Elimination of MUDA (waste) using Material Information Flow Chart in pre-chassis Automobile assembly line

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Abstract

Purpose of the Study

The purpose of this study is to showcase a case study of a project focused on optimizing Manufacturing processes by using material information flow chart mapping. The primary aim is toeliminate stock waste resulting from overproduction. The study intends to provide a compelling account of how strategic mapping, analysis, and proactive adjustments can lead to operational excellence in manufacturing.

Need and Rationale of the Study

The need for this study arises from the common issue of stock waste and overproduction in Manufacturing, which can lead to inefficiency and increased costs. The rationale behind the study isto demonstrate how the utilization of material information flow charts can help identify areas for Improvement and guide the elimination of overproduction. By addressing these issues, the studyaims to improve efficiency and reduce costs in manufacturing operations.

Objectives

The objectives of the study include:

To optimize manufacturing processes by mapping the material information flow chart.
To identify and eliminate stock waste resulting from overproduction.
To reduce lead time in the manufacturing process.
To demonstrate the cost savings and efficiency improvements achieved through theseoptimizations.

Methodology

The study employs a case study approach to analyze the manufacturing processes. It involves meticulous analysis of existing procedures, the use of material information flow charts, and theimplementation of strategic adjustments. The design and methodology focus on identifying Bottlenecks, streamlining material flow, aligning inventory with demand, and applying Just-in-Timeconcepts to reduce overproduction.

Findings

The findings of the study indicate significant improvements in manufacturing processes:

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Lead time was reduced from 837.06 minutes to 536.6 minutes.
Overproduction was eliminated, reducing stock waste.
Cost savings of 22 lakhs in the first year, with a projected 36 lakhs for the second year.
Investment expected to be recovered within five months.

Practical Implications

The practical implications of this study are significant. It demonstrates how manufacturing processes can be optimized to reduce waste, improve efficiency, and achieve cost savings. The use of material information flow charts and strategic adjustments can serve as a practical framework for other organizations seeking operational excellence in manufacturing.

Value

The originality and value of this study lie in its practical application of material information flowchart mapping and strategic adjustments to address overproduction and stock waste in
Manufacturing. The study provides a real-world case of how these concepts can lead to substantialcost savings and enhanced efficiency, with a short payback period for the investment.

Keywords

Keywords associated with this study include:
Manufacturing Optimization, Material Information Flow Chart, Overproduction, Stock Waste, LeadTime Reduction, Just-in-Time, Cost Savings

Introduction

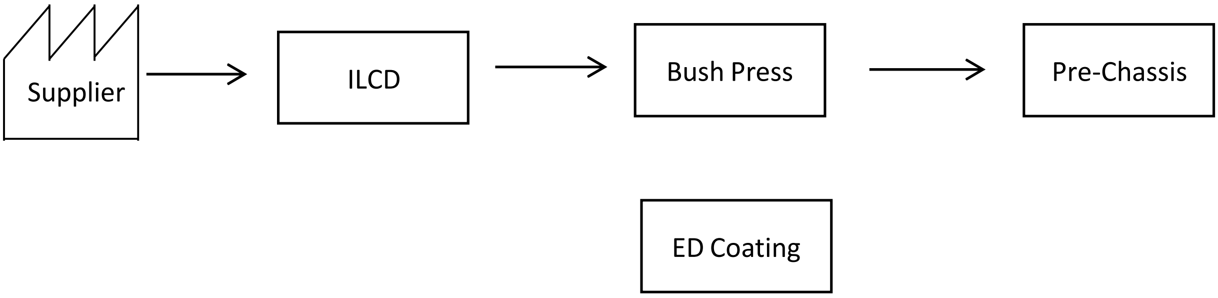
A graphic depiction or diagram known as a material information flow chart is used to show how materials and information travel within a system or process. To visualize and comprehend how goods and information flow through multiple phases or procedures, it is frequently used in a variety of industries, including manufacturing, logistics, and supply chainmanagement.

To depict the flow of materials and information, flow charts frequently include a varietyof symbols and arrows. The symbols can stand in for a variety of things, including tools, workspaces, inventory locations, decision-making points, and data sources. The flow ofinformation and material between these elements is indicated by the arrows, which also show their direction of flow.

