# Project Title:

Capacity ramp-up Through Productivity Improvement
In existing Zinc Nickel plating Plant

## About our company, Product range, Vision & challenges:

**About Lucas TVS:**

Established in 1961, originally a joint venture between Lucas Plc UK and TVS, wholly owned since 2001

Six decades of leadership on Indian market with 7 plants in India

Product development capability: 75% revenue from in-house developed products

Lucas TVS group sales turnover Rs.4800 Crores

World class Technology center Equipped with BS VI / EV / Hybrid Technology /BLDC

**Vision:**

Domestic dominance in rotating electrical products

Enhance exports in global passenger and commercial vehicle segments

**Explore our creativity and innovation by "Going Beyond Frontiers"**

This will lead to a sales turnover of USD 1 Billion (INR 8000 Crs) by 2025 & achieve shareholders' expectations

**Challenges:**

Increasing Market share

Retaining customers

**Our Product range:**

Starter Alternator

Compressor Motors Ignition system

Wiper

## 1. Brief Description of the Project:

**Business Case:** The customer demand on our Compressor Motors is doubled, necessitating increase in the Plating Capacity from the current level of 5500 no's in 2022 to 12000 nos by 2025. This is one of our prestigious product being exported to Germany & fitted onto World Class vehicles like Audi, BMW, Mercedes Benz, Rolls Royce. Hence, meeting this demand is our COMPANY ‘s VISION & it contributes to nearly 20% of our Plant Turnover.

**Constraints:** The major constraint in meeting the demand is the non-availability of space to install another plating plant along with additional effluent treatment facilities and also non-availability of any other local source doing this type of plating

**Innovative Solutions:** Our team could overcome these constraints by innovative ways — within the space used for one plating plant - using the concepts of Geometry, PM Analysis, Theory of Constraints, TRIZ and Lateral Thinking.

Additional space could be created within the existing space as "Blessing in Disguise” by viewing the in-line Plating-Jig Buffer storage space in “Another Dimension” and innovating alternative way of storing plating-jigs in Non-reactive Tanks(using TRIZ principles) which lead to increasing capacity by way of duplicating bottleneck stations.

Further, to improve the capacity of bottleneck stations, the number of parts per Jig is increased by “Evaporating the Conflict” of “part orientation & need for auxiliary diode” through innovative "Lateral Thinking’ of introducing Spray-Type cleaning.& Tilted orientation of part loading in Jig.

In order to make the process robust to yield consistently best quality, Taguchi Inner – Outer Array DOE along with Process Window study are conducted to optimize the part tilting angle & other parameters.

**Benefits:** Thus, the existing plant capacity is increased by 2.5 times avoiding requirement for additional space & investment of Rs.18 Cr on new machines and eliminating generation of additional hazardous wastes – paving way for GREEN environment. Also the OEE is improved from 85% to 93% by reducing Jig maintenance down-time, Quality & Start – up Loss.

## 2. Trigger for the Project:

Our Company’s vision is to “Enhance exports in global passenger and commercial vehicle segments” Accordingly we have a separate EOU department catering to export customer. The customer has given an opportunity to achieve our vision, by way of increasing the Demand.

The customer has informed the demand forecast in advance and asking for our confirmation. Any default in advance confirmation & audit / approval will lead to loss of business. The major constraint is increasing the capacity of Zinc-Nickel Plating – an exclusive plant used for plating the export product.

At present we are Single Source for the export customer- firm action plan is required **to retain Business & avoid competition**. Preliminary exploration to increase capacity requires installing a new line but it has constraints. Hence developing & evaluating alternate solutions is need of the hour –triggering this project.

## Zn-Ni Plating Plant Capacity in Nov-2022

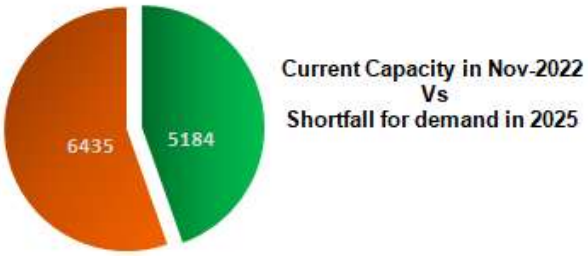
Cycle Time = 6.2 minutes

No of loads per day (22.5 hrs) – 216

No of Components per load – 24 No's

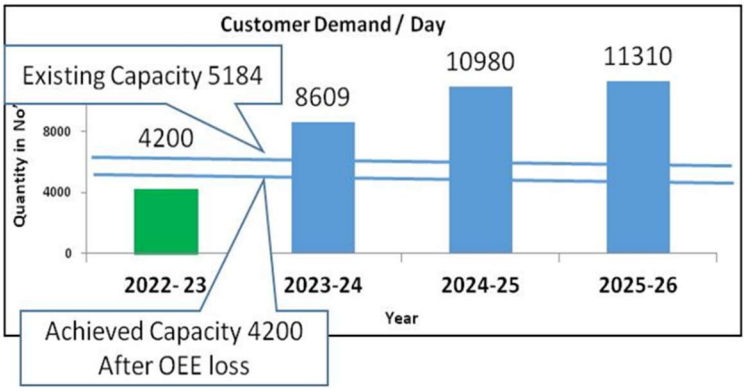
No of Components per day – 5184 No's

OEE – 85% (Quality Loss & Break down due to Auxiliary anode issue)




Inference: **Current capacity can only meet 40% of the increased customer demand.**

## Objective:




## Project time line:

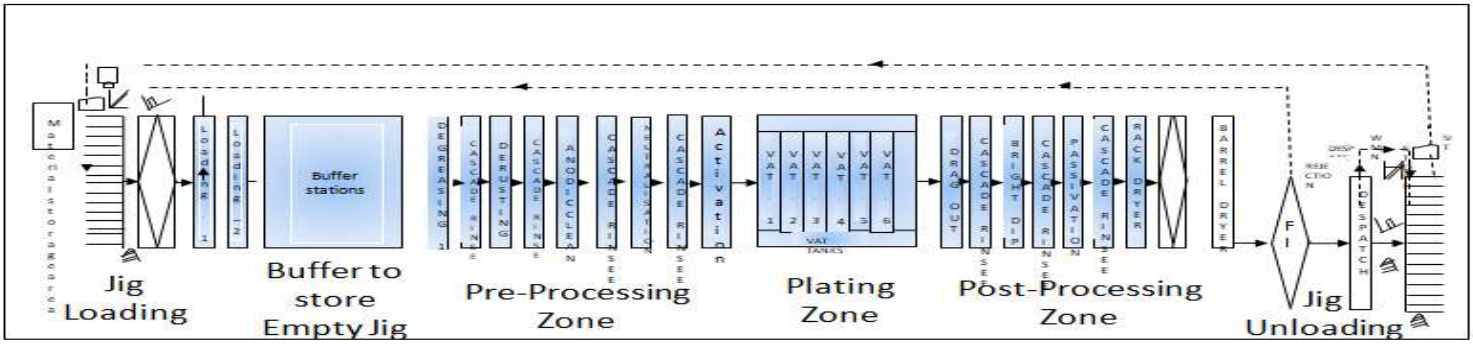
| S.No | Steps | Rep | Sep-22 | Oct-22 | Nov-22 | Dec-22 | Jan-23 | Feb-23 | Mar-23 | Apr-23 | May-23 | Jun'24 | Feb'24 | Mar'24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Define | CM/KS/Mk/JH | | | | | | | | | | | | |
| 2 | Measure | CM/KS/Mk/JH | | | | | | | | | | | | |
| 3 | Analyze | CM/KS/Mk/JH | | | | | | | | | | | | |
| 4 | Improve- Phase 1 (Requirement - 2023-24) | CM/KS/Mk/JH | | | | | | | | | | | | |
| 5 | Improve- Phase 2 (Requirement - 2023-24) | CM/KS/Mk/JH | | | | | | | | | | | | |
| 6 | Improve - Phase 3** (Requirement - 2024-25) | CM/KS/Mk/JH | | | | | | | | | | | | |
| 7 | Control | CM/KS/Mk/JH | | | | | | | | | | | | |

