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PARAMETRIC EFFECT OF LEAN MANUFACTURING IMPLEMENTATION IN CORRUGATION INDUSTRY

Abhishek Gupta[1] , Sanjeev Kumar[2]

[1]M.Tech(Student, *Subharti Institute of Technology & Engineering,Swami Vivekanand Subharti University, Meerut, (India)*

[2]HOD Mechanical Department, Subharti Institute of Technology & Engineering, Swami Vivekanand Subharti University, Meerut, (India)

ABBREVIATION

DSR: Diagnostic Study Report
MBR: Milestone Based Report
LMC: LEAN Manufacturing Consultant
SPV: Special Purpose Vehicle
NMIU: National Monitoring & Implementing Unit
QCI: Quality Council of India
ISO: International Standardization for Organization
IQS: International Quality System
QC: Quality Control
LFF: Lean Factory Fundamentals
VSM: Value Stream Mapping
OEE: Overall Equipment Efficiency
OPL: One Point Lesson
GWI: General Work Instruction
PPE: Personnel Protective Equipment
FG: Finish Goods
RM: Raw Material
SOP: Standard Operating Procedures

NPD: New Product Development
SMED: Single Minutes Exchange of Die
PM: Preventive Maintenance
MRM: Management Review Meeting
FIFO: First In First Out
PPC: Production Planning Control
ITR: Inventory Turnover Ratio
FTR: First Time Right
JIT: Just In Time
PDCA: Plan, Do, Check, Act
5S: Sorting, Set in Order, Shine, Standardize, Sustain
C/T: Cycle time
C/O: Changeover Time

ABSTRACT

Lean Manufacturing (LM) is widely accepted as a world-class manufacturing paradigm, its currency and superiority are manifested in numerous recent success stories. Most lean tools including Just-in-Time (JIT) were designed for repetitive serial production systems. This resulted in a substantial stream of research which dismissed a priori the suitability of LM for non-repetitive non-serial job-sho**ps.** This Study material is prepared and structures for Developing Knowledge on Improvements in Shop Floor & it's better Management and for **Lean Manufacturing Implementation** to the Production Managers and Supervisors. These concept will the benefit the units in the areas of Productivity, Quality and Manpower Management. Areas in the Study Materials may look as if it exclusively covered for Members Practicing in the Plant in the Shop Floor for leading organization those are leading in Quality, Productivity and Management Systems. But this Study Material may be used for conceptual up-date of the Production Managers and Supervisor about the World-wide latest Practicing Tools in the Shop-Floor. **"Lean manufacturing is a management philosophy focusing on reduction of waste through over production, waiting time, process time, transportation, inventory, motion and scrap in any business. By eliminating waste, quality is improved and production time and costs are reduced to satisfy the customer needs".** Though lean manufacturing practices are now being practised in many sectors, it's implementation in Corrugation industry in India pose a special challenge because of nature of industry. This industry is characterized by large number of standard and nonstandard varieties based on customer requirement. Each variety has a comparatively shorter life cycle. Further each product goes through a number of short cycled processing steps. Batch production is commonly used mode of processing. However, some of the units are well organized and professionally run.

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I. INTRODUCTION

Lean manufacturing techniques are used in Corrugation Industry to increase profitability by reducing costs. By understanding how customers define value, costs that do not add value are reduced or eliminated. Traditional View: *Cost + Profit = Sales Price* In the above example the cost to bring your product to market plus profit dictates the selling price of a product. Particularly in our global economy this model is rarely reflective of current practices. Competition and customer demand will often set selling prices. By controlling your costs through eliminating non value-added activities, a lean manufacturing environment will directly affect your bottom line. Lean View: *Profit = Sales Price – Cost* When you implement and follow a lean path you should see direct cost savings by driving out waste. You will also see significant improvements in other areas: • Employee morale and productivity • Customer satisfaction due to reduced defects and improved delivery • Faster time to market Lean manufacturing is customer focused. Since the success of your business as a whole is due in large part on satisfying customer demands, lean allows your manufacturing activities to become more closely aligned with other company goals and activities.

Developed by the most competitive automotive manufacturer in the world, lean manufacturing has been popularized in many western industrial companies since the early 1990s. It has become a universal production method and numerous plants around the world have embraced it in order to replicate Toyota's outstanding performance. The purpose of the Lean study under consideration is to explore implementation of the above approach in Indian MSME sector and learn the necessary lessons. The ultimate objective of such Lean implementation is to enhance the manufacturing competitiveness of MSME's through the application of various Lean Manufacturing (LM) Techniques.

"Lean manufacturing is a management philosophy focusing on reduction of waste through over production, waiting time, process time, transportation, inventory, motion and scrap in any business. By eliminating waste, quality is improved and production time and costs are reduced to satisfy the customer needs".

Our definition of LEAN- L- Least, E- Efforts, A- Are, N- Needed, means Least effort are needed. Lean is not a short term quick fix, but a long term marathon journey or a movement for any organization. It requires a very serious effort on the part of all the stakeholders of the organization, at all levels.Target of MSME sector through Lean are not only betterment of the units, but to change in the

total health and culture of the organization with sustainable standard path of Improvement.Our Purpose of Lean Study cum Implementation in Cluster is not only Lean Implementation but apply it with systematic and continual assessment with problems and constraints of Implementations, so that the difficulties in the application of functioning Tools and Techniques could be identified and that will help the Industry for future for identifying best Tools.The Team of Implementation wants to generate the confidence among the units about Lean philosophy in their shop-floor as well as in their Strategy making and also in the thinking and planning of the units' Growth.

II.BACKGROUND OF THE STUDY

The Government of India launched the much awaited "Lean Manufacturing Scheme" for the micro, small and medium enterprises to enhance the manufacturing competitiveness of the sector, battling the global economic recession.

The objective of this scheme is to enhance the manufacturing competitiveness of the micro, small and medium enterprises (MSMEs) by applying lean Manufacturing techniques to identify and eliminate waste in the manufacturing process.

Lean Manufacturing is a set of techniques, which have evolved over a long period and are based on various minor to major breakthroughs that helps in reducing cost and hence increases productivity.

There are about 13 million MSME units in the country which employ over 42 million people. The sector contributes over 45 per cent to the country's industrial production and 40 per cent to the total exports.