A material information flow chart is used to illustrate the interactions and dependenciesbetween various components and to portray the complete process visually. Stakeholders and decision-makers can use it to acquire understanding of the entire flow of materials and information, spot bottlenecks or inefficiencies, and come to wise conclusions on how to enhance the process.

Organizations can optimize the flow of resources, cut waste, streamline processes, andboost overall effectiveness by studying the flow chart. Additionally, it assists in locating potential hot spots for information or material delays, promoting efficient communication andcollaboration between various stages or departments.

Flow of material from Supplier to Pre-Chassis:



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Inefficiencies and waste can dramatically reduce productivity, drive up expenses, and impair overall performance in any organization or business process. Finding and reducing "muda," a Japanese term that translates to "waste" or "non-value-added activity," is a successfulstrategy for resolving these problems. Any procedure or activity that does not help the client orend-user create value is referred to as muda.

A key component of lean management, a technique that strives to optimize operations and maximize value while minimizing waste, is recognizing and removing muda. Organizationscan streamline operations, increase efficiency, improve quality, and cut costs by methodicallylocating and removing muda.

This procedure starts with a thorough examination of the complete value stream, whichincludes all of the actions, materials, and data necessary to provide a good or service.Organizations can identify a variety of waste through this study, including but not limited to excess inventory, overproduction, waiting, wasteful transportation, over processing, faults, andunderutilization of talent.

Specific tactics and technologies can be used to reduce or eliminate waste after it has been discovered. Process optimization, waste reduction, and value generation can all beimproved by using lean principles such as just-in-time production, continuous improvement, standardised work, and visual management.

MUDA'S that can occur in the part of production

Repair

Repair/Rework.
(Process Need to repair / rework before sending to the next process).
Overproduction:
Advance operation.
(Buffer more than requirement)
Over processing:
Double job /Over judgment.
(Repeat / double job / Inspection over judgment)

Conveyance

Long distance.
(Long transfer time / Complicate supply route)
Many methods for 1 route transfer.
(Long transfer time / Complicate supply route)

Stock:

Over necessary stock.
(Over stock work in process, big stock area, over supply)

Motion:

Many time of returning.
(Frequency of walk between work position and flow rack)
Many working position transfer.
(Number of movement for change working position (Buishuyaku))
Part area over working area.
(Part area over working area / 1 pitch)
Poor work posture.

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(Reach, bend (body), twist, turning (body, face), looking for)	Double handing. (Many handling job for parts /tools)

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Waiting:

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Interfere process.
(Interfere of Man-Man, Man-Part /Tool, Man-Machine)
Multi processes work together. (Dual process, Continuous process)
Poor relation of man & machine.
(Waiting mean machine operation / home position)
Weight Cycle time Lower than takt time (Waiting time before starting next vehicle assembly)

PROJECT DESIGN & METHODOLOGY:Problems identified

MUDA'S identified in small parts (bush pressing area)

Many work position transfer.
The upper arm process has four internal processes that contribute to workposition transition and is classified as a muda.
Many times of return.
The upper arm process has two returns for a single part.
During the operation, the individual working on the lateral rod and lowercontrol keeps transferring from lower control to later rod and vice versa.
Overproduction.
There is over stock/ stagnation after the process for every part in small parts.
Upper arm
Lower arm
Lateral control rod
Upper control
Lower control
All these parts have stagnation after the process.

Double handling.
a. After the skid is unloaded, the dolly is temporarily kept and then providedto the line, resulting in double handling.
Multi-process work together.
A man begins unloading the skid before it arrives at the unloading place.
When the skid arrives at the unloading place, the man begins the loadingprocess.
Loading and unloading are being handled concurrently.

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MUDA'S identified in Pre-Chassis:

Long distance.
The distance between the man in line and the buffer dolly is long.
Double handling.
The tow motor person places the buffer dolly in temporary storage before moving it to the line.
Stock.
There are buffer in Pre-Chassis.
Waiting.
a. The tow motor person is supposed to wait until the dolly is empty before returning it to small parts.

