Mechanization & Automation – Need of the Hour for Composites Manufacturing in India

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Composites Manufacturing In India

- Composites are Wonderful Materials of Construction - Highly Versatile class of Materials having unique Nature of Tailored Properties
- Composites Manufacturing in India dates back to early 1960s with fabrication shops setup for Marine and Roofing Application in Cochin and Kolkata
- Major Production Activity is still by Open Mold and Hand Layup even after five decades – with handful of organizations in business with Mechanized and/or Automated production units

What Is Achieved Till Now?

- Currently all types of Manufacturing Processes are used in India
- Composites Products are practically used in every corner of India in all types of applications
- Composites manufacturing in India has started getting recognition in the world with FRP Components being exported to Developed Nations on regular basis

What is Happening Today?

- Moderate growth seen in the last one decade compare to other BRICS nation
- Huge difference between Potential for Growth and Real Growth – never been seen converging during the same period – instead a diverging trend is seen
- Increased gap in demand and supply equation is frequently bridged, at the cost of quality and performance of finished product
- Inconsistency in Quality and Performance leading to lack of Confidence in Composites by the End Users in our Country

Some Points to Ponder?

Some Reasons Known / Some Ignored:

- Lack of skilled workers and Experienced Work Force
- Missing Structured Training at every level of Composites Business
- Reluctance and Inertia to shift to newer technologies / ideas
- Poor Resource Management and lack of Planning / Forecasting and Forced Cross Functional Roles playing aggravates situation
- Many more can be listed

Growth and Expansion!

Growth and Expansion i.e. Higher Production Volumes

- Increased Labor and working space – Primary Requirement
- Increased Raw Material Handling
- Increased Finished Product handling and quality checks
- Increased requirement of Funds Etc., etc., etc.,

Typical Questions Come to Mind

- Can one have Increased Volume in production with same resources of man power and space?
- What is Mechanization and Automation?
- What are Cost and Benefits – Can these be Quantified?
- Who can Help in Moving Forward?
- Each need is unique and different – can there be a common solution or each one is to be tailored?
- How does one decide where to Start? When to Start? Etc. etc. etc…….

Mechanization & Automation

Mechanization – In a Layman's words,

- Mechanization can mean deployment of any tools which can help in completing a task more efficiently and effectively in consistent manner
- Mankind has embraced Mechanization right from Stone Age by creating various tools and tackles to help in day to day life

Mechanization & Automation

Automation – Understanding in Layman's words

- Automation be considered as a system by which instruments / equipment etc. execute the tasks which are completed in sequence or in parallel through integration of various using a logical programing and signals
- Mankind has always put efforts to achieve a level of automation which would create an Efficient system to Consistently carry out tasks in Desired sequence to get the defined end results – typical example being Robotic Production Line

Broad Classification in Level of Mechanization & Automation

Primery Level (Suitable for Any Manufacturing Unit):

- Deployment of suitable mechanization and automation in
  - Raw Material Handling viz., Electrical Mat Cutters, Transfer Pumps
  - Mold handling viz., Trollies and Tracks, Winches / Presses
  - Processing Application viz., Use of Semi permanent mold releases, Saturation Rollers and / or Spray applications, Preheating / Post Curing using Infrared Heaters
  - Post Molding / Fabrication – Pneumatic / Electrical Tools for Trimming, Cutting+Polishing+Buffing, Spray Painting

Broad Classification in Level of Mechanization and Automation (contd.)