** Phase 3 Planned in Dec-2024

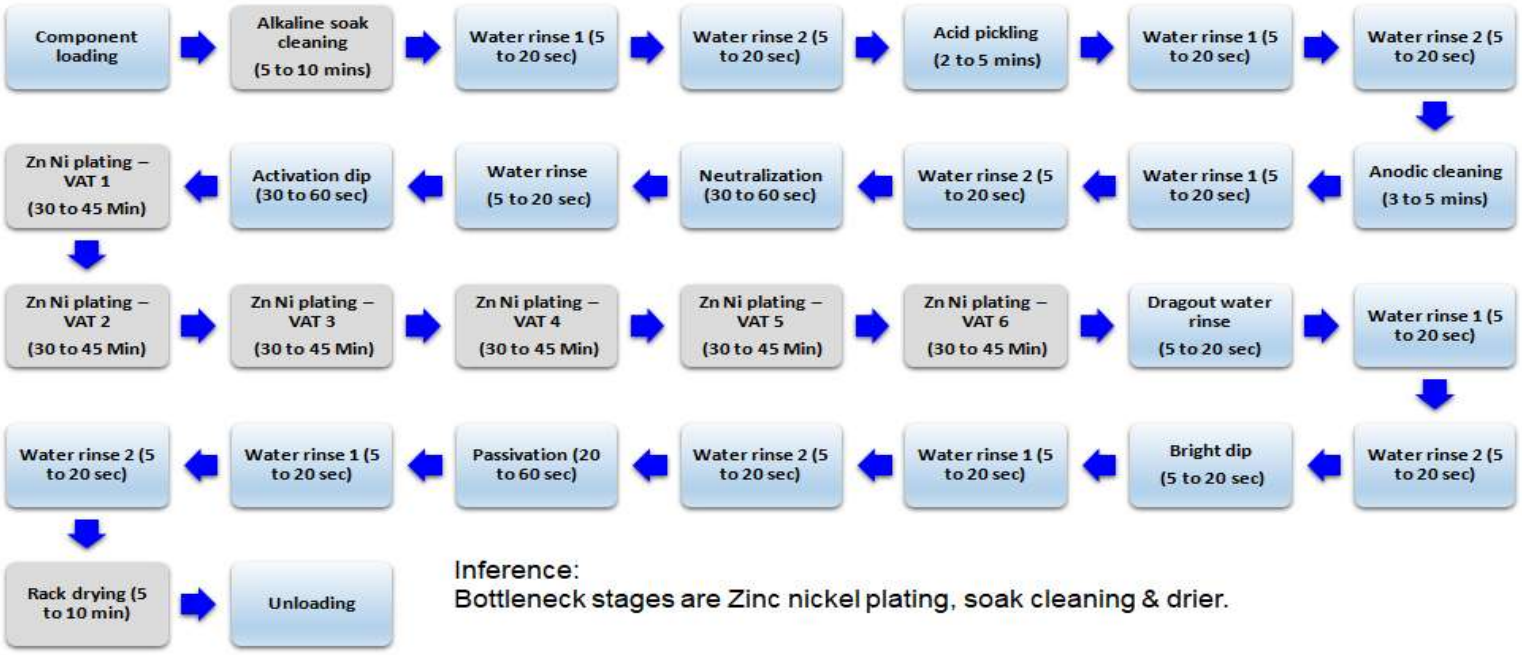
## Measure Phase:

( Understanding the Current Status & Requirements )

## Zinc – Nickel Process flow – Understanding the process



## Zinc – Nickel Process flow – Critical to capacity study




Inference:
Bottleneck stages are Zinc nickel plating, soak cleaning & drier.

## Value Analysis – Zinc Nickel Plating process

| Opn description | Value Adding Process (Score) | Non Value adding Process | |
|---|---|---|---|
| | | Essential | unessential |
| Component loading | 0 | ✓ | ← To load in Fixture |
| Buffer station | 0 | ✓ | ← To avoid start up loss |
| Transfer | | ✓ | ← To move to next process |
| Hot AlKaline Soak Cleaning | 2 | | |
| Transfer | | ✓ | |
| Cascade water rinse I | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse II | 1 | | |
| Transfer | | ✓ | |
| Acid pickling (De-rusting) | 2 | | |
| Transfer | | ✓ | |
| Cascade water rinse I | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse II | 1 | | |
| Transfer | | ✓ | |
| Anodic Cleaning | 3 | | |
| Transfer | | ✓ | |
| Cascade water rinse I | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse II | 1 | | |
| Transfer | | | |
| Neutralisation dip | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse I / Spray rinse | 1 | | |
| Transfer | | ✓ | |
| Non-etching Activation dip (NaOH of 2 to 5%) | 2 | | |

Relative Score – Scale: 1 to 5 1- Low Value 5- High Value

| Opn description | Scoring for value addition | Non Value added | |
|---|---|---|---|
| | | Essential | unessential |
| Transfer | | ✓ | |
| Zinc Nickel Plating | 5 | | |
| Transfer | | ✓ | |
| Rinse in dragout water | 1 | | |
| Transfer | | ✓ | |
| Spray rinse | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse | 1 | | |
| Transfer | | ✓ | |
| Neutralization (Bright Dip) | 2 | | |
| Transfer | | ✓ | |
| Cascade water rinse I | 1 | | |
| Transfer | | ✓ | |
| Cascade water rinse II | 1 | | |
| Transfer | | ✓ | |
| Dip in trivalent iridescent passivation | 3 | | |
| Transfer | | ✓ | |
| Cascade water rinse I | 1 | | |
| Transfer | | ✓ | |
| Hot water rinse | 1 | | |
| Transfer | | ✓ | |
| Rack drying | 3 | | |
| Transfer | | ✓ | |
| Rack Unloading | 0 | | |

**Requirement: Minimize ESSENTIAL & Eliminate Un-ESSENTIAL**

**Inference: ALL Non –Value Adding Processes are found ESSENTIAL**

## Zinc Nickel Plating process – Govt. Regulations

Zinc Nickel plating factories require consent to establish and consent to operate is governed under Air and water act.

Hazardous waste in Zinc Nickel plating process having the following Government regulations.

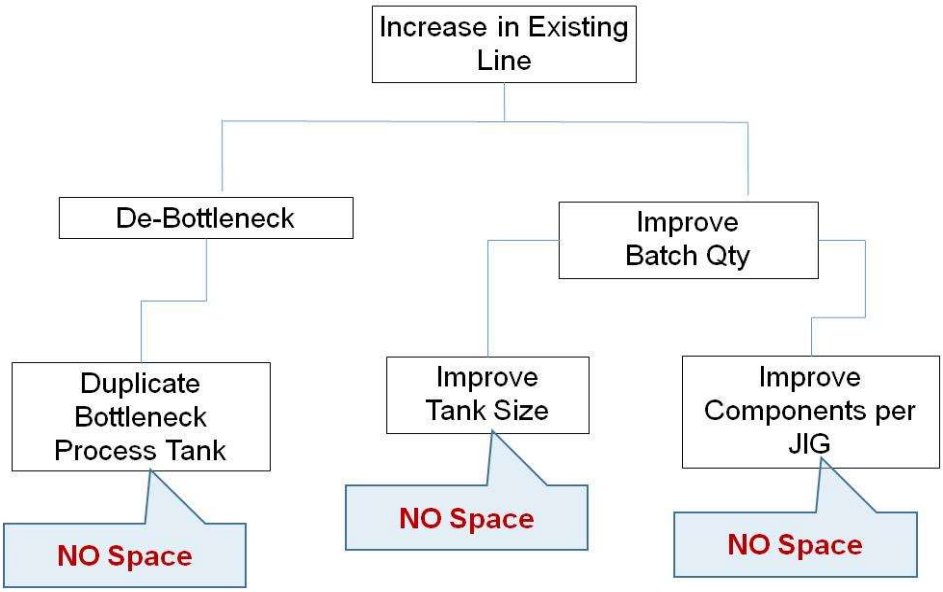
| Hazardous wastes in Zinc Nickel Process | Government regulations for Hazardous wastes |
|---|---|
| • Hazardous solid waste | • Waste generation Approval from TNPCB<br>• Waste disposal Approval from TNPCB |
| • Hazardous Liquid waste | • Effluent treatment plant with spray drier and evaporator is Mandatory for liquid waste treatment. |
| • Hazardous Gas Emissions | • Wet scrubber is Mandatory for hazardous gas emission treatment. |

## 3. Solution generation, Innovation and Complexity

### Analyze Phase:

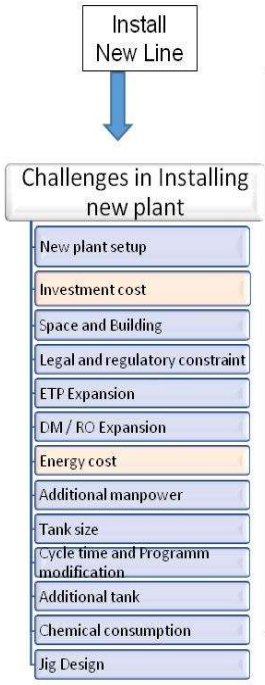
( Identifying And Evaluating The Alternatives )