The Scheme will be implemented under the overall superintendence, control and direction of DC (MSME). A three tier implementing structure will be in place with a group of ten or so MSMEs at the lowest local-tier and a Lean Manufacturing Screening and Steering Committee (SSC) under DC (MSME) at the highest tier.

The middle level tier, National Monitoring and Implementing Unit (NMIU), will be responsible for facilitating implementation and monitoring of the Scheme.

III.GAP ANALYSIS OF THE STUDY

GAPs of the units of the Cluster have developed after the repeated visit as per Monthly schedule of the unit in Lean DSR Project. We have not only observed but discussed repeatedly with Owners or Sr. persons, supervisors and Workers of the concerned units with predesigned blank format of date and inputs and take direct observation from GEMBA. We/ our Team have analysed the existing data, forms, records etc. of the units after visit and made this GAP and on the basis of gap an action plan have developed for NMIU and Cluster for proper Planning and Monitoring of the Lean Implementation.

The Gaps of the units are as follows;

2.1 Factory Fundamentals

In cluster there are poor factory fundamentals in the area of :

A- Visual Management
B- Asset Management/ Machine Maintenance
C- Kaizen Practices

We found the reason of Lack of Management focus and knowledge awareness.

2.2 Space Utilization

Space in the shop-floor of the units are not adequately used due to the following reasons;

A. Poor Housekeeping and 5S
B. Failure in customer delivery
C. Holding Inventory
D. Work-Stations are not clearly identified
E. Process flow and flow of work sometimes overlapped
F. Scrap and defect items blocks in the working areas
G. Comparatively less shorting and Cleaning attention
H. PPC are not developed and maintained
I. Tools and Machined are not properly arranged as per the Flow of work
J. Workers and Supervisors are not Trained in these Concepts

2.3 Documentation/ Standardization

Standardization in the form of documentation is very weak in the cluster except the units few units. Team found following reasons:

2.4 No previous training on ISO/ System
2.5 Have feeling of managers documentation is burden
2.6 Lack of skills and awareness

2.4 Level of Production and Productivity

Productivity are the main motto of the units in the to MICFO Cluster. Maximum/ optimum utilization of the available Resources should be main focus, but there are low Productivity for the following reasons;

A. Wastages of Time due to unimproved flow of work
B. Not Full utilization of Man and Machine
C. 7 Types of Wastes also one of the Root cause
D. Productivity norms are not developed
E. No study ever done on Productivity Improvement areas
F. Process Flow Chart with Time and Manpower not available

G. Supervisors Training are not conducted in these areas

2.5 Manpower and Skills

Most of the Units have combination of Manpower – semi and Un-skilled or knowledge of work by Practice. Muti-skill are required to develop in the units for the workers.
Apart from Skills, the Knowledge level of worker is very poor. Still there is no concept of Knowledge matrix and Skill matrix.. All supervisors of all units should be Trained on Production, Productivity, Quality, Process and Operations areas etc. with Lean Concept. They also develop the skill of Communication with Management and Workers with Training of Leadership Quality.

2.6 Wastages

Units have major Wastages in the areas with causes;

A. Time – Due to improper Work-flow in the Lines
B. Motion – Absence of Standard Workplace Layout
C. Transportation - Shop-floor Layout
D. Scrap - Problem of Identification and analysis and Quality problems
E. Overproduction - Workers/ supervisors knowledge gap
F. Over-processing - Workers/ supervisors knowledge gap
G. Defects - Quality Planning Problems

2.7 Scrap

In this Cluster, Major Scraps in most of the units piled up due to long term gap in decision of release and removal problems. Supervisors and owners could not decide the existing scrap is on use or not. So, absence of confidence may be one of the root causes. But our Lean Team justified about the scrap as an unnecessary items blocked the space in the shop floor and helps the units to remove it with Technical assessment.

2.8 Attitude And Awareness

There are required a immense changes in the attitude in the units are requires to forward their Journey to the EXCELLENCE in the following areas;

i. *Reserve or Conservative Attitude and not confident what to Change, so agent and proactive thinking of all members of the units are outmost required (but it have marked changed after we have started initiative in the units)*
ii. *Craftsmanship with cordial and fellow feeling Attitude of Supervisors towards Workers*
iii. *Careful Attitude of Workers towards Supervisors*
iv. *Supportive Attitude of Owners towards Supervisors and Workers*
v. *Professional Attitude of Owners towards Consultants and External Change Agents*
vi. *Long Term relation Attitude of Owners, Supervisors and Workers towards Customers*

vii. *Not focused Layout*

2.9 Strategy and Planning

All changes and Improvement of the units should be on the basis of Strategy and Planning;

A. *Strategy for Quality Improvement*
B. *Strategy for Customer's Satisfaction*
C. *Planning for Short and Long Term Improvement*
D. *Planning for Growth, Progress and Development*

2.10 Technology, Process and Control of Manufacturing

Planning are there all the units about the Technological Improvement but it should be as per the best suited and applicable Techniques and Technology.

EFFECTIVE TECHNOLOGY MEANS

A. Comparatively easy Operations and easy to understand
B. Reduces the Cost of Production
C. Limited Wastages
D. Control of all Operations
E. That take care all critical Production Factors in the Lines
F. Easy Availability, Reduce lead time for Technology acquisition
G. Availability of Services
H. Suitable in our conditions
I. Cost Effective

Units should Develop and Use of Production Parameters, Ratio Analysis and suitable Measurements for Controlling for Production, Price, Quality and Delivery.

2.11 Delivery

Most of the units in the Cluster have delivery problems and their expectations from Lean are to reduce delivery time.

