

Agenda for Today

1

Why DMAIC

2

Origin of DMAIC

3

DMAIC Methodology

Need of DMAIC ?

*The Spirit of “**Ganbaru**” - Meaning to persist and do one's best despite difficulties*

Lean Manufacturing

Methodology that focus on minimizing waste within mfg. system while simultaneously maximize productivity

Productivity : *It is measure of resources utilization, efficiency which is defined as Output/ Input*

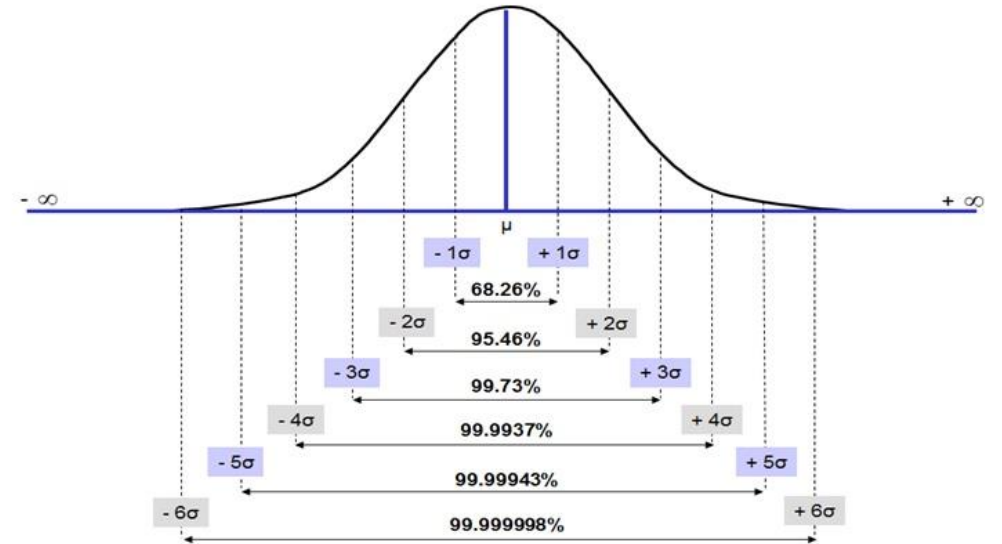
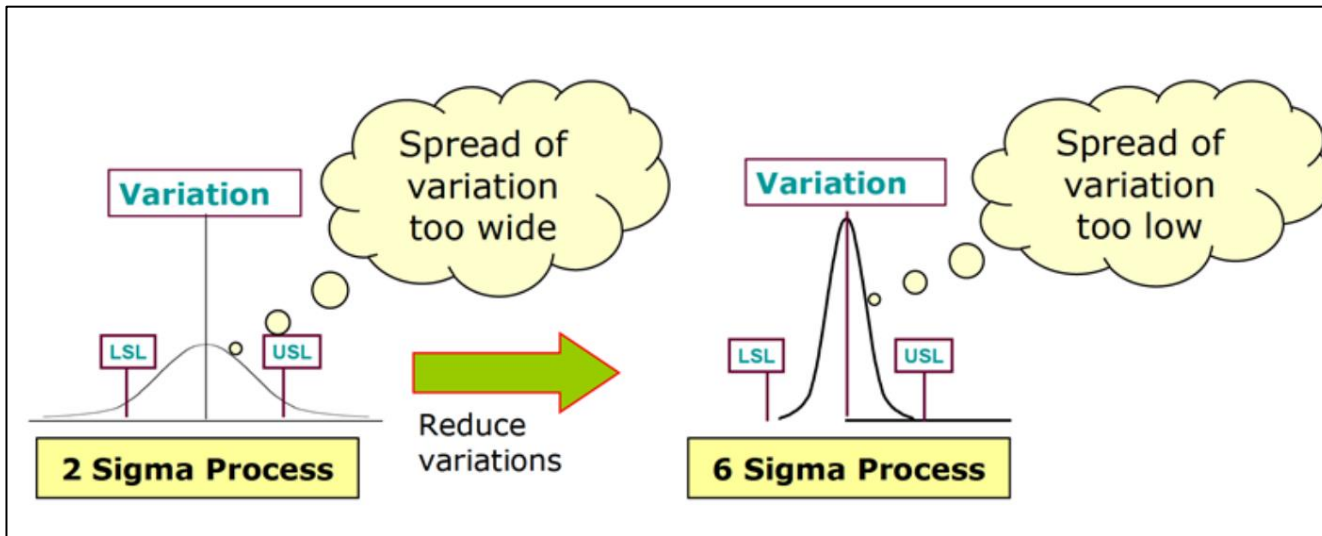
8 Type of waste (TIMWOODS)