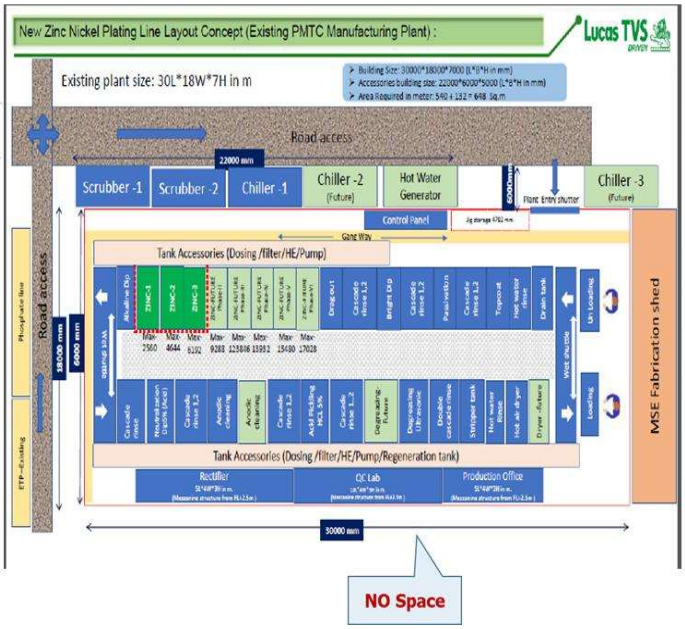
## Alternative 1: Maximise Capacity of Existing Plant




Inference: Space is not available in existing plant for adding bottleneck process tanks & Increasing Jig & tank size.

## Alternative 2: Install a New Plant

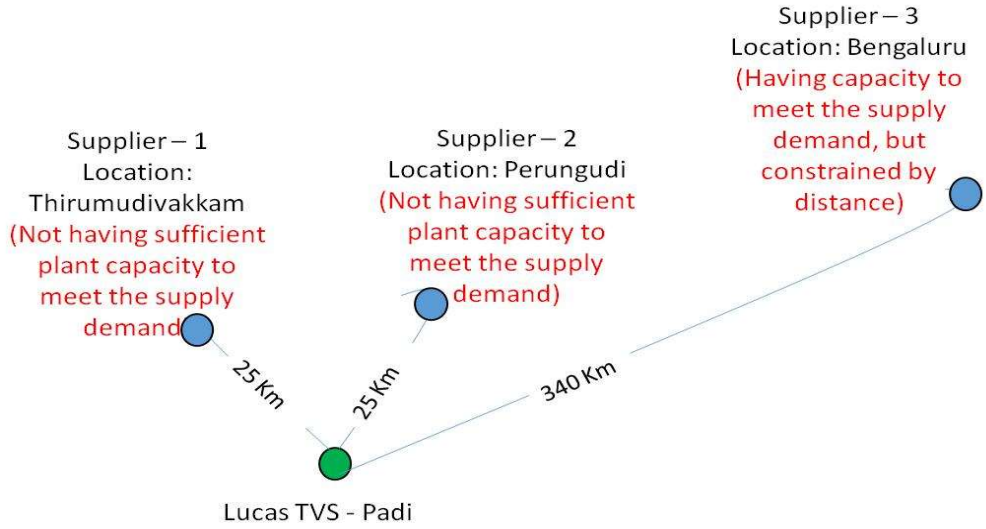



| Head | Type | Total Cost - without tax | GST - 18% | Total Cost - with tax |
|---|---|---|---|---|
| Process Equipment(Ph 1) | Equipment | ₹ 6,70,00,000.00 | ₹ 1,20,60,000.00 | ₹ 7,90,60,000.00 |
| Jig(Ph1) | Tooling | ₹ 54,01,100.00 | ₹ 9,72,198.00 | ₹ 63,73,298.00 |
| Heat Pump | Accessorises | ₹ 2,25,00,000.00 | ₹ 40,50,000.00 | ₹ 2,65,50,000.00 |
| QC Lab items | Accessorises | ₹ 79,39,751.00 | ₹ 14,29,155.18 | ₹ 93,68,906.18 |
| Chemical requirement items | Consumable | ₹ 51,25,000.00 | ₹ 9,22,500.00 | ₹ 60,47,500.00 |
| PMTC Building refurbishment and Facility requirements | Building refurbishment | ₹ 88,51,771.80 | ₹ 15,93,318.92 | ₹ 1,04,45,090.72 |
| MTC - New Building and Facility requirements | New Building for Process shop | ₹ 1,14,95,040.00 | ₹ 20,69,107.20 | ₹ 1,35,64,147.20 |
| Electrical work out | General requirement | ₹ 80,00,000.00 | ₹ 14,40,000.00 | ₹ 94,40,000.00 |
| ETP + RO Plant | General requirement | ₹ 1,30,00,000.00 | ₹ 23,40,000.00 | ₹ 1,53,40,000.00 |
| DM Water plant requirement | General requirement | ₹ 5,00,000.00 | ₹ 90,000.00 | ₹ 5,90,000.00 |
| Total in INR | | ₹ 14,98,12,662.80 | ₹ 2,69,66,279.30 | ₹ 17,67,78,942.10 |
| | | 14.98 Cr | 2.69 Cr | 17.67 Cr |

Inference: Installing new plant requires the Investment cost of Rs. 18 Cr. But, space not available installing new plating plant. It requires acquisition of new land and building and also Govt. Approval for environmental effects

## Alternative 3: Out-Source Plating


Note: Outsourcing requires fresh approval from export customer which involves time and the mfg. cost also will increase due to transportation.

## Prioritization Matrix

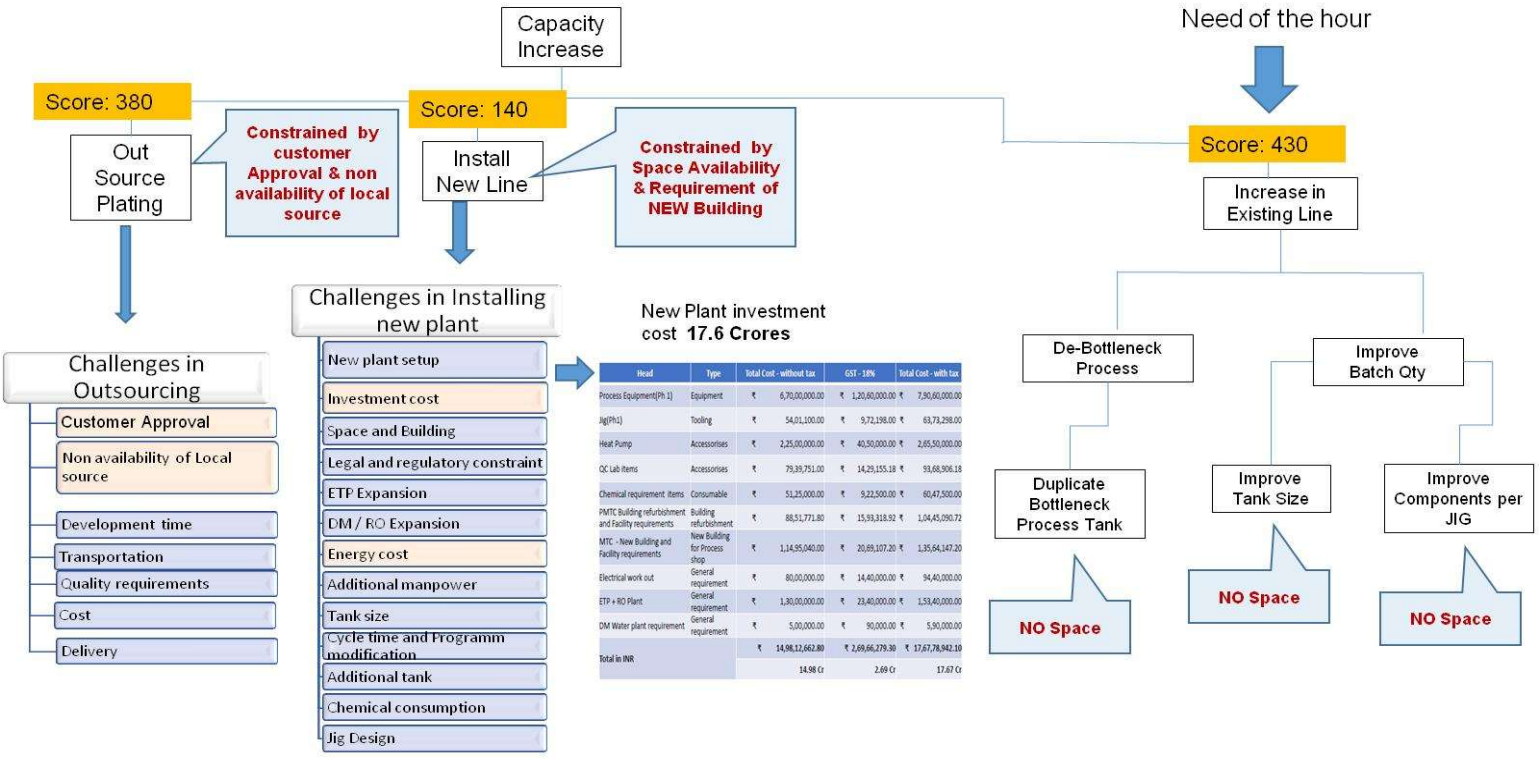
| Criteria for Evaluation | | Capital Investment | Customer Approval | Govt. Approval | Space Requirement | Time to Implement | Mfg. Cost per Part | Total |
|---|---|---|---|---|---|---|---|---|
| Weightage for Criteria | | 20 | 10 | 10 | 20 | 20 | 20 | 100 |
| ALTERNATIVES | OUT SOURCE | 5 | 1 | 5 | 5 | 5 | 1 | 380 |
| | INSTALL NEW PLANT | 1 | 3 | 1 | 1 | 1 | 2 | 140 |
| | MAXIMISE EXISITNG PLANT | 4 | 5 | 4 | 4 | 4 | 5 | 430 |