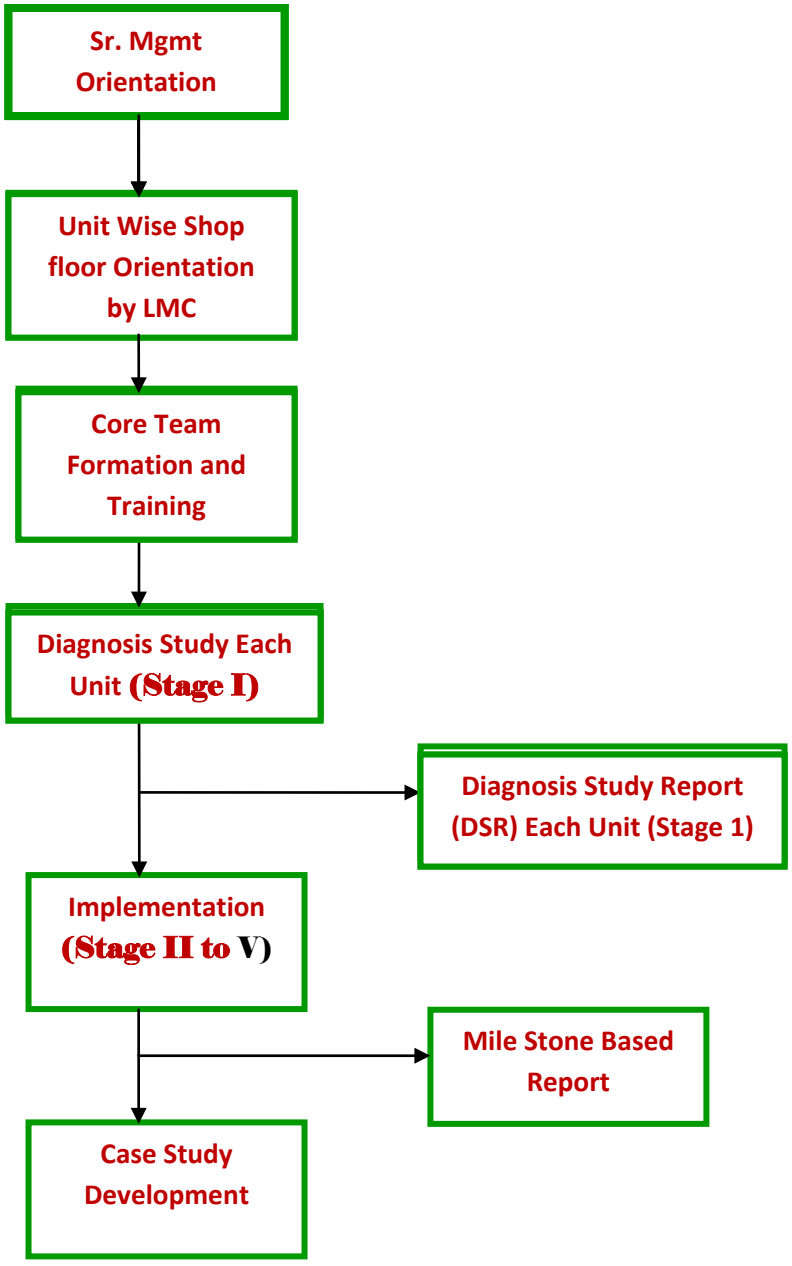
Delivery period problems arises for different problems of the units;

A. Rework Problems
B. Delivery from Suppliers
C. Shop-floor Traditional Management
D. Space Problems
E. Scrap, Quality etc.

IV. APPROACH AND METHODOLOGY

4.1. Broad Approach to Methodology:

The overall approach as proposed is given below in a schematic manner-



Stage wise details are given Below:

STAGE – I (DSR –Diagnosis Study Report & TRAINING)

1) Visit and details Understanding the Existing Processes, Machines, Tools and Production System (All the Information of the Implementing units of Lean according the Scope of the Work)
2) Analysis about the Implementation and Formulation of Implementation
3) Discussions about the Problems and Checking the Existing Data
4) Identify the Critical Factors for Implementation
5) Prepare Checklist, Diagnosis study report Formats and Charts for Implementing and Guiding the Employees of the concerned units to use (use in Time of Training and Implementation)
6) Taking Initial Video shots unit wise
7) Planning Steps of Implementation of the LM Tools in Unit-wise
8) Identifying employees skills gap ,if required, with the help of matrix**,**

Training on the Contents and Implementation of the Lean in the Units

1) About Lean – Concept, Purpose, Effectiveness and Result
2) LM Tools and its Concepts of Utilization (the applicable Tools)
3) Process and Activities Related of the Groups in the Units, responsible for Implementation
4) Selection of the Effective Team unit wise
5) Empowerment of Selective team “Factory with in Factory”

The typical outline of action plan as given in annexure D will be prepared based on the finding of diagnostic study to be made in each unit during this phase.

STAGE – II to IV

A) Initiation

1) Project Selection (Based on Company Conditions & Priority) as per made in stage 1 DSR
2) Team Formation at Shop Floor
3) Facilitation to Teams in implementing projects
4) Application of LM Tools in project implementation
5) Timely discussion with CEO/Unit heads

B) Follow ups

1) Follow and Monitoring of the Activities

2) Correction of the Deviations, if any
3) Measures of the Effects and Improvements
4) Confidence of the Groups and Checking of the Faults
5) Contact to the SPV and NMIU any problems and differences

STAGE – V :

C) Completion

1) Closing the activities
2) Submission of the Report to the Units, NMIU and office of DC-MSME
3) Maintenance of Confidentiality of the Repots and organisation process

4.2 Deliverables

1) Capability of Employees developed

2) Benefits (Quantative and Qualitative) achieved in selected parameters*

3) Cultural Change accessed qualitatively

4) Reports, Video & Case study Submitted

* Relevant Parameters to be chosen from are as follows:

- Productivity
- Quality
- Response time to customer
- Inventory
- Working capital
- Space Utilizations
- Documentations
- Working Environment
- Employee Morale

V. EXPERIMENTAL PLANNING

5.1 Pilot Value Stream Selection	
Product Families	*Corrugated box*
Value Streams	*INNER & OUTER*
Pilot Value Stream	*5ply- SWIFT- COMBI*
Value Stream Map	Annexure III & IV
Number of Employees	*21*

5.2 Value Stream Benchmark				
Factors	*Unit*	*Baseline*	*After Lean*	*Improvement*
1. Labour Productivity	Tonnage per day/manpower	*0.1	0.11	10% Up(Increase)
2. Capital Productivity	Total Revenue Generated/ Capital Employed	1.07	1.17	10% Up (Increase)
3.Annual Savings (Lean)	Rs.		23 Lakh	23 Lakh
4. Quality Performance	%age (ok pieces/Total no. of pieces)	*90	95	5% up (Increase)
5. Inventory Turn	Net Sales/ Avg. Inventory	11.93	13	10% Up (Increase) by reducing inventory
6. No. of Kaizen	Nos./Month	Not in Practice	Minimum one kaizen Per month/ Zone	One kaizen Per month/ Zone