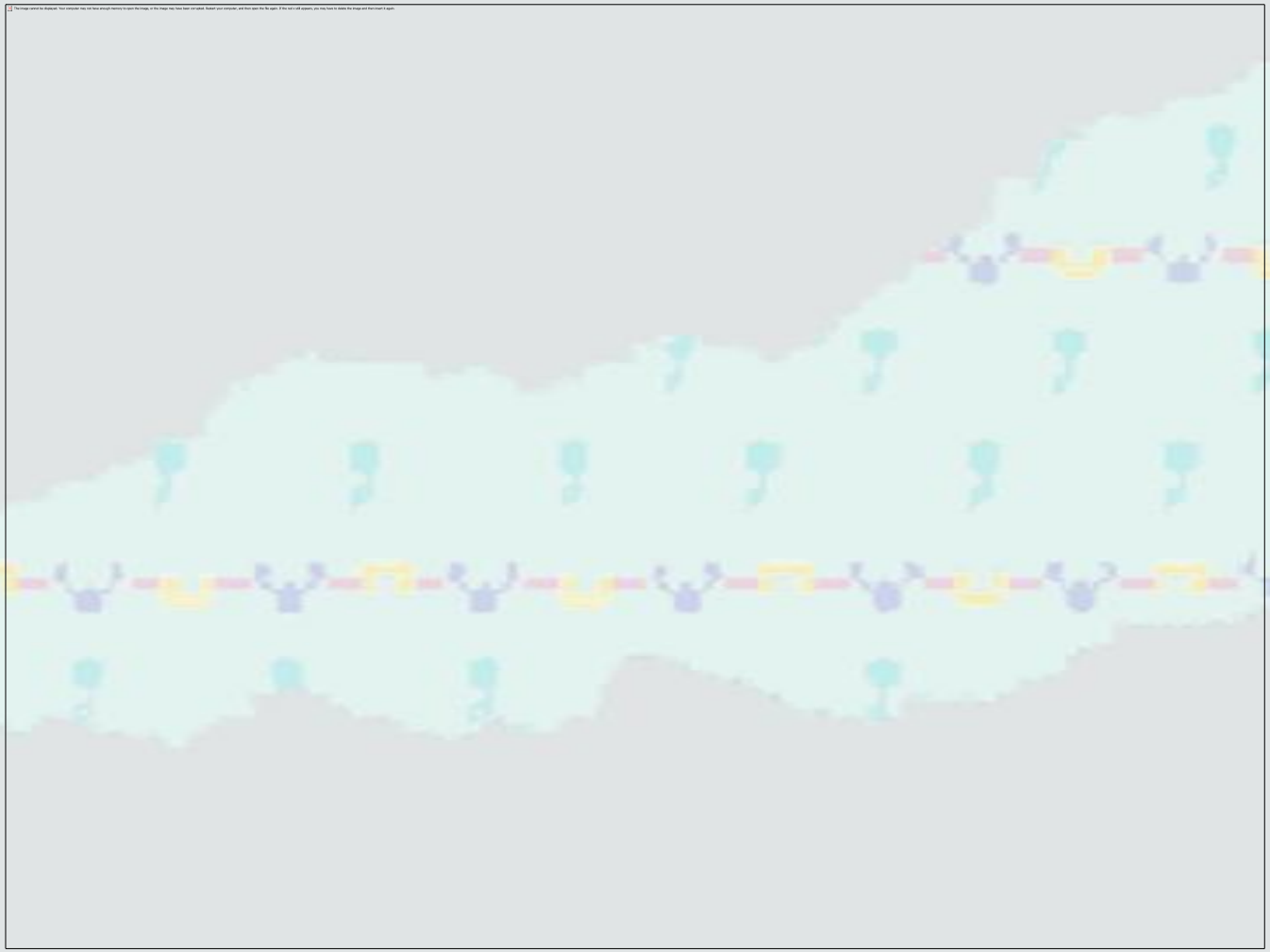
- **Intermediate Level of Mechanization and Automation**
  - Raw Material Handling with Bulk Supplies – IBCs and Bulk Bags, use of Preforms and Combination Reinforcements etc., Prepreg cutting with Two / three axis routers etc.
  - Mold Movements / Material Movements with Hydraulic Power Packs / Pneumatic Presses, etc., High Temperature and High Pressure Processing viz., SMC, DMC, Filament Winding etc.
  - Controlled Metering, Mixing and Dispensing of Materials – viz., RTM/LRTM, Vacuum Infusion processes, Auto Gelcoat Spray & Chop-spray, Vaccum Bagging / Prepreg Processing

Broad Classification in Level of Mechanization and Automation (contd.)

- **High Level of Mechanization and Automation**
  - PLC Controlled Systems for Material and Mold Handling
  - Robotic Systems for Material Dispensing
  - Integrated Time and Material Processing System
- **Typical Examples are:**
  - Continuous Filament Winding of Pipes
  - Automated Plant for Composite LPG Cylinder Manufacturing
  - Automated High Speed Pultrusion / Pulwinding Process for profile manufacturing
  - Automated Grating Manufacturing
  - Automated Sandwich Panel Manufacturing with Robotic System for Gelcoat Spray and Chop-Spray

Robotics – Fully Automated

How It Works



Robotic System for Part Manufacturing

Pros and Cons of Mechanization & Automation

Important Benefits Derived are:

- Increased Reliability
- Increased Consistency
- Increased Productivity
- Decreased Costs per unit production
- Improved Quality and Performance
- Reduced Labor / Manpower issues

Pros and Cons of Mechanization & Automation (contd.)