- *Unnecessary **T**ransportation*
- *Excess **I**nventory*
- *Unnecessary **M**otion*
- ***W**aiting Time*
- ***O**ver Production*
- ***O**ver Processing*
- ***D**efects*
- ***S**kills*



Six Sigma

Problem Solving Methodology or Six Sigma is a methodology to reduce defect by reducing variation to Improve performance.



Lean Six Sigma Methodology (DMAIC)



Define

Express Problem in
Numbers
(SET Target)



Measure

TO get Base line
performance ,
Measure it W/O Error



Analyze

Identify The Reason (
Risk , Loss, Waste ,
Variation)
Validate the Root
Cause " X"



Improve

**Provide Solution to
Optimize " X"**

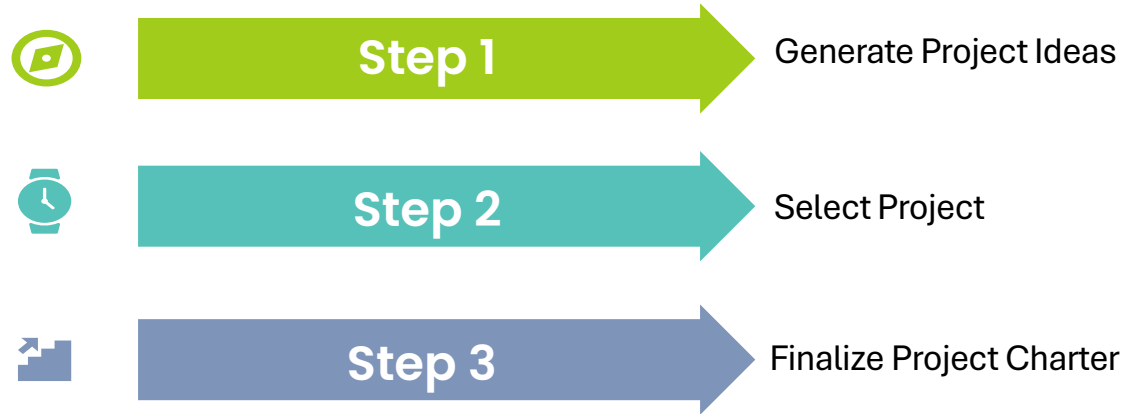


Control

Monitor & Control "
X"

15 SIMPLE STEPS OF DMAIC PROJECT

Define Phase



Tool Used in Define Phase

Project Identification : Pareto Charts , Brainstorming

Project Selection : Project Prioritization Matrix

Project Approval : Project Charter

Example : Material Handling Project

DEFINE

Present- Manual assembly and disassembly of heavy transportation supports for the 400 KV DS modules

"Manual handling is required for the assembly and disassembly of heavy transportation supports (weight ~ 40 kg)"

Present Status-

- Currently, mounting of heave supports requires 3 to 4 people to manual assembly and need to assembled four supports per module. This manual lifting process increases safety risks and leads to process waste due to the manpower involved.
- Manually lifting heavy supports is causing physical strain on operators, which can lead to ergonomic problems and Low morale due to repetitive work.
- The finishing stage is a bottleneck during FAT and dispatch readiness.
- Safety risk due to communication gaps in collaborative tasks as component may fall during assembly.

PROBLEM

C Frame Support

Disconnecter/ Busbar modules

C Frame Support

Example : Project Charter

1.PROJECT INTRODUCTION

PROJECT TEAM

Goal / Objective : Develop a portable automated lifting mechanism with a zero-gravity balancing facility to reduce safety risks to operators and cycle time. It should also reduce manual lifting dependency, enabling single-person operation while adhering to safety norms and ergonomic working conditions..