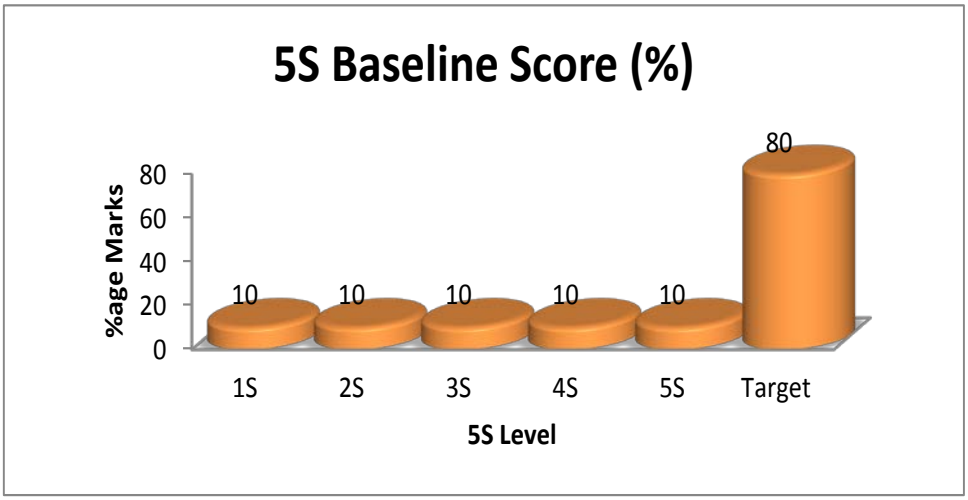
	NO. Of Projects	Not in Practice	1. LFF 2. 5S 3. Document Standardisation 4. Quality Improvement 5. Productivity Improvement 6. PPC & Inventory Reduction 7. Training	7
7. Recognition/Certification	Nos.	No	ISO 9001:2008	1
8. HR Development	A.No of HR Intervention	No modern practices	Multi Skilling, Job Responsibility, Skill Matrix, Work Procedures	4
	B. HOURS	Zero	21	21
9. Lead Time	Hours (Dispatch time –Schedule Received Time)	48	43	10% Down (Decrease)
10. Value Add Ratio	%age (Sum of CT/Lead time)x100	0.024	0.026	10% Up (Increase)
11.On-time Delivery	%age (Adherence of Target date)	80	88	10% Up (Increase)
12.Throughput Yield	%age (FTR)	Not in practice	Focus will increase on FTR (First Time Right)	10% Up (Increase)
13.Equipment Availability	%age(Total Available Time-Total Breakdown time/Total Available time) X 100	No Breakdown is recorded	Breakdown data will be calculated for Each Assets, Preventive maintenance practice will start	10% Up (Increase)
14.OEE	%age (Availability X Performance X Quality)	Not in Practice	For Critical machine OEE Will be calculated and Monthly action plan will be made on OEE losses	10% Up (Increase)
15.Floor Area Freed up	Sq Mt. (Area saved through 5 S)	Wanted and unwanted items are mixed up at Gemba	Floor area will be freed through factory fundamental activities	10% Saving

5.3 Value Stream Waste Summary

Waste	*Metrics*	*Baseline*	*Improvement Target*	*Estimated Saving*
1. Over production	**Metrics attached (Annexure V)*	*1*	*7*	*Rs 23 lakhs/ Year, 30% knowledge & Skill improvement*
2. Inventory		*4*	***6***	
3. Defects		*1*	*6*	
4. Waiting		*1*	*5*	
5. Over processing		*1*	*8*	
6. Transportation		*1*	*6*	
7. Motion		*1*	*5*	
8. Unused Talent		*1*	*7*	

5.4 5S Baseline Score:

5S Score is as per Annexure VI audit conducted during Phase I.



5.6 Phase-wise Milestone Based Implementation Plan

Phase	Project Details	Current Status (Baseline)	PHASES			
			II	III	IV	V
			Milestone Completion Date			
			Feb 2015 – Apr 2015	May 2015 – Jul 2015	Aug 2015 – Oct 2015	Nov 2015 -Jan 2016
			Targets for Each Parameter			
II-V	*Lean Project-1* *Lean Factory Fundamentals (Visual Management, Kaizen, Asset Management)*	Visual Management-Very Poor Kaizen- No Concept in plant Asset Management- No Practices is applying	1.Visual Management- 1.1-Plan- Identify Requirement of Visuals 1.2-Do-Visual Boards fix up at Gemba and in offices 2. Asset Management-Breakdown Recording as per Procedure 3. Audit- LFF and prepare radar chart	1.Visual Management-1.1-Check-further requirement if any gap 1.2 Act- to meet requirement of visuals 2. Asset Management-Model Machine, choose and make it model, Prepare Preventive Maintenance Plan	1.Kaizen-Kaizen Gallery at Gemba & in office, Kaizen Week conduct, Kaizen Reward Distribution 2. Asset Management-Adherence Preventive Plan	1- Asset Management-Comparison of trends, Amendments of Preventive Plans 2.Zone Competition on Best LFF (Lean Factory Fundamentals)
II-V	*Lean Project-2* *Five S*	10%	-Zone & team formation, Zone map, Red Tag Area, - Seiri-Area Freed up, Waste Elimination calculation - Audit-2 Target 20%	- Seiton – Gangway & Marking at floor, Shadow board, Material placement - Seiso-Cleaning, Shining, Painting, Seiso Standard - Audit-3 Target 40%	Sieketsu-Standardize 5S work at company level, 5S Visual Standard Audit-4 Target 60%	-Shitsuke-Cross function Audit, 5S Week, Best Zone Reward - Final Audit-5 Target 80%
II-V	*Lean Project-3* *Document Standardization*	Document-Some only Place GWI is displayed	-One Point Lesson -Skill Matrix	-General Work Instruction (GWI) -Job responsibilit	-SOP (Standard Operating Procedures) for All department	-MRM Matrix - Conduct MRM (Management Review Meeting)