Relative Score – Scale: 1 to 5 1- Least Favourable 5- Most Favourable

Total Score = (4*20) + (5*10) + (4*10) + (4*20) + (4*20) + (5*20) = 430

Inference: we used prioritizing Matrix to select the best alternative - considering the various criteria and the relative weighted score. The option of Improving the capacity of existing plant emerged as the best alternative with top ranking

## Summary of Alternatives for capacity Increase

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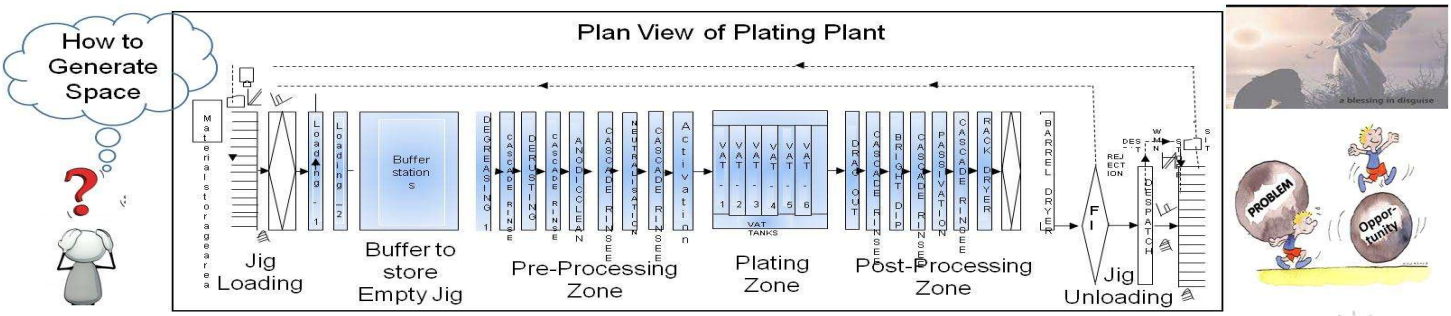
| | | 14.98 Cr | 2.69 Cr | 17.67 Cr |

## 4. Implementation

**Improve Phase:**

(Developing solutions)

## Idea Generation – Phase 1:




**TRIZ Principle 17: "Another Dimension"**
Look in another Perspective

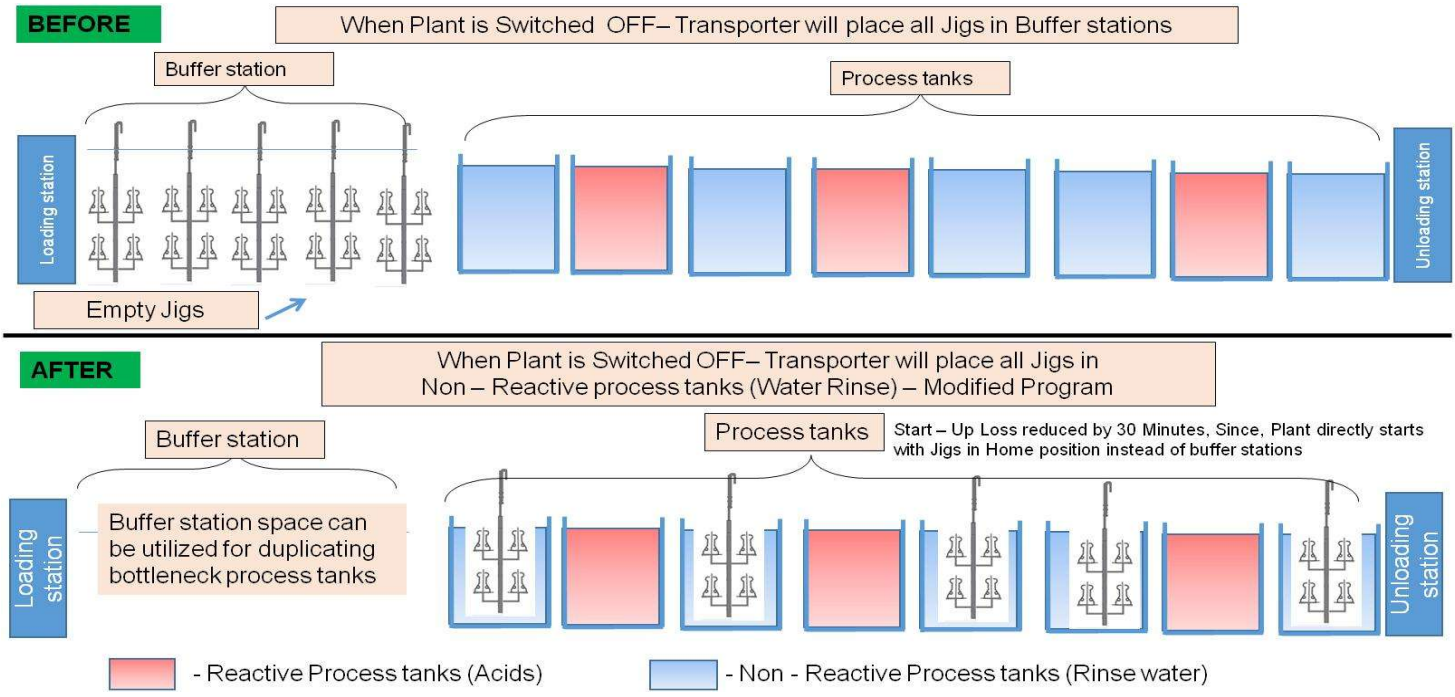
**TRIZ Principle 22: "Blessing In disguise"**
Convert Wastes into useful objects

The Buffer space is used ONLY - WHEN PLANT IS SWITCHED OFF - for storing empty jigs

- The Buffer is UNPRODUCTIVE SPACE – But Empty Jigs must be kept in-line & not outside- to avoid start up loss
- Why Not Store inside tanks itself as plant is switched off – But the chemical in the plant will react with Jig material
- Why Not store in Non-reactive cleaning tanks ??? !!!!! & Use the Buffer space for Plating Process
- This idea not only release buffer space But also reduce start – up loss

**GOOD IDEA**

## Idea 1: Converting Un-Productive Buffer Space into Productive Plating Process Zone

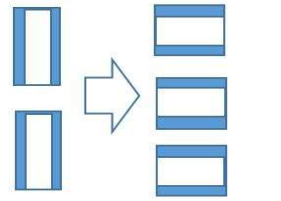



## Idea Generation – Phase 2:

Can we increase the number of parts in the Jig

## Geometrical Visualization


Present Jig Design

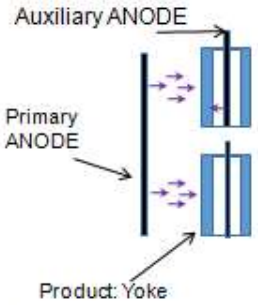



**For the same size of the tank**
If the Parts are loaded Horizontally instead of vertically, the number of parts can be increased

BUT
Why are we loading Vertical ?