SCOPE : "Replace manual handling of heavy components required during 400 kV Disconnecter finishing"

Theme : FOF (Factory Of Future)

Project Team :

- ✓ Swapnil Adhe (Project lead)
- ✓ Pavan Hingne (Team Member)
- ✓ Aniket Thawkar (BE)
- ✓ Akshay Channe (Young T)
- ✓ Pratik Salunke (Young T)
- ✓ Akshat Desai (Process Planning)
- ✓ Mangesh Masane (Maintenance)

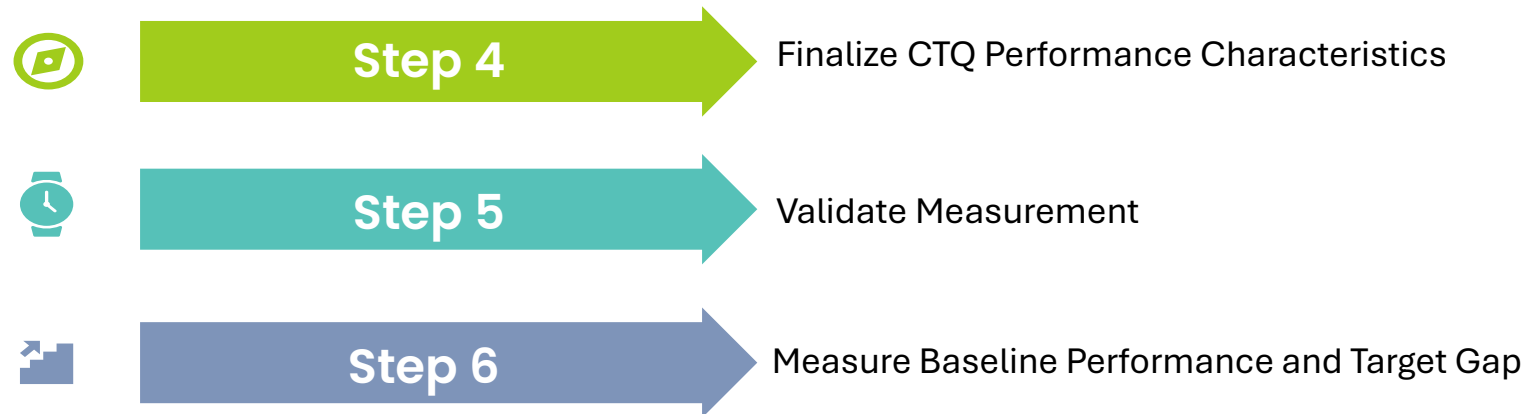
Mentor : Akshay Madhekar

Project start date : 18-02-2025

Project End date : 30-10-2025

Manish Patel | Business Excellence 30
Restricted © Siemens Energy India limited , 2025

Measure Phase



Tool Used in Measure Phase

Value Stream Mapping, 7 WASTE etc

Example : Measure (Data Collection)

MEASURE
(Data collection & Quantification)

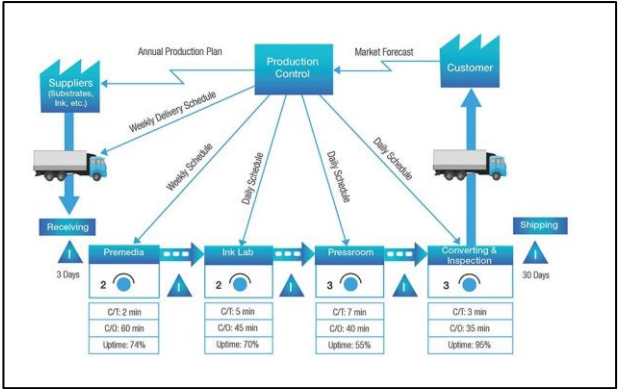
Boundary – Support Assembly From DS-3 to HV, HV to finishing & Finishing to Final Packing.

Present facts and figures collected

- Demand
- Cycle Time
- Space
- Manpower
- Variants
- Product mix
- Productivity & quality challenges
- QEHS risk
- Skill dependency
- Photo/ Video
- SOP etc
- BOM / Dwg / Models

| Sr. No | Parameters | Present |
|--------|--|-------------|
| 1 | Cycle Time (SMH) for DS/BB Module support assembly (Hrs), required 4 no. of manpower with 45 Min each. | 3~ HRS |
| 2 | Output / Day (1 Q9 + 2 BB module) | 3 DS/BB |
| 3 | Lead Time (Hrs) | ~0.75 HRS |
| 4 | Total Manpower Req / Module | 4 (Skilled) |
| 5 | Safety Risk | High |
| 6 | Person Dependency | 100% |
| 7 | Automation % | 0 % |
| 9 | Workstation capacity Per Month (Nos) | 50 |
| 10 | Variants produced | 2 |