				y	excluding Finance and NPD	
III-V	*Lean Project-4 Quality Improvement*	90%		Recording of Defects Define-Problems Measure-Defects via graph; pareto Analyze- Root Cause via Fishbone	Improve-Take appropriate action on appropriate root cause Control-Defects and monitoring trends Target 2.5 %	Monthly Defects will analyses and CAPA practices start Target 5 %
III-V	*Lean Project-5 Productivity Improvements*	0.1		- Cycle Time Study through video recording of each operation - Analyses Production Plan & Gap Analyses -Layout Modification	-Line Balancing - Wastage Elimination - Shift Scheduling Target 5 %	-Value Addition ratio Monthly trend comparison -Plant Layout Target 10 %
III-V	*Lean Project-6 PPC & Inventory Reduction*	ITR-FIFO is not in Practice		-Analyze Material Order & Market Order plan, Shift plan, Manpower Plan	Analyse-Inventory Plan, FIFO hindrance Identification Target 5 %	Implement-FIFO, Stock taken, ITR, Prepare PPC System Target 10 %
II-V	*Lean Project-7 Training*		Tr-1: Lean Factory Fundamentals Tr-2:5S	Tr-3:Kaizen Tr-4: Productivity Improvement	Tr-5: SOP & Documentation Tr-6 Quality Improvement Tools	Tr-7 MRM

5.7 Outcome (Benefits) from Lean Projects

Lean Project	Applicable Lean Tools	Qualitative Benefits	Quantitative Benefits	Annualized Saving

				(Approx. Rs)
Lean Project-1 Lean Factory Fundamentals (Visual Management, Kaizen, Asset Management)	*Visual Management, Kaizen, Asset Management*	Proper visualization and information at Gemba	3 Lakh	3 Lakh
Lean Project-2 Five S	Model work Place	Space Saving at Gemba	2 Lakh	2 Lakh
Lean Project-3 Document Standardization	SOP, OPL, GWI	Right Information at Right Place, Increasing Awareness to workers on their work	Zero Accident	
Lean Project-4 Quality Improvement	Poka Yoke, 7 QC Tools	Natural Resource Saving	3 Lakh/10% Up	3 Lakh/10% Up
Lean Project-5 Productivity Improvements	Value Stream Mapping, Cycle time Study, Single Piece Flow		12 Lakh/ 10% up	12 Lakh/ 10% up
Lean Project-6 Inventory Reduction	Kanban, FIFO, JIT		3 Lakh/10%Down	3 Lakh/10%Down
Lean Project-7 Training	Role Play	Skill Improvements, High Moral, Knowledge Enhancement	30% Skill & Knowledge Improvements	

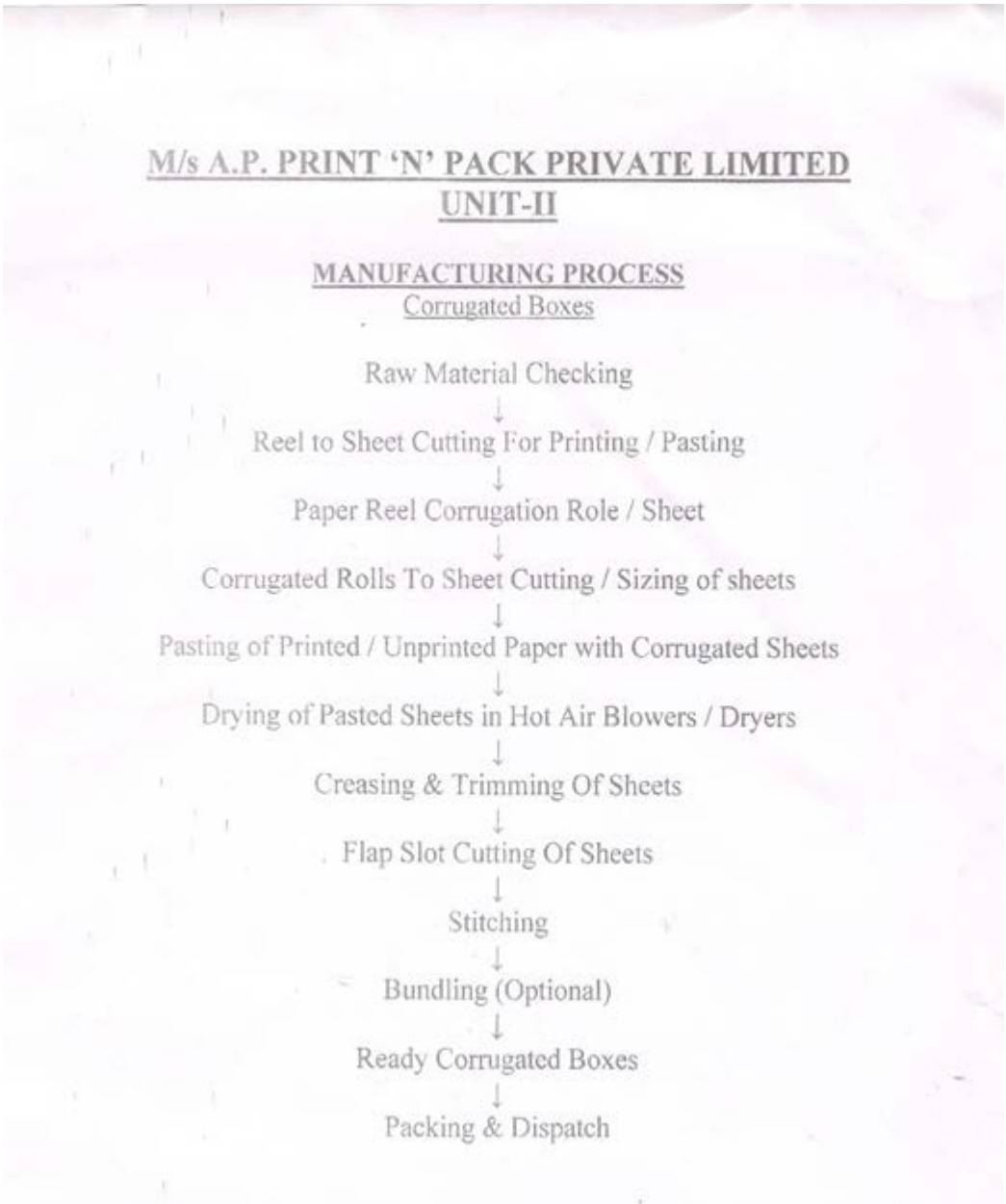
List of Lean Tools: 1. Value Stream Mapping, 2. Kaizen-DMAIC/PDCA, 3. The 7QC Tools, 4. SMED, 5. JIT & Kanban, 6.Single Piece Flow, 7. Poka Yoke, 8.Standardized Work, 9.Five S, 10.Visual Management, 11.TPM