## Understanding the Current Process

| PM Analysis - Physical Phenomenon Analysis of Plating Process | | |
|---|---|---|
| **Process** | **Elements Involved** | **Physical Phenomenon** |
| Zn-Ni Plating | Part to be plated<br>Cathode<br>Anode<br>Plating Bath | Electroplating, also known as electrochemical deposition or electro deposition, is a process for producing a metal coating on a solid substrate through the reduction of cations of that metal by means of a direct electric current |

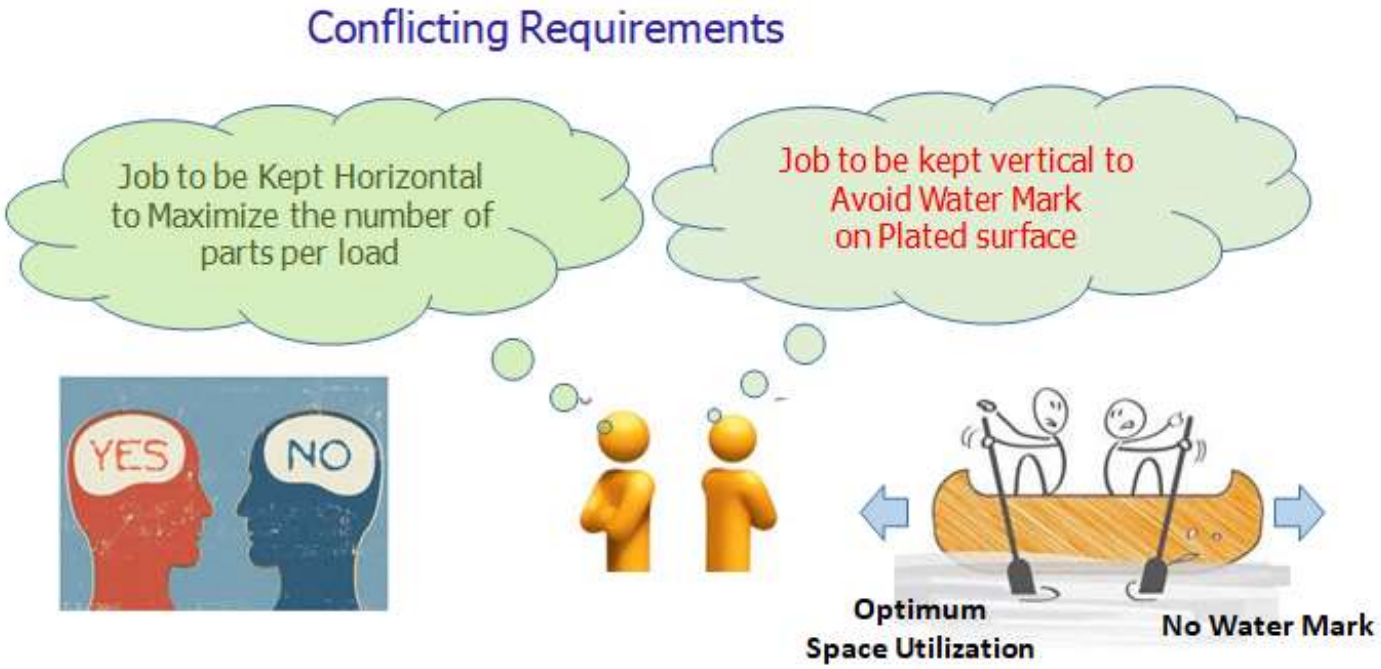



Why loading vertical and using additional anodes to coat Inner dia. ???

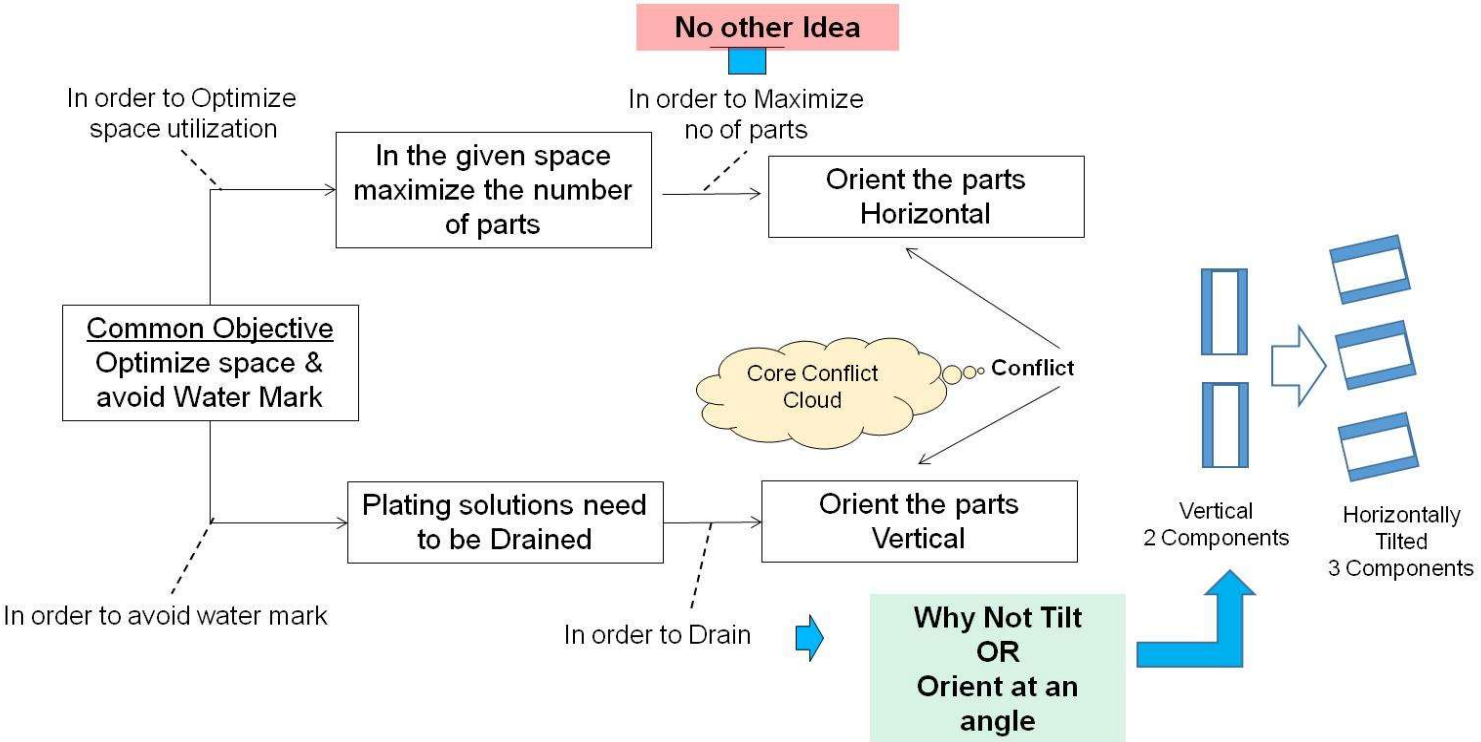
**History**
It is understood vertical loading is a result of PFMEA
To avoid Water Mark in plated surface

**What is Water Mark**
A mark left on the plated surface if the plating solutions are not drained properly

In the current Process Parts are loaded vertically in Jig and to improve the flow of metal ions Auxiliary Anodes are used to plate the Inner Diameter of Part

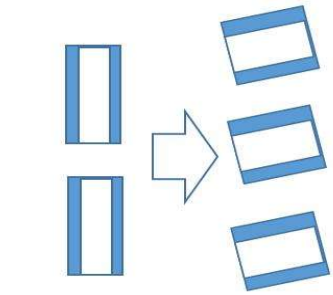



## Theory of Constraints – Evaporating the CONFLICT Cloud




## Developing a Robust process to Implement the Innovations:

# Optimizing the Plating Parameters when Increasing the Number of Parts per Load



Vertical
2 Components
With
Auxiliary Diode

Horizontally Tilted
3 Components
No Auxiliary
Diode

When changing
The Part orientation & Eliminating Auxiliary Diode
The Factors that will affect the Plating are
Part Tilt Angle & Plating Current
Hence
DOE conducted to find the optimum Levels
Considering Three Output characteristics
as Responses given below

| Plating Process Parameters | | | |
|---|---|---|---|
| Descpn | UOM | Level 1 | Level 2 |
| Part Tilt Angle to Horizontal | Deg | 45 | 30 |
| Plating current | A | 450 | 550 |

| Response Ranking | | | |
|---|---|---|---|
| Out put Characteristics | UOM & spec | Acceptance | |
| | | OK | Not OK |
| Yoke ID coverage | Visual/Full coverage on yoke ID | 1 | 0 |
| Plating thickness | 8 Microns (Min) | 1 | 0 |
| Proper draining of plating solutions | Visual – No water mark | 1 | 0 |
| Note: Response = Sum of above characteristics | | | |