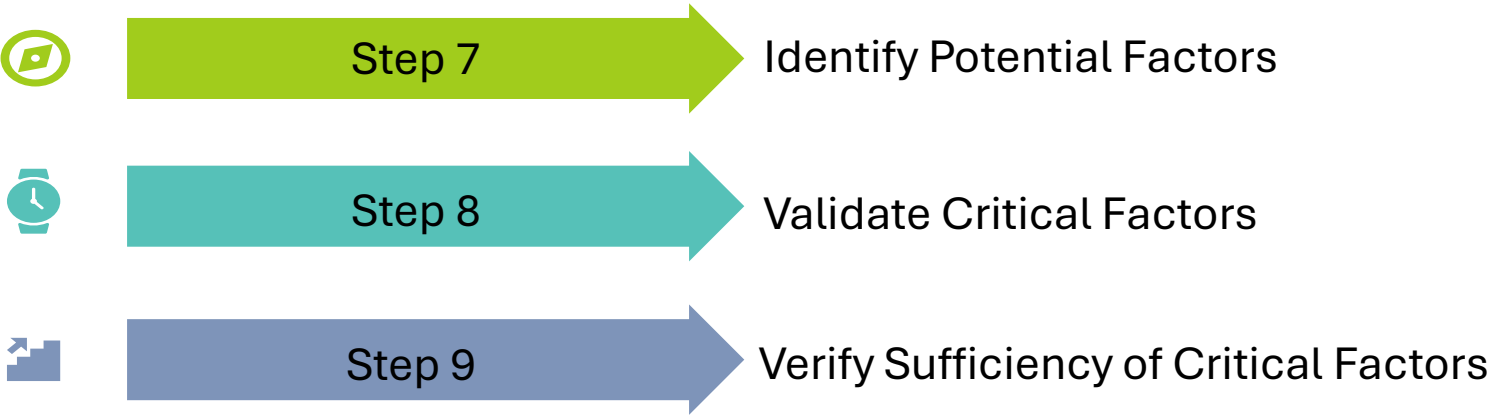
Valu Stream Mapping



WASTE



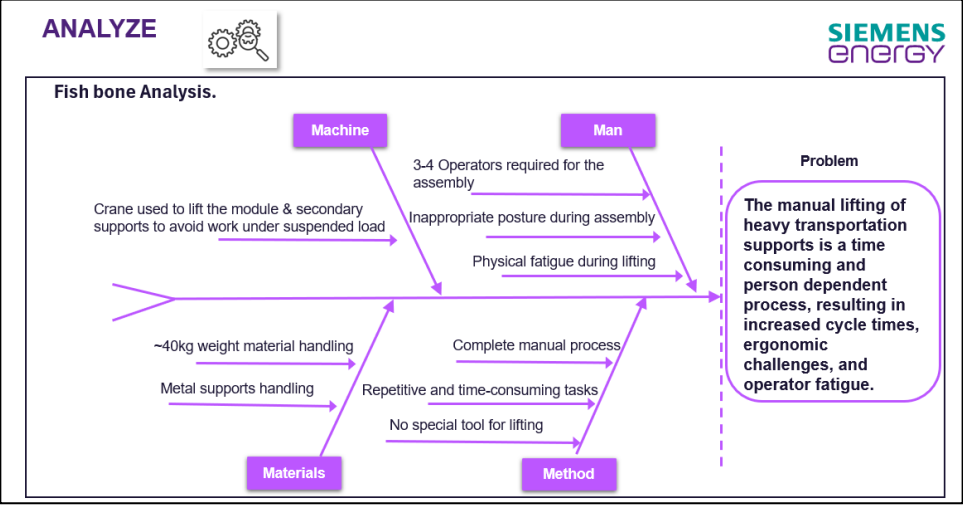
Analyze Phase



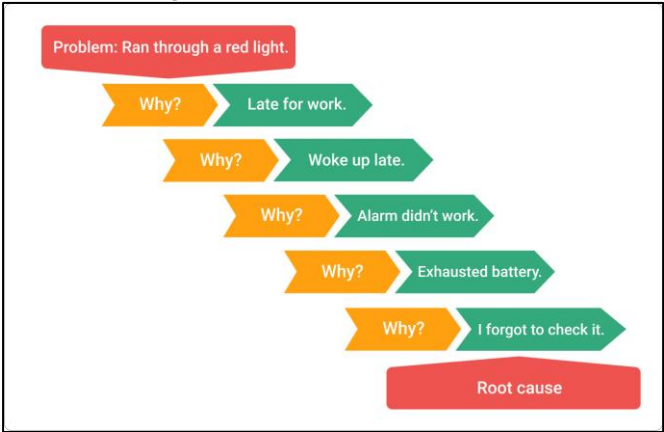
Tool Used in Define Phase

Y-Y Analysis , Cause & Effect Diagram,

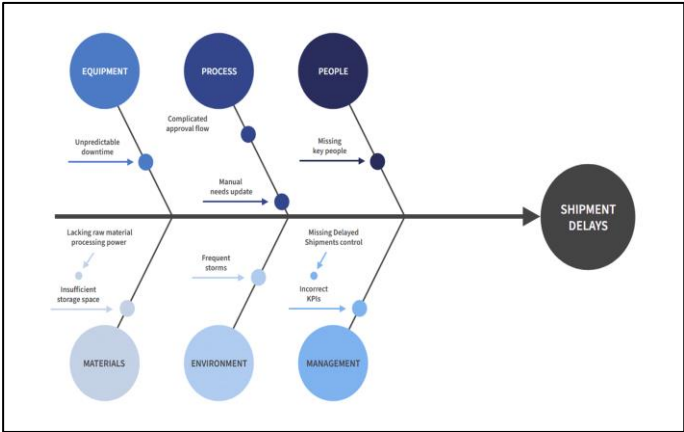
Example : Analyze (Case & Effect Diagram)



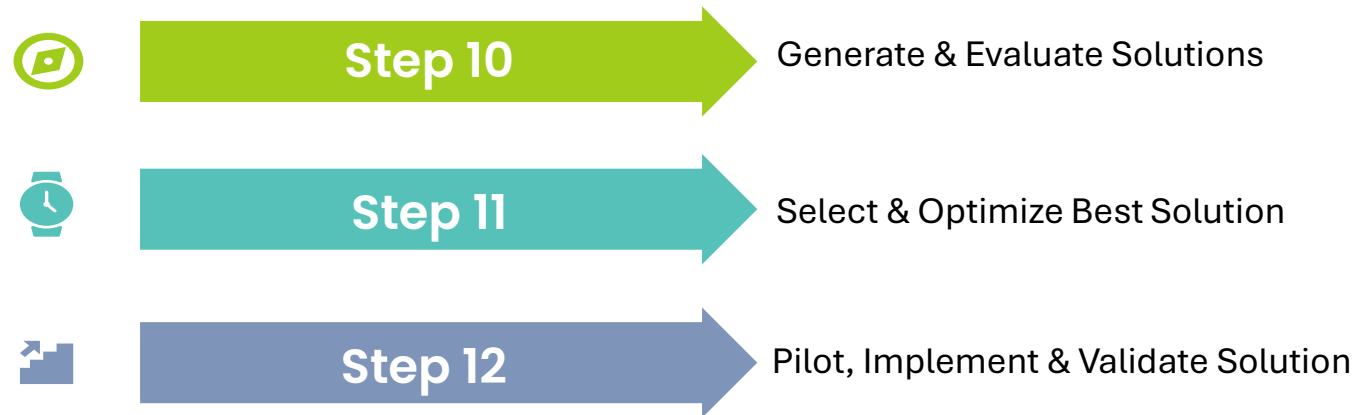
Y-Y Analysis



Cause & Effect Diagram



Improve Phase





Tool Used in Define Phase

FMEA, Kaizen, One-piece flow, Kaizen, 5S, SMED

Example : Improve

AIM - SET TARGET






➤ Customized heavy component lifter shall be designed to accommodate a variety of material types, ensuring flexibility and adaptability in handling diverse components.

➤ The lifter shall be designed for **single-person operation, featuring a user-friendly interface that requires no specialized training or expertise**

➤ The lifter shall facilitate **ease of operation during lifting and mounting tasks**, with a design that prioritizes operator ergonomics to **minimize physical strain and improve efficiency**.

➤ Lifter should enable to **reduce cycle time in between stages** & will make final impact on **lead time**.


➤ Ensure lifter will have the latest safety technology to **prevent and respond promptly to potential hazards**.