Attachments

- Photographs/Video
- Project Report
-

5.8ANNEXURE

Annexure I: Manufacturing Process Flow

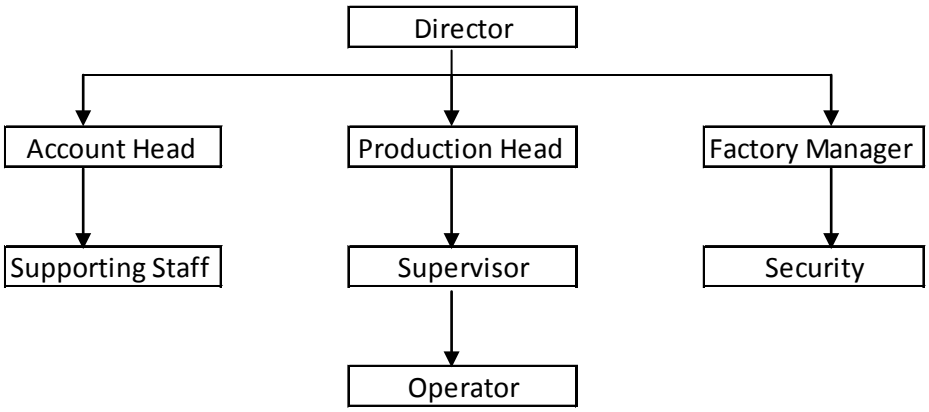


M/s A.P. PRINT 'N' PACK PRIVATE LIMITED
UNIT-II

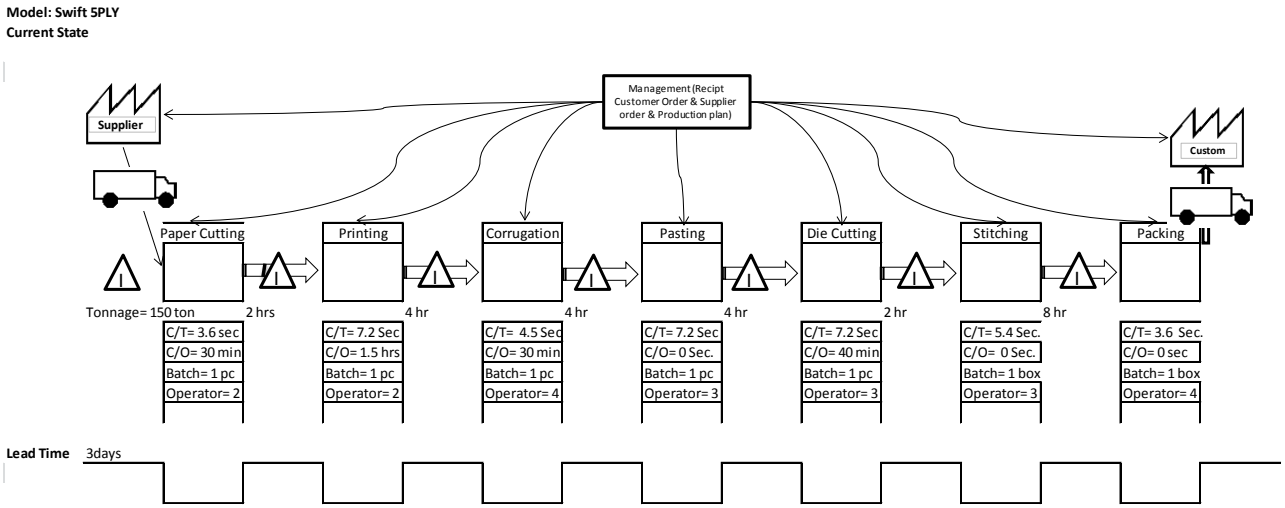
MANUFACTURING PROCESS
Corrugated Boxes

Raw Material Checking
↓
Reel to Sheet Cutting For Printing / Pasting
↓
Paper Reel Corrugation Role / Sheet
↓
Corrugated Rolls To Sheet Cutting / Sizing of sheets
↓
Pasting of Printed / Unprinted Paper with Corrugated Sheets
↓
Drying of Pasted Sheets in Hot Air Blowers / Dryers
↓
Creasing & Trimming Of Sheets
↓
Flap Slot Cutting Of Sheets
↓
Stitching
↓
Bundling (Optional)
↓
Ready Corrugated Boxes
↓
Packing & Dispatch