## DOE – To select the robust parameters

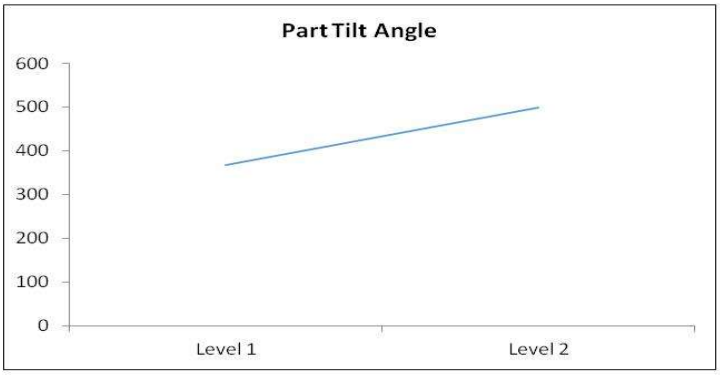
Experiment Response table

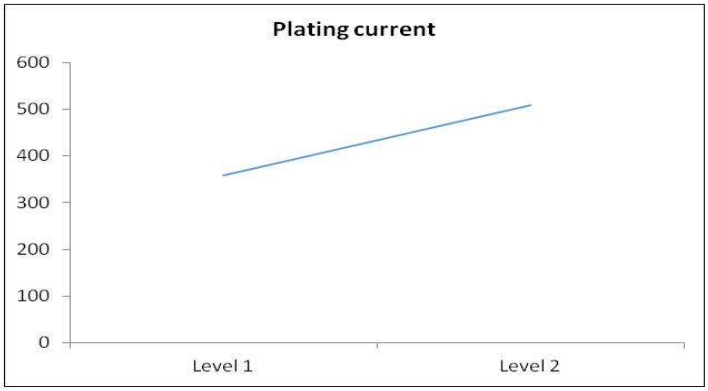
- ❑Two factors
- ❑Two levels
- ❑Four combination
- ❑Three response

| Plating tilt angle | Plating current | Trial 1 – 32 Samples | Trial 2 – 32 Samples | Trial 3 – 32 Samples | SN Ratio Higher the better |
|---|---|---|---|---|---|
| 30 | 450 | 2 2 2 2 1 2 3 2 3 2 2 2 3 2 2 2 2 2 2 3 2 2 3 2 2 3 2 2 3 2 3 2 | 2 3 2 2 2 3 2 3 2 2 2 3 2 2 2 2 2 2 3 2 2 2 2 3 2 2 3 2 2 3 2 3 | 3 2 2 2 2 2 2 2 3 3 2 2 2 3 2 2 3 2 2 3 2 2 3 2 2 2 2 3 2 2 2 | 7.00 |
| 45 | 450 | 2 1 2 1 1 2 1 2 1 0 1 2 1 3 1 2 2 1 2 2 1 1 2 1 3 1 2 1 1 2 1 2 | 1 2 2 1 2 1 1 2 2 1 2 2 1 3 0 2 2 1 2 2 1 1 2 1 3 1 2 1 1 2 1 0 | 2 1 1 2 1 2 2 2 1 2 2 1 1 2 3 1 2 1 0 2 2 1 1 1 3 2 2 2 1 2 1 0 | 3.39 |
| 30 | 550 | 3 3 3 3 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | 13.19 |
| 45 | 550 | 3 2 2 2 2 2 3 2 3 2 2 2 3 2 2 2 3 2 2 3 2 1 3 2 2 2 3 3 3 3 3 3 | 2 2 3 2 3 3 2 3 3 2 2 3 2 2 2 2 2 3 3 2 2 2 3 2 1 2 2 3 2 2 2 2 | 3 2 2 3 2 2 3 2 3 3 2 3 2 2 2 3 3 2 2 3 2 2 3 2 1 2 2 2 2 3 2 2 | 6.42 |

**Best Combination - Based on Highest S/N Ratio**
**Plating Tilt Angle – 30 Deg**
**Plating current - 550 A**

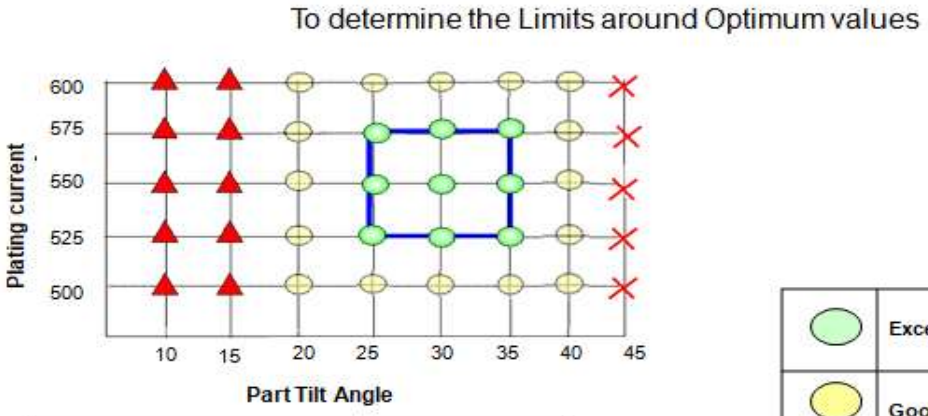
## Effect Plot




| Higher the better | | |
|---|---|---|
| **S.No** | **Factors** | **Level** |
| 1 | Part Tilt Angle to Horizontal | 30 |
| 2 | Plating Current | 550 |

## Process Window Approach



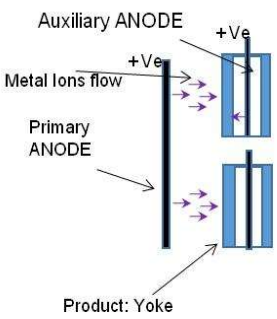

| Higher the better | | | |
|---|---|---|---|
| **S.No** | **Factors** | **DOE Level** | **Optimized Limits** |
| 1 | Part Tilt Angle to Horizontal | 30 | 25-35 |
| 2 | Plating current | 500 | 500 - 600 |

Legend graph

| | | |
|---|---|---|
| | Excellent | ID coverage Excellent, Plating thickness > 8 Microns, Plating solutions effectively drained |
| | Good | ID coverage good , Plating thickness > 8 Microns, Plating solutions effectively drained |
| | NG | Water Mark – due to poor drainage of Plating chemicals |
| | NG | ID Less coverage of plating |

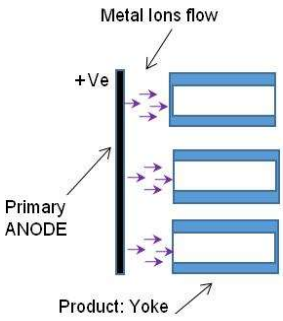
## Idea 2 - Optimum Utilization of Tank Space – Increasing number of parts per Jig

**Before**




➢ No. of Parts / Jig – 24 No's
- Auxiliary Anode is required for yoke ID coverage
- Capacity – 7512 No's / Day
- Poor coverage rejection noticed (2.5%) due to current distribution loss ( Between Primary anode and auxiliary anode)

**AFTER**




30%

Capacity Increase
Process Electrical Current increased from 450 to 550 amps

➢ No. of Parts / Jig – 32 No's
- Auxiliary Anode ELIMINATED
- Capacity – 10016 No's / Day
- Poor coverage rejection reduced (0.65%) due to uniform current distribution only to the Primary Anode