Value stream mapping: Collected Data's:

Small parts material cycle time

LWR CONTROL ARM	
SL. NO	CYCLE TIME
1	35 SEC
2	34 SEC
3	34 SEC
4	33 SEC
5	34 SEC

UPR CONTROL ARM	
SL. NO	CYCLE TIME
1	27 SEC
2	27 SEC
3	26 SEC
4	27 SEC
5	28 SEC

LWR ARM RH & LH	
SL. NO	CYCLE TIME
1	1M 43SEC
2	1M 48SEC
3	1M 44SEC
4	1M 40SEC
5	1M 40SEC

LATERAL ROD (F)	
SL. NO	CYCLE TIME
1	39 SEC
2	36 SEC
3	38 SEC
4	36 SEC
5	36 SEC

LATERAL ROD (I)	
SL. NO	CYCLE TIME
1	15 SEC
2	20 SEC
3	16 SEC
4	19 SEC
5	16 SEC

UPR ARM LH & RH	
SL. NO	CYCLE TIME
1	2M 46SEC
2	3M 07SEC
3	2M 56SEC
4	2M 21SEC
5	2M 48SEC

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Upper arm (Model 1

Material Information Flow Chart

Current

Supplier → Bush Press → ED Area → Bush Press → Pre-Chassis

						SKID		Buffer SKID		ED Coating	ED Parts buffer			ED Parts buffer	Bush Press		Pre-Chassis		
Upper arm	Part ID	Box Qty	ILCD Unload	Manifest	Non ED parts loading	Non ED parts loading	Logistics	Non ED parts Buffer	Logistics	ED Coat Area	ED Parts buffer	Logistics	ED Parts unload	ED Parts buffer	Process	Logistics	Pre-Chassis		
	Stock Lead time			97.04	33.22	33.22		32.22		95.66	65.44		31.22	62.44	69.6		139.2	Total	
	Process Lead time		60		3		1		7	73		7	3		2.3	7	14.5	In Mins	837.06
	Total lead time																	In Hrs	13.95

Ideal

Supplier → ED Area → Bush Press → Pre-Chassis

						SKID		Buffer SKID		ED Coating	ED Parts buffer			ED Parts buffer	Bush Press		Pre-Chassis		
Upper arm	Part ID	Box Qty	ILCD Unload	Manifest	Non ED parts loading	Non ED parts loading	Logistics	Non ED parts Buffer	Logistics	ED Coat Area	ED Parts buffer	Logistics	ED Parts unload	ED Parts buffer	Process	Logistics	Pre-Chassis		
	Stock Lead time																	Total	
	Process Lead time		60							73		7	3		2.3	7	14.5	In Mins	166.8
	Total lead time																	In Hrs	2.78

Target

Supplier → Bush Press → ED Area → Bush Press → Pre-Chassis

						SKID		Buffer SKID		ED Coating	ED Parts buffer			ED Parts buffer	Bush Press		Pre-Chassis		
Upper arm	Part ID	Box Qty	ILCD Unload	Manifest	Non ED parts loading	Non ED parts loading	Logistics	Non ED parts Buffer	Logistics	ED Coat Area	ED Parts buffer	Logistics	ED Parts unload	ED Parts buffer	Process	Logistics	Pre-Chassis		
	Stock Lead time			97.04	33.22	33.22		32.22		95.66	65.44			2				Total	
	Process Lead time		60		3		1		7	73		7	3		2.3	7	14.5	In Mins	536.6
	Total lead time																	In Hrs	8.93