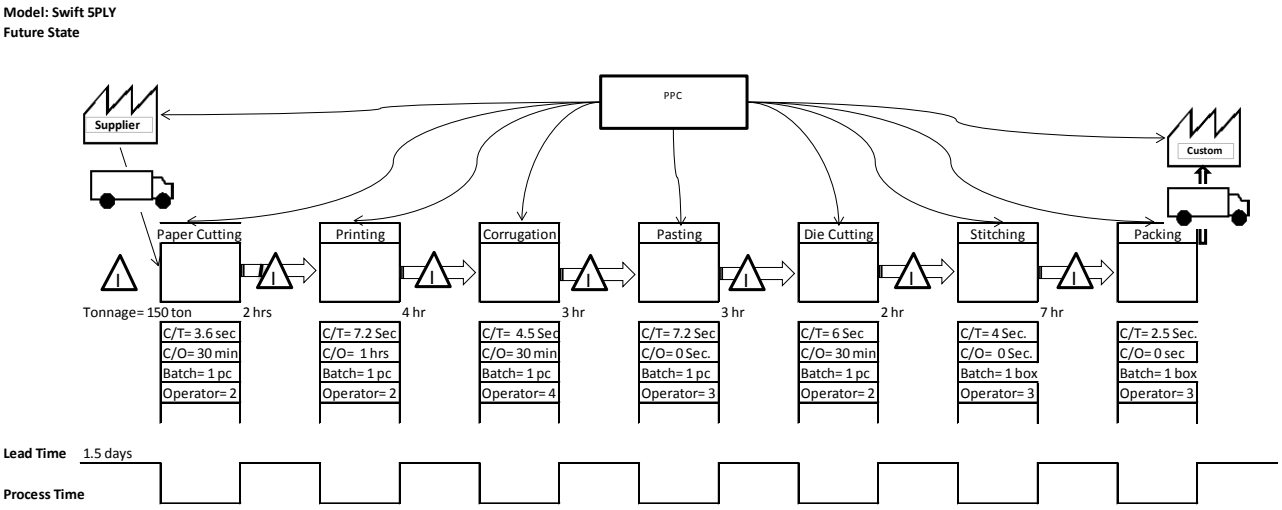
Annexure II: Organization Structure



Annexure III: VSM Current State Map



Annexure IV: VSM Future State Map



Annexure V: Waste Matrix

8 Waste Metrics										
Areas	**10 Marks**	**9 Marks**	**8 Marks**	**7 Marks**	**6 Marks**	**5 Marks**	**4 Marks**	**3 Marks**	**2 Marks**	**1 Marks**
1. Over production	Having Documentation & Displayed, known & Followed by all (0-.2 %)	Having Documentation & Displayed, known & Followed by all (2-3 %)	Having Documentation & Displayed, known & Followed by all (4-5 %)	Having Documentation & Displayed, known & Followed by all (6-7 %)	Having Documentation & Displayed, known & Followed by all (8-9 %)	Having Documentation & Displayed, known & Followed by all (10-11 %)	Having Documentation & Displayed, known & Followed by all (12-13 %)	Having Documentation & Displayed, known & Followed by all (14-15 %)	Having Documentation & Displayed, known & Followed by all (16-17 %)	No Record is available > 18%
2. Inventory	Hourly	Per Shift	1-3 Days	4-6 Days	7-15 Days	16- 29 Days	1-3 Months	4-6 Months	> 6 months	No Record is available
3. Defects	0-2 % (Inhouse) or Zero Customer Complain/month	2-3% (Inhouse) or 1 Customer Complain/month	4-5% (Inhouse) or 2 Customer Complain/month	6-7 % (Inhouse) or 3 Customer Complain/month	8-9% (Inhouse) or 4Customer Complain/month	10-11% (Inhouse) or 5 Customer Complain/month	12-13% (Inhouse) or 6 Customer Complain/month	14-15% (Inhouse) or 7 Customer Complain/month	16-17% (Inhouse) or 8 Customer Complain/month	No Record is available & >8 customer complan or > 18%
4. Waiting	Zero second delay	< 1 Mintue	2 -15 Mint	16-30 Mintues	31-45 Mintues	46-60 Mintues	ween Hour &	> Per Shift	Cycle time Exist but not followed	No Cycle time Exist
5. Over processing	No Over Processing, Standards are define for >90 % stations & Followed at Each Station	81- 90 % (Standards are define & Work Accordingly)	71- 80 % (Standards are define & Work Accordingly)	61-70 % (Standards are define & Work Accordingly)	51-60% (Standards are define & Work Accordingly)	41-50 % (Standards are define & Work Accordingly)	31-40 % (Standards are define & Work Accordingly)	21-30 % (Standards are define & Work Accordingly)	11-20 % (Standards are define & Work Accordingly)	No Standards are define / >10%
6. Transportation	For 100- 91 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 81-90% % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 71-80 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 61-70 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 51-60 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 41-50 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 31-40 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 21-30 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	For 11-20 % product are covering minimum distance as per Rout Plan and Displayed & Followed for Man, Material & MHE(Material Handling Equipment)	No Rout Plan Is made/ > 10%
7. Motion	For 91-100 % operators are working as per standard Work combination sheet (SWCS)	For 81-90 % operators are working as per standard Work combination sheet (SWCS)	For 71-80 % operators are working as per standard Work combination sheet (SWCS)	For 61-70 % operators are working as per standard Work combination sheet (SWCS)	For 51-60 % operators are working as per standard Work combination sheet (SWCS)	For 41-50 % operators are working as per standard Work combination sheet (SWCS)	For 31-40 % operators are working as per standard Work combination sheet (SWCS)	For 21-30 % operators are working as per standard Work combination sheet (SWCS)	For 11-20 % operators are working as per standard Work combination sheet (SWCS)	No Record & Layout is displayed / > 10%
8. Unused Talent	For 91-100 % operators & excutive are working as per their Knowledge & Skill Matrix	For 81-90 % operators & excutive are working as per their Knowledge & Skill Matrix	For 71-80 % operators & excutive are working as per their Knowledge & Skill Matrix	For 61-70 % operators & excutive are working as per their Knowledge & Skill Matrix	For 51-60 % operators & excutive are working as per their Knowledge & Skill Matrix	For 41-50 % operators & excutive are working as per their Knowledge & Skill Matrix	For 31-40 % operators & excutive are working as per their Knowledge & Skill Matrix	For 21-30 % operators & excutive are working as per their Knowledge & Skill Matrix	For 11-20 % operators & excutive are working as per their Knowledge & Skill Matrix	No concept is exist / > 10 %

Annexure VI: 5S Baseline Score

Five S Assessment Score Card						
Company: AP Print 'N' Pack						
Level	**Beginner (1-2)**	**Basic (3-4)**	**Visual (5-6)**	**Systematic (7-8)**	**Preventive (9-10)**	**Score**
1 Seiri (**Sort**)	Needed and un-needed items found in work area.	Needed /un-needed items separated, un-needed tagged.	Red tag area created, all un-needed items removed	List of needed items developed, maintained, posted.	Un-needed items are not allowed in the work place area.	1
2 Seiton **(Set in Order)**	Needed and un-needed items are placed randomly throughout the	Needed items stored in an organized manner.	Needed items have dedicated positions which are clearly indicated?	Needed items can be retrieved within (cell target) seconds and (cell target)	Method for adding/deleting indicators for needed items	1
3 Seiso **(Shine)**	Work area and machines are not cleaned on a regular basis.	Area and equipment cleaned daily.	Standard work layout posted and maintained.	Daily inspections of plant and area occur.	Root cause sources of dirt, grease & spillage have been eliminated.	1
4. Seiketsu **(Standardize)**	Methods of work not completely documented.	Methods of work documented but not consistently used.	Methods of work posted and consistently used by some cell team members.	Methods of work consistently used by all cell team members.	Methods of work are regularly reviewed and improved.	1
5 Shitsuke **(Sustain)**	Occasional, unscheduled 5S activity.	5S activities conducted on regular basis.	5S assessment conducted occasionally and results posted.	5S assessment conducted on a regular basis and recurring problems	Root causes of problems revealed by 5S assessment are identified and	1
		Date: 12.01.2015			Total Score (Max-50)	5