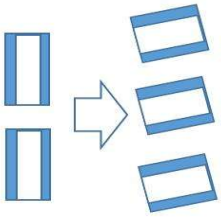
## Idea Generation – Phase 2 – Idea – 3

## Effective Drain of plating solution


**LATERAL THINKING**

Spray Cleaning Car

Spray Cleaning in Washing m/c





Archimedes

**Introduce Water Spray Cleaning**
To positively clean the Plating solutions from the surface of the Job

**Before**

Dip type Rinse tank

**AFTER**


Spray type Rinse tank

## Control Phase:

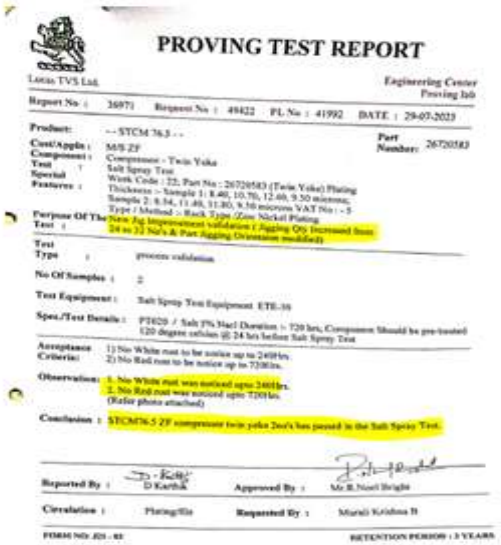
( Sustaining the Improvements ) Validation of Improved Process

Plating Visual Ok - Outside & Inner side

Product Validation:

1. Thickness OK
2. Adhesion test OK
3. Magnet adhesion OK
4. Salt spray - OK

Salt spray test passed



PROVING TEST REPORT

Lucas TVS Ltd. Engineering Center Proving lab

Report No : 36971 Request No : 49822 PL No : 41992 DATE : 29-07-2023

Product: --STCM 76.3 --

Cust/Applic : M/S ZF Part Number: 26720583

Component : Compressor - Twin Yoke

Test : Salt Spray Test

Special Features : Work Code : 22; Part No : 26720583 (Twin Yoke) Plating Thickness :- Sample 1: 8.40, 10.70, 12.60, 9.30 microns; Sample 2: 8.54, 11.40, 11.80, 9.30 microns VAT No : - 5 Type / Method :- Black Type (Zinc Nickel Plating

Purpose Of The Test : New Jig Improvement validation ( Jigging Qty Increased from 24 no 22 No's & Part Jigging Orientation modified)

Test Type : process validation

No Of Samples : 2

Test Equipment : Salt Spray Test Equipment ETE-16

Spec./Test Details : PS020 / Salt 5% NaCl Duration :- 720 hrs, Components Should be pre-heated 120 degree celcius @ 24 hrs before Salt Spray Test

Acceptance Criteria: 1) No White rust to be notice up to 240Hrs 2) No Red rust to be notice up to 720Hrs.

Observation: 1. No White rust was noticed upto 240Hrs. 2. No Red rust was noticed upto 720Hrs. (Refer photo attached)

Conclusion : STCM76.5 ZF compressor twin yoke 2no's has passed in the Salt Spray Test.

Reported By : D Karthik Approved By : Mr.R.Noel Bright

Circulation : Plating/Qa Requested By : Murali Krishna N

FORM NO: JQS - 02 RETENTION PERIOD : 3 YEARS

## Project Management:

We have implemented the ideas in the existing plant without affecting the continuous production. We planned & all the offline activities like PLC program modification, tank , wagon, Jig, Flight bar design & procurement before Implementation of the Idea. we selected national & regional holidays for Implementation without affecting the regular production.

## Technical & Managerial Challenges:

In Phase 2 Implementation “Utilization of Tank Space – Increasing number of parts per Jig”, we conducted trials with proto jigs with horizontal tilted loading & validated the part for thickness, adhesion, coverage & salt spray test. Once all the validations completed by our Engineering department. We got the approval for this Jig design & Implementation.

## Green as Management concept:

**Impact on Environment:**

- As we increased the capacity in existing plant itself, the Increase in effluent outflow due to new plating plant got eliminated.

**Water Consumption:**

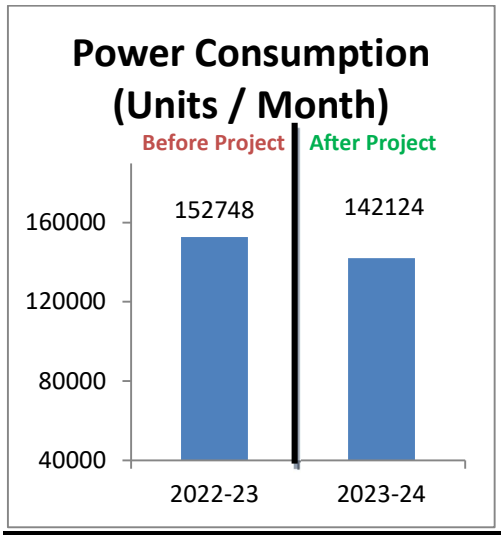
- Water consumption & effluent got reduced from 2.94 L / Piece to 1.63 L / Piece. (We increased the capacity in the same plant itself by duplicating bottleneck process tanks)

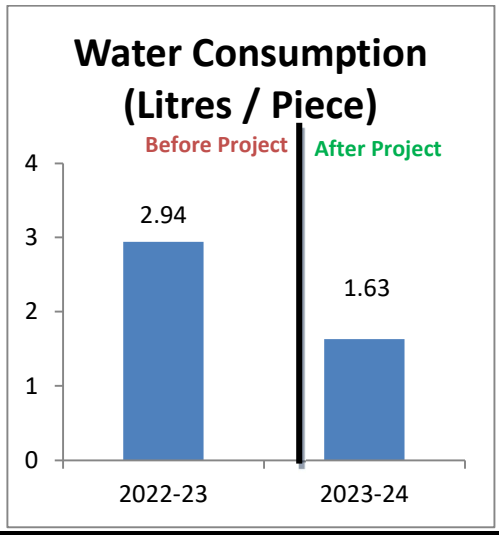
**Power Consumption:**

- Power consumption got reduced from 0.8 Unit / Piece to 0.5 Unit / Piece.

**Carbon Footprint:**

- As we reduced the power consumption, Carbon Footprint got reduced by 2700 $tCO_2e$