AGV with Trolley tunnel

| | | |
|---|-------------|---|
|  | | |
| Handling | Safe | ✓ |
| Cost | High | ✗ |
| Manual Operation | Yes | ✗ |
| Navigation | Magnet tape | ✗ |
| Battery & swapping | Yes | ✗ |
| Compact size | Yes | ✓ |


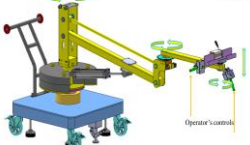






BOT

| | | |
|---|------|---|
|  | | |
| Handling | Safe | ✓ |
| Cost | Low | ✓ |
| Manual remote Operation | Yes | ✗ |
| Navigation | NA | ✗ |
| Battery charging | Yes | ✗ |
| Compact size | Yes | ✗ |

AMR with Trolley tug

| | | |
|---|---------|---|
|  | | |
| Handling | Safe | ✓ |
| Cost | High | ✗ |
| Auto Operation | Yes | ✓ |
| Navigation | Natural | ✓ |
| Battery & swapping | Yes | ✓ |
| Compact size | No | ✗ |

Smart & simple solution

| | | |
|---|---------|---|
| CONCEPT DESIGN: Zero Gravity magnetic Litter | |  |
|  | | |
| Handling | Safe |  |
| Cost | Low |  |
| Auto operation | Yes |  |
| Navigation | Natural |  |
| Battery & swapping | No |  |
| Compact size | Yes |  |

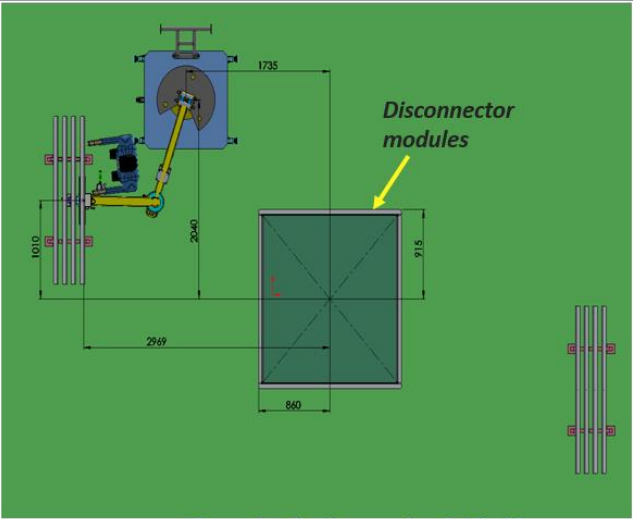
Improve Phase

PROCESS & PEOPLE TRANSFORMATION

SIEMENS
energy



Manual operation



Semi-Automated Cell

This initiative will enhance operational efficiency, improve workplace safety, and ensure that all tasks are ergonomically feasible for personnel involved.

3. BENEFITS

SIEMENS
energy

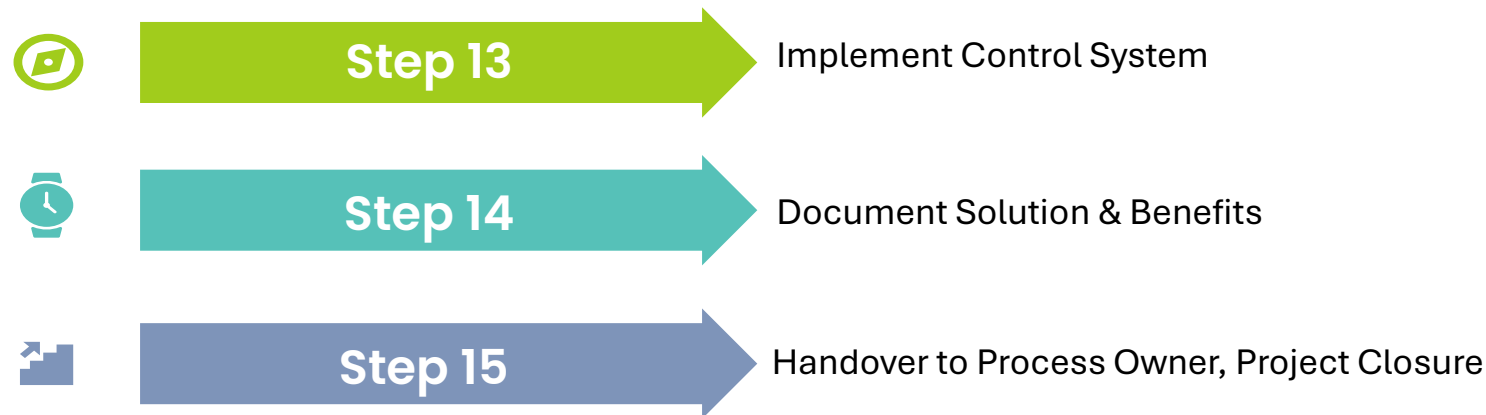
| Sr. No | Parameters | Present | Future |
|--------|--|-------------|-------------|
| 1 | Cycle Time (SMH) for DS/BB Module support assembly (Hrs) for 4 no. of operators 45 Min each. | ~3 HRS | ~1.25 HRS |
| 2 | Output / Day (2 Q9 + 1 BB module) | 3 DS/BB | 3 DS/BB |
| 3 | Total Manpower Req / Module | 4 (Skilled) | 1 (Skilled) |
| 4 | Person Dependency | 100% | 40% |
| 5 | Safety Risk | High | Low |
| 6 | Automation % | 0 % | 60% |
| 7 | Workstation capacity Per Month (Nos) | 50 | 55 |
| 8 | Variants produced | 2 | 2 |