Annexure VII: Base Level "Photographs"

Area: Production	Area: Production
	
Finish Good And Semi Finish Good Are Placed On Floor.	Floor Is Not Clean.
Area: Store	Area: Store

	
No Clear Identification Of Raw Material	Raw Material Not In Proper Order On The Floor.
Area: Production	Area: Production
	
Finish Good And Semi-Finish Good Are Placed Together.	No Proper Place For Drums.

Area: Production	Area: Production
	
Unwanted Items Are On The Floor.	Floor Is Not Clean.
Area: Production	Area: Outskrits

	
Finish Good Are On The Floor	No Red Tag Area.
Area: Production	Area: Production
	
Raw Material Is Not Placed In Proper Way	Material Are Placed In Office

Area: Store	Area: Production
	
Finish Good Are Not Placed In Proper Way	No Work Instruction On Machine
Area: Production	Area: Production
	
Electrical Panel In Unsafe Condition	Material Are Placed In Undefined Area

Area: Production	Area: Production
	
No Visualization For Material	No Red Tag Area

VI. RESULTS AND DISCUSSION

LEAN IN PACKAGING UNIT

LEAN IMPLEMENTATION OPPORTUNITY

Where there are imperfection and disorder, it means the scope is high. So, the units may be performing well in their Business but for better Efficiency and competitiveness it required Lean Techniques for Improvement.
As per our visit and subsequent analysis the units, it is required large effort to Implement the Lean in the shop-floor.

LIMITATIONS AND PROBLEMS OF THE IMPLEMENTATION

Our mission is to create Provision for better Implementation of Lean Manufacturing to the units. But success depends upon the how far the constraints cad be eliminated.

A. Long time and less Technical Studies undertaken by most of the units, so we have to start from the threshold level
B. High effort required to Change the long Term Traditional Business and Working Culture in the units
C. Mind and attitude of the Workers and Supervisors
D. Technical support of the units, some of the Owners are overenthusiastic & courageous and some are comparatively less, so consultants are required to Balance the expectations of both the sides and make them to understand Growth is not one person or limited days program
E. Most of the units have Single Knowledgeable Head with decision maker – I.e. the Owners – all Heads of all the activities
F. Customer Focus, Values (corporate and employees) with value assessment should be developed

The results of the study suggest followed by a methodical approach to reduce the time in the process, or project in theirimplementation of continuous improvement, therefore improving throughput.
Manufacturing throughput time reduction can be a daunting task due to the many factors that influence it and their complex interactions. However, there are basic principles that, if applied correctly, can be used to reduce manufacturing throughput time. The report presents the factors that influence manufacturing throughput time at Pharmadule, the actions that can be taken to alter each factor, and to approach the purpose. Introduction of project background and literature search, which focus on lean production and based on project management.
After literature search, based on one week survey work in the factory in Haridwar the following chapter is pay attention to analysis of project data, including production hours and number of workers, and also their relation.

VII. CONCLUSION

The results of successful lean thinking can be observed in various areas of an organization. In order to measure these results, some common performance measures are used. The areas where the biggest improvements through lean thinking should occur, are: Quality and quality improvement, cost and productivity improvement, delivery and service improvement, and business results (financial performance). These categories and most of the performance measures within them are adapted from the Shingo business prize guidelines (2005).
Improvements can be expected in all categories summarized in Appendix A, if an organization is able to successfully and thoroughly apply all, or most of the lean practices and principles described earlier. The enablers (philosophy and HRM) and the resulting lean culture are the most important factors to understand and practice. This will ensure lean thinking on a sustainable, long-term basis.

7.1 Performance measures

7.1.1 Quality & quality improvement

To measure quality and its improvement, metrics such as rework/scrap as a percent of sales or production costs can be used. More examples include customer rejects due to poor quality in parts per million, or finished product first pass yield and percentage. Warranty cost as a percent of sales or production cost can also be used. These are just a few examples and there are more to find in Appendix A. It is important that there is a quality

measurement system in place that is well suited for the particular situation. After all, you can't improve something you do not measure.

7.1.2 Cost & productivity improvement

When it comes to cost and productivity there are also several metrics commonly used. Value added per payroll (sales minus purchased goods and services divided by total payroll dollars) is one example. Manufacturing cycle time (start of product production to completion), physical labor productivity (units/direct hour) are other examples. Not only labor productivity should be measured. Energy productivity and resource utilization (e.g., vehicles, plant and warehouse floor space, etc.) are also important measures of productivity. To quantify improvements, product cost reduction and unit manufacturing cost reduction may be used. There are many more metrics that can measure costs and productivity. It is important to have a sound system in place in order to keep track of improvements and problems.

7.1.3 Delivery & service improvement

The percent of products shipped on-time (define on-time window) and/or percent of complete orders shipped on-time (define on-time window) is one example of a metric to measure delivery and service. Customer lead time (order entry to shipment) is another important variable in a lean system that must be measured and monitored precisely. Mis-shipments, return rates, and stock level and rotation are some more examples how to keep track of delivery and service. Since delivery and service takes place right at the front end of the organization and is the part that deals the most with customers it is very important to improve and maintain the highest level of service and quality in order to offer customers a positive experience with the organization and its products.

7.1.4 Business results

Business results refer to bottom line measures of firm performance. These can be customer satisfaction, or more quantitative metrics such as market share. Other examples include operating income on sales ratio, reduction in fixed and/or variable costs, administrative efficiency, cash flow, and product line margins. More examples are shown in Appendix A. These business metrics are very important since they show how profitable an organization is. They might also be helpful to identify areas that need special attention. Positive business results should be the outcome of successful lean implementation.

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Authors

Author's Name: Abhishek Gupta

Author's profile.: B.Tech(ME) , M.Tech(pursuing)(Production)