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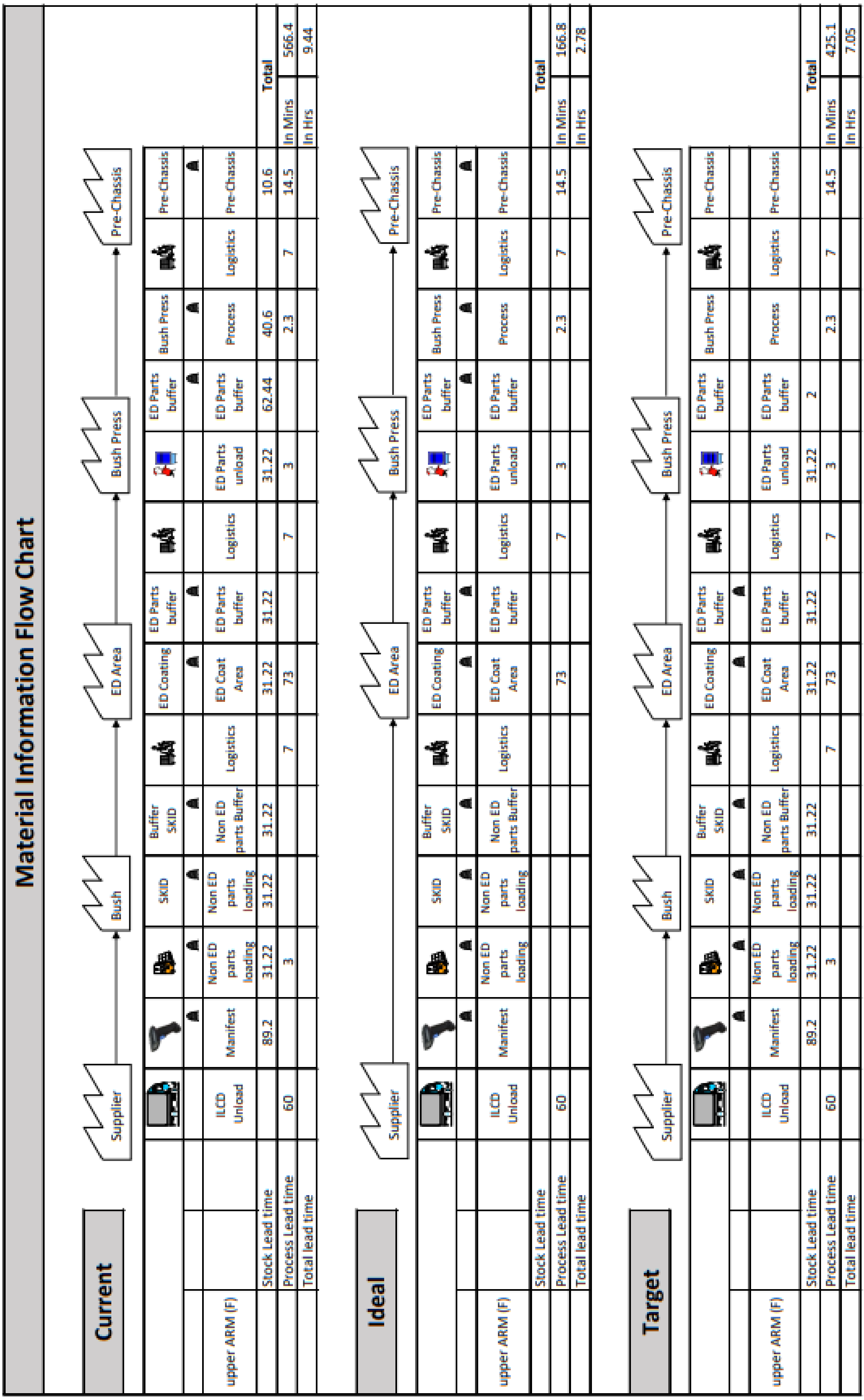
Upper arm (Model 2):