Costs to be Paid:

- Increased Capital Investment
- Increased level of skill for Labor / Manpower
- Requires special allocation of funds for Operation and Maintenance of installed facilities
- Increased burden of Safety and Risk Management with respect to materials, processes and manpower

Typical Case Study

- **Product Type:** Flat Sheet
- **Product Size:** 1050mm x 2100 mm x 2 mm
- **Material of Construction:** Gelcoat (400 micron) + Surface Tissue + CSM (suitable number of layers)
- **Production Process:** Brush Method open Mold vs. Spray Gelcoat and Chop-Spray
- **Mold Handling:** Manual Mold Movement vs. Carousal Concept
- **Mold Preparation:** Wax PVA vs. Semi Permanent Release
- **Material Curing:** Ambient Curing vs. Flash Curing after Gelcoat Application and Flash Heating after Chop-Spray
- **Labor Team per Mold:** 2 Nos. Vs. 3 Nos.

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Direct Cost Saving on Material

Material	Hand Lay up (kg)	Spray up (kg)	Direct Material Savings		Direct Cost Savings
Gelcoat	2.00	1.40	0.60 kg	30%	~ 25%
Laminating Resin	2.50	2.20	0.30 kg	12%	~ 10%
CSM Mat/Rovings	1.00	1.00	0.00 kg	0%	~ 15%
Total Weight	**5.50**	**4.60**	**0.90 kg**	**16.4%**	~ 15%

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Labor Cost Saving

Process Step	Hand Lay-up (Man hours)	Spray-up (Man Hours)	Time Saving (Man Hours)		Labor Cost Savings
Mold Preparation	0.25	0.00	0.25	100%	**~ 90%**
Gelcoat Application	0.67	0.03	0.64	95%	**~ 85%**
Laminating	1.00	0.16	0.84	84%	**~ 76%**
Total Time	**1.92**	**0.19**	**1.73**	**90%**	**~ 81%**

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Total Time Savings & Productivity

Item	No. of Sheets Produced Per Mold per Day		Effective Increase		Effective Increase Productivity (No. of Sheets/Person)
	Hand Layup	Spray-up			
Number of Sheets	3	12	9 No.	300%	**266%**
Number of Labor in Team	**2**	**3**	**1 No.**	**50%**	

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Myths of Mechanization & Automation

- **Myth No. 1:**
  - Costs are Very High to Automate / Mechanized Operations & Traditional Methods are Best
- **Facts:**
  - The Costs are nominal when systematic upgrading of the facility is taken up with planning.
  - Higher Investment can be funded through Banks as well as Non Banking Financial Institutions –
  - SIDBI actually provides special funds for Modernization and Upgrades!!
  - Recovery of the Cost is commensurate with production volume and projected sales –
  - Typical payback period of 6 months to 5 years which is considered good investment in the commercial parlance

Myths of Mechanization & Automation

- **Myth No. 2:**
  - Mechanization and Automation is for Big League Business for High Volume and Large Components
- **Fact:**
  - Larger benefits are for business with Low Output and Smaller Components as hidden costs are no longer overlooked
  - System becomes more efficient leading to better pricing and USP in the market for consistent quality
  - Carefully charted path of Systematic Investment on Capital Equipment and Utilities is actually the best path for a SME to saw seeds to grow in to a large scale organization

Myths of Mechanization & Automation

- **Myth No. 3:**
  - Mechanization and Automation means import of Capital Goods
  - Requires Specialized Skills and requires training of the manpower abroad, which in turn make the person indespensible
- **Fact:**
  - There are many companies locally who import components and integrate the systems with customization
  - Local support and quality after sales services are available.
  - With the mechanization in place, one can always achieve freedom from the labor problems to a large extent

Summary and Conclusions

- Mechanization and Automation can be embraced by every company to achieve sustainable growth to keep up with the growing demand in the local market
- Irrespective of the nature of the business / production program, each company has a scope to enter in to Mechanization / Automation at the next level
- Systematic Planning and Implementation must be done in line with the current state-of-the-art technology and material to be profitable for a longer term
- Let us all Yearn for Fruits of Success with Intelligent Planning and Execution to Modernize through Mechanization & Automation

Thank You All !!

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