ROI CALCULATIONS

SIEMENS
energy

| SR No. | Description | Calculations | Details | Unit |
|--------|--------------------------------|-----------------|-----------|-------|
| 1 | Project Cost | A | 15,00,000 | INR |
| 2 | Cycle time Before | B | 3 | Hrs |
| 3 | Cycle time After | C | 1.25 | Hrs |
| 4 | Cycle time saving | D=B-C | 1.75 | Hrs |
| 5 | No of units Per month Required | E | 55 | Nos |
| 6 | No of units Per Year | F=E \times 12 | 660 | Nos |
| 7 | Time saving Per year | G= F \times D | 1155 | Hrs |
| 8 | Standard rates Per hour | H | 300 | INR |
| 9 | Total saving Per year | I=G \times H | 3,46,500 | INR |
| 10 | ROI | J=A/I | 4.33 | Years |

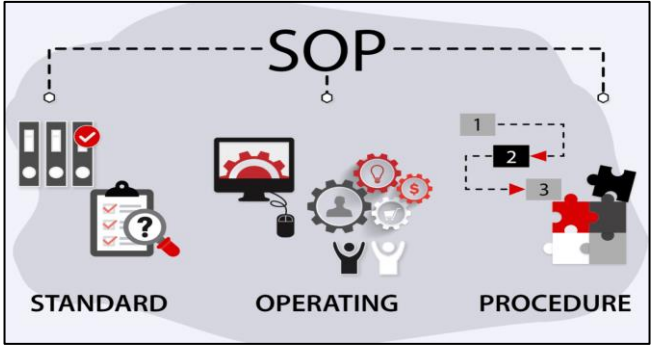
Control Phase



Tool Used in Define Phase

Control Chart, Control Plan, Poka Yoke, TPM, Standardization, SOP, Hazardous Identification & Risk Assessment HIRA