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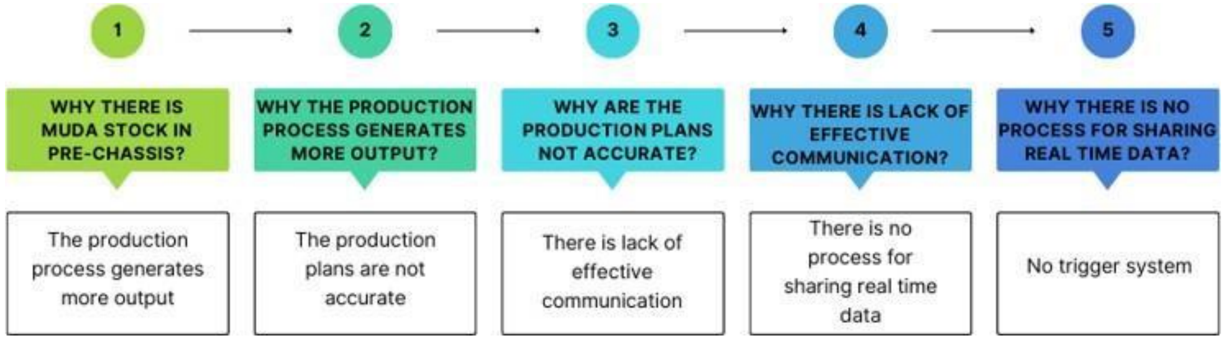
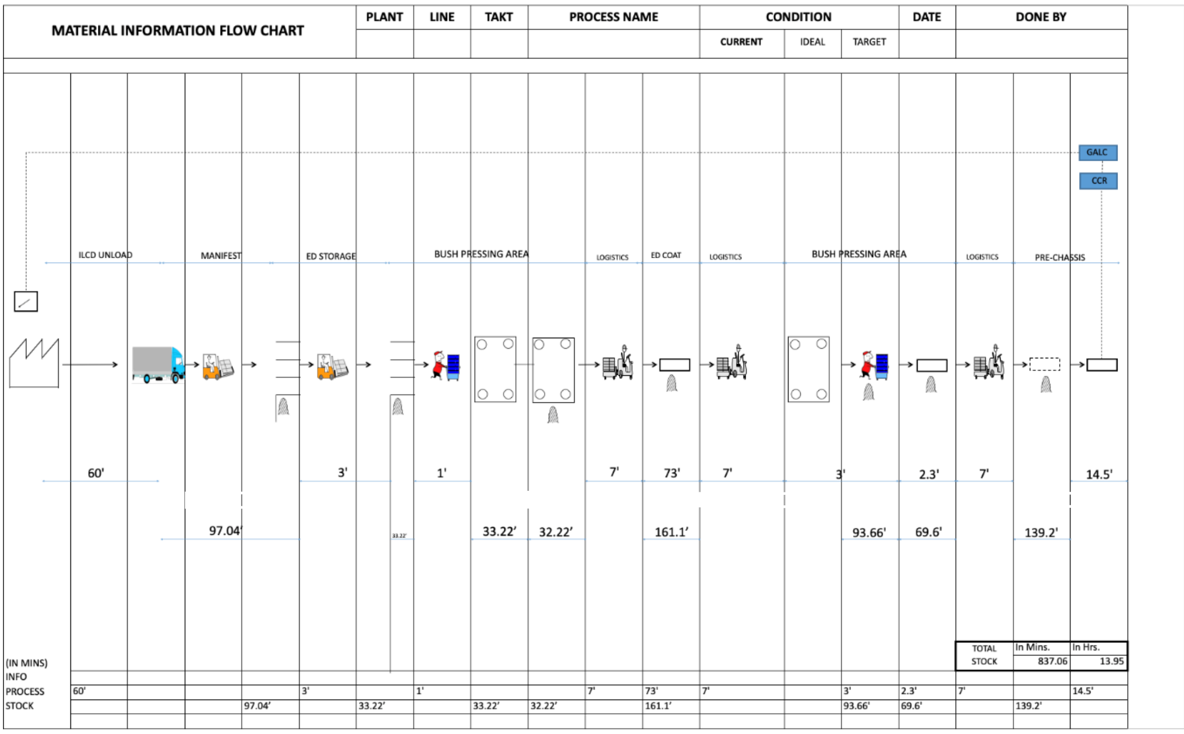
5 Why analysis:



DATA ANALYSIS AND INTERPRETATION:

Current MIFC of the material flow from Supplier to Pre-Chassis:



This is the current state of material flow from Supplier to Pre-Chassis, where it is supplied fromthe supplier and after entering the TKM it is manifested and sorted(stock), then it is stored at ED Storage(stock), then it is loaded in skid for ED(stock) at bush pressing area and sent to EDCoating(stock) after the coating it returns to bush pressing area(stock) and gets processed(stock) before being supplied to pre-chassis, where there are some stagnations in pre-Chassis.

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