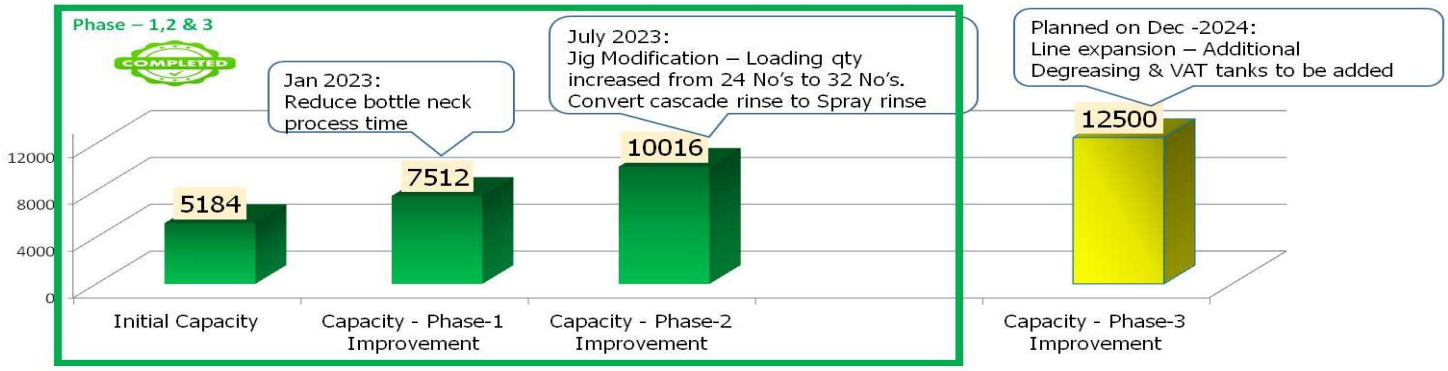



**Standardized through updation in Control Plan & FMEA**

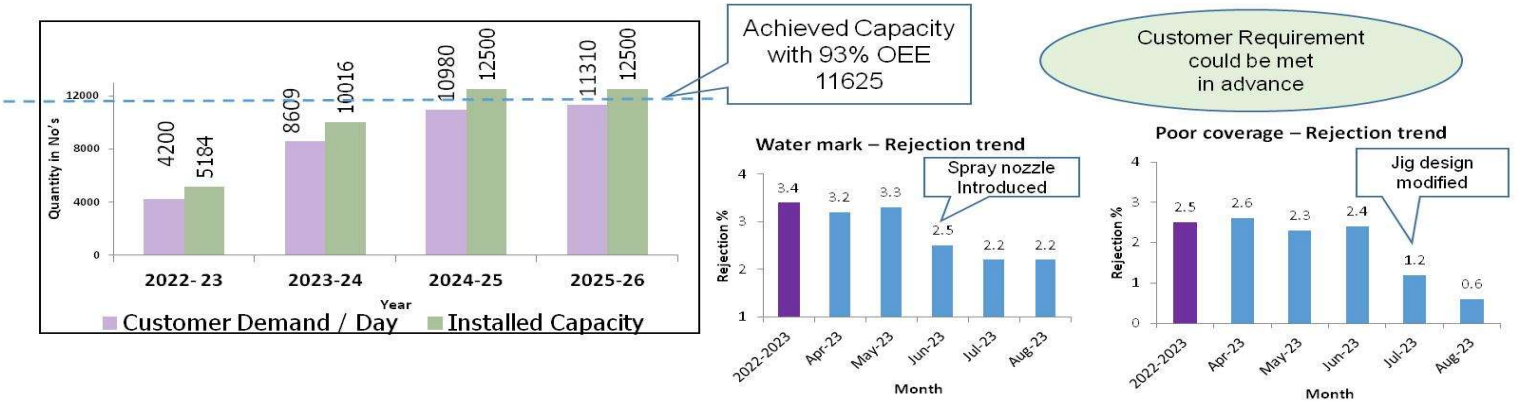
## 5. Results / Impacts:

Existing Plant capacity increased by almost 2 times & eliminating need for fresh Govt. Approval.




| Phase | Improvement details | Capacity | Status |
|---|---|---|---|
| Phase 1 | **De-Bottle-** Eliminate the buffer stations by repositioning of Flightbars / jigs into non-reactive tanks during plant Switch-off. Hence Buffer space can be utilized for providing additional bottleneck process tanks | 7512 No's | Completed Jan 2023 |
| Phase 2 | **Jig design modification** - No of components loading to be increased from 24 to 32 per jig | 10016 No's | Completed July 2023 |
| Phase 3 | **Line Expansion:** Additional Degreasing, Anodic tank, Plating tank & transporter to be added – to fully utilize the Buffer space released for production | 12500 No's | Target Dec - 2024 |

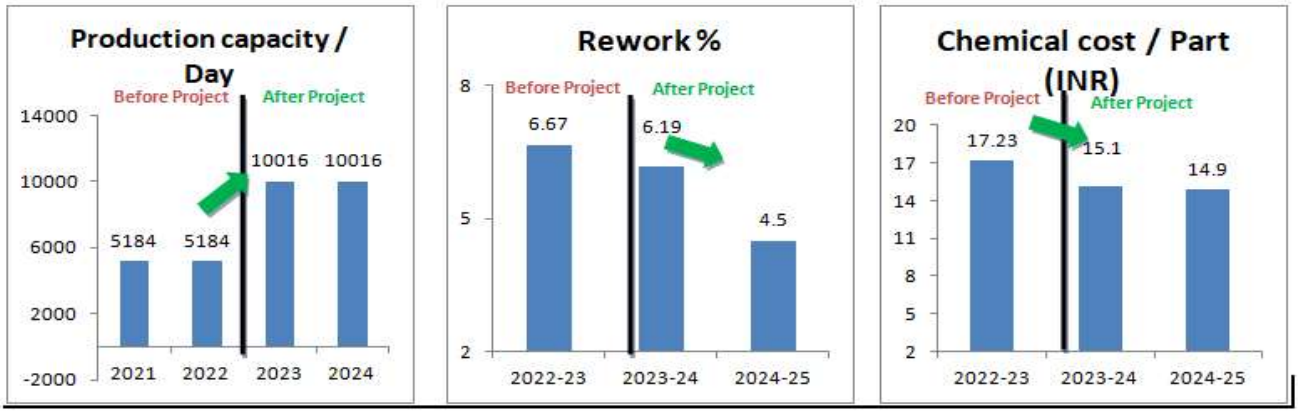
## Project - Outcome




| | Nov 2022 | Phase 1 Jan 2023 | Phase 2 July 2023 | Phase 3 Mar 2024 (Plan) |
|---|---|---|---|---|
| Cycle Time- per jig coming out | 6.2 Minutes | 4.3 Minutes | 4.3 Minutes | 3.4 Minutes |
| No. of loads per day | 216 | 313 | 313 | 390 |
| No. of Components per load | 24 | 24 | 32 | 32 |
| No. of components per day | 5184 | 7513 | 10016 | 12480 |
| Plant OEE | 85 % | 85 % | 93 % | 93 % |

**Company's VISION Achieved thro' Stated Strategies**

## Project Results




| Parameters | Before | After | Unit of Measure |
|---|---|---|---|
| Productivity | 5184 | 10016 | No's / Day |
| Rework | 6.67 | 4.5 | % |
| No of ALR | 25 | 8 | No's / Day |
| Chemical cost / Piece | 17.23 | 14.90 | INR |
| Manpower (No Change) | 5 | 5 | No of Employees |
| Delivery | 92 | 100 | % |
| Safety (No Change) | 0 | 0 | Incidents |

## 6. Business Sustainability & Future Focus:

- We can able to achieve our Company's vision of "Enhance exports in global passenger and commercial vehicle segments" through Innovative Ideas.
- We can able to gain our export customer's confidence. This will help us in getting new export business.
- With this idea we could retain the customer and achieve a sales of Rs.600 Cr by 2025 from Rs. 200 Cr in 2022

## 7. Resource Impact

| Parameters | Before | After | Unit of Measure |
|---|---|---|---|
| Water per piece | 2.94 | 1.63 | INR |
| Power per piece | 0.8 | 0.5 | Units |
| Chemical cost per Piece | 17.23 | 14.90 | INR |

* The Investment cost of Rs. 18 Cr on new plant is avoided. (Refer section.3 – Alternatives)
* We have achieved increased capacity by investing about Rs. 1.5 cr. in the existing plant itself
* Energy cost of new plant avoided
* Consumption of chemicals in new plant avoided
* The increase in the Effluent Outflow and associated Treatment Cost of installing a new plant avoided
* Maintenance cost of auxiliary anode eliminated.
* The cost of acquiring land for new plant avoided
* Cost of Jig reduced from Rs.5.3 to Rs. 1.9 Per part

| | Cost of Jig (Rs) | Life No of Loads | Life (No. of Parts) | Cost per Part (Rs.) |
|---|---|---|---|---|
| Old Jig | 45,000 | 355 | 355*24 = 8520 | 5.3 |
| New Jig | 65,000 | 1065 | 1065*32=34080 | 1.9 |

## 8. Business Metrics

| Parameters | Before | After | Unit of Measure |
|---|---|---|---|
| Market share | 100 | 100 | % |
| Internal service level adherence | 90 | 100 | % |
| Customer score – Fill rate | 100 | 160 | % |
| Export sales | 200 | 320 | Crores (INR) |

* 100% Market share retained with the export customer

* Internal customer service level increased from 90% to 100%

* Customer fill rate increased from 100 to 160%

## 9. Scope for horizontal deployment

* We Incorporated the Idea of "**Converting Un-Productive Buffer Space into Productive Plating Process Zone"** in our Zinc plating line & adding additional bottle neck process tanks. We Modified the PLC program & sequence. We can able to reduce the cycle time from 12 minutes to 7.5 Minutes. (Horizontal deployment project completed on April – 2024)

* Capacity Increased by 30% in the existing plant with the Investment of 30 Lacs.

* This horizontal deployment enables in sourcing of the components' plated outside. Resulting in saving of 1 Cr / Month (Approx)

## Tool & Techniques used

**Define Phase**

- Project charter
- Project selection matrix
- Project viability Matrix

**Measure & Analyse Phase**

**Process study & Alternatives Analysis**

- Cycle time study
- Critical to capacity study
- OEE study
- VALUE ANALYSIS
- PRIORITIZATION Matrix

**Improve Phase**

**Innovative Thinking tools & techniques**

- TRIZ Principles (Another Dimension, Blessing in disguise)
- Physical Phenomena mechanism analysis
- Geometrical Visualization
- Lateral thinking
- Theory of constraints – Evaporating conflict cloud

**Optimizing tools**

- Multi response optimization
- S/N ratio
- Process window approach

## Appreciation by Lucas TVS Management:

### The Team Awarded with Cash Prize & Certificate from MD