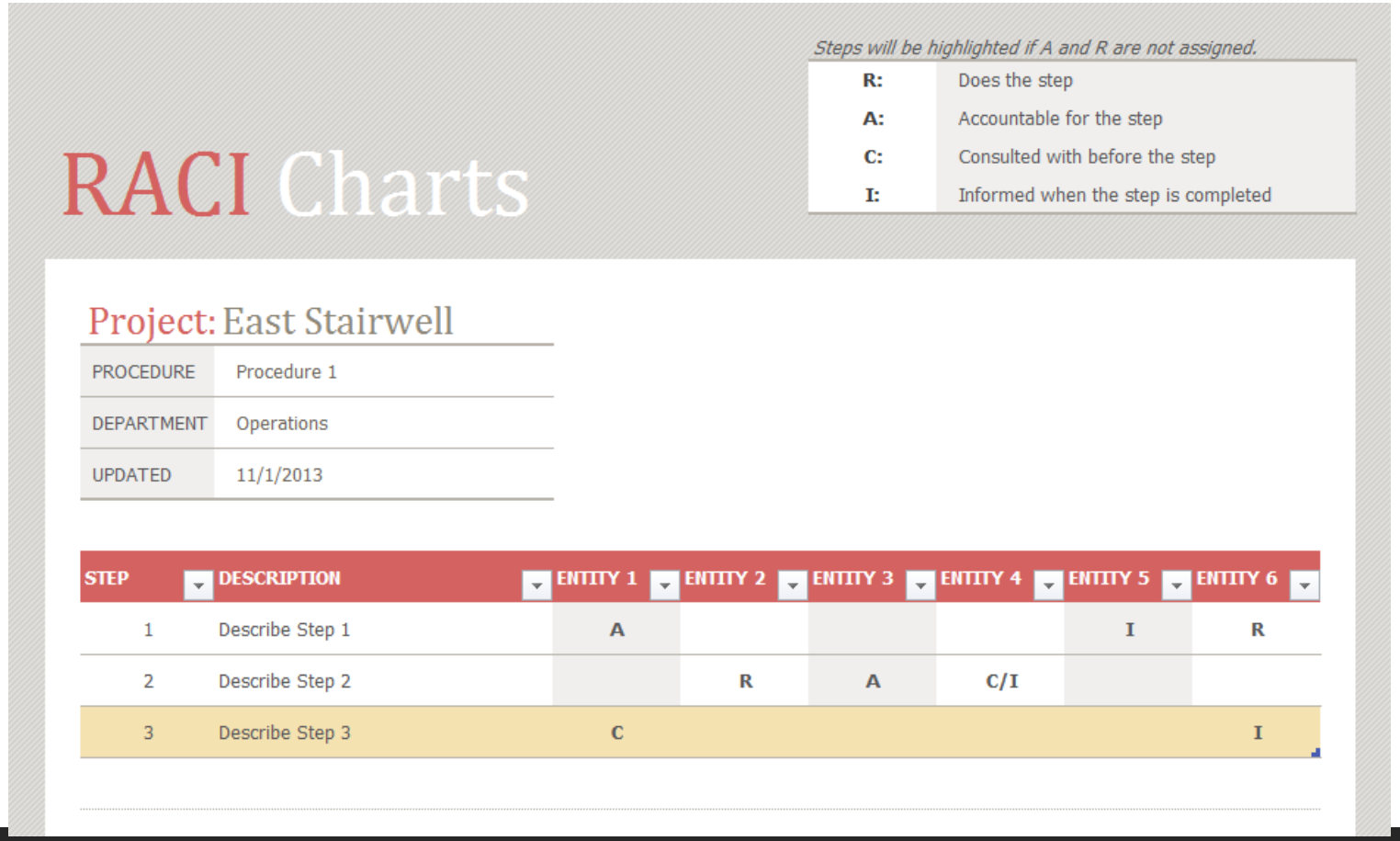
2022 – Changes in the BoK – 2F

II.F	**F. Team dynamics and performance**	
2014 BoK	**2022 BoK Details**	**Notes**
II.F.1	1. Team stages and dynamics Define and describe the stages of team evolution, including forming, storming, norming, performing, adjourning, and recognition. Identify and help resolve negative dynamics such as overbearing, dominant, or reluctant participants, the unquestioned acceptance of opinions as facts, groupthink, feuding, floundering, the rush to accomplishment, attribution, discounts, digressions, and tangents. (Understand)	
II.F.2	2. Team roles and responsibilities Use tools such as RACI, to describe and define the roles and responsibilities of participants on six sigma and other teams, including black belt, master black belt, green belt, champion, executive, coach, facilitator, team member, sponsor, and process owner. (Apply)	Added RACI
II.F.3	3. Team tools and decision-making concepts Define and apply team tools such as brainstorming, and decision-making concepts such as nominal group technique, and multi-voting. (Apply)	Revised subtopic name and added decision-making concepts to subtext
II.F.4	4. Team communication Identify and use appropriate communication methods (both within the team and from the team to various stakeholders) to report progress, conduct reviews, and support the overall success of the project. (Apply)	

RACI

- Describes the participation by various roles in completing tasks.
  - Responsible: Those who do the work to achieve the task
  - Accountable: The one ultimately answerable for the correct and thorough completion of the deliverable or task
  - Consulted: Those whose opinions are sought, typically subject matter experts
  - Informed: Those who are kept up-to-date on progress

RACI



RACI Charts

Steps will be highlighted if A and R are not assigned.

R:	Does the step
A:	Accountable for the step
C:	Consulted with before the step
I:	Informed when the step is completed

Project: East Stairwell

PROCEDURE	Procedure 1
DEPARTMENT	Operations
UPDATED	11/1/2013

STEP	DESCRIPTION	ENTITY 1	ENTITY 2	ENTITY 3	ENTITY 4	ENTITY 5	ENTITY 6
1	Describe Step 1	A				I	R
2	Describe Step 2		R	A	C/I		
3	Describe Step 3	C					I