Standard Operating Procedure



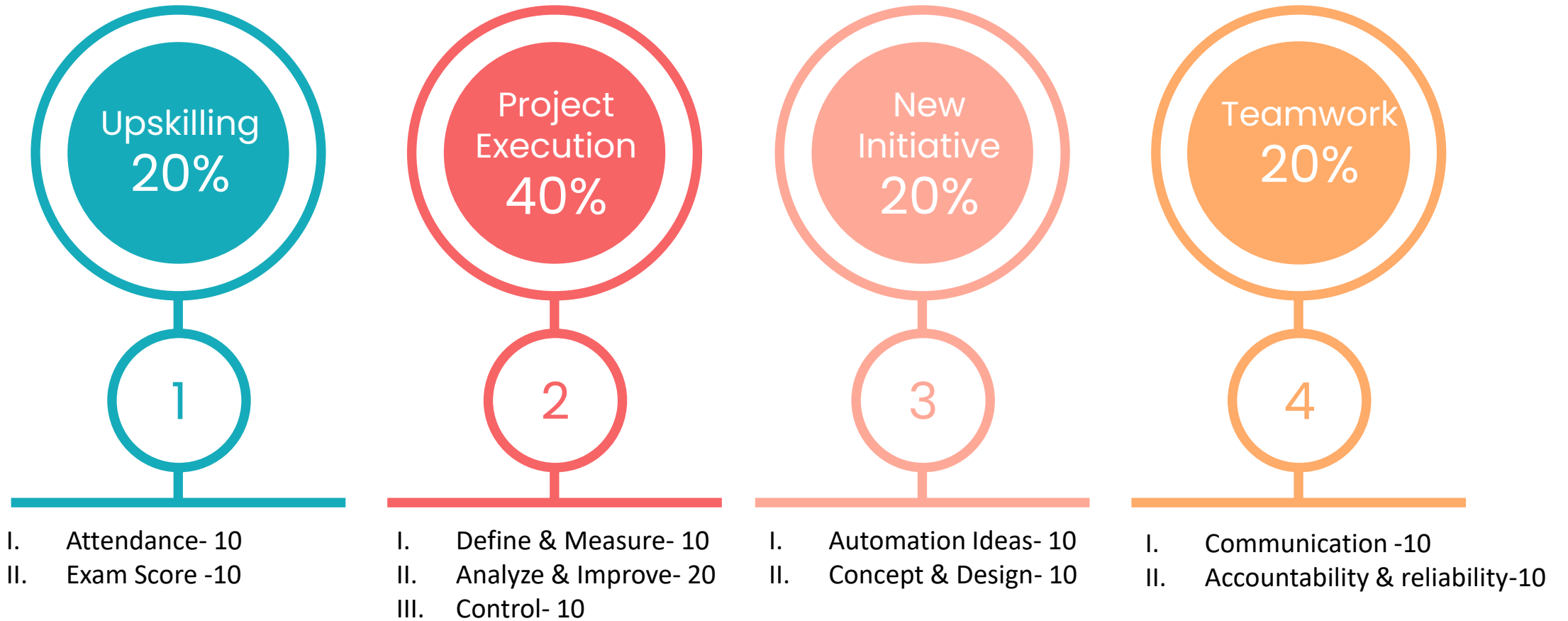
Control Charts Plan

| Control Plan Number: | | | Control Plan Revision Level: | | | Date of last revision: | | | | | |
|----------------------|--|--|------------------------------|---------|------------|---------------------------|----------------------------------|-------------|-------|---------------|----------------|
| Part Number: | | | | | Part Name: | | | | | | |
| Process Number | Process Name/ Operation Description | Equipment Requirements (Machine, jig, tools) | Characteristics | | | Methods | | | | Reaction Plan | |
| | | | No. | Product | Process | Specification & Tolerance | Evaluation Measurement Technique | Sample Size | Freq. | | Control Method |
| 1 | | 2 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

HIRA

| ACTIVITY SERIAL NUMBER | | | | | | | | | | NAME OF ACTIVITY: Excavation | | | | | | | | | |
|---|--|----------------------|----------|--------------------------------|---------------------|-----|------------|-----------|---|---|-----|------------|---------------|---------------|--------|--|--|--|--|
| Risk Level = R, Severity rating = S, Probability Rating = P Categories of Hazards | | | | | | | | | | Physical Chemical Ergonomic Biological Psychosocial Mechanical Electrical | | | | | | | | | |
| # | Hazard | Categories of Hazard | Risk | Consequence | Pre Risk Evaluation | | | Condition | Control Measures | Post Risk Evaluation | | | Advisory | Residual Risk | Remark | | | | |
| | | | | | (R) | (P) | (RL= (RP)) | | | (R) | (P) | (RL= (RP)) | | | | | | | |
| 3. | Water logging | Physical | Moderate | Causes drowning situation | 3 | 4 | 12 | Y | • Provide suitable dewatering pump. | 1 | 1 | 1 | Site Engineer | Low Risk | | | | | |
| 4. | Movement of vehicle / equipment close to the edge of excavation. | Physical | High | Causes workers may get buried. | 5 | 4 | 20 | Y | • Provide hard barricade with warning sign. • Monitor at least 2m distance from edge and also stop blocks / barricade board to prevent over run. • Provide warning horn in vehicle. • Signage sign to be displayed at work site. | 2 | 2 | 4 | Site Engineer | Medium risk | | | | | |
| 5. | Fall of tools & material. | Physical | Moderate | | 5 | 3 | 15 | Y | • Using designated safe of hoist to distance. • Conduct safety sign talk for safety awareness. • Don't keep tools near excavated cut. • Provide all mandatory PPEs. | 5 | 1 | 5 | Site Engineer | Medium risk | | | | | |

Evaluation Criteria



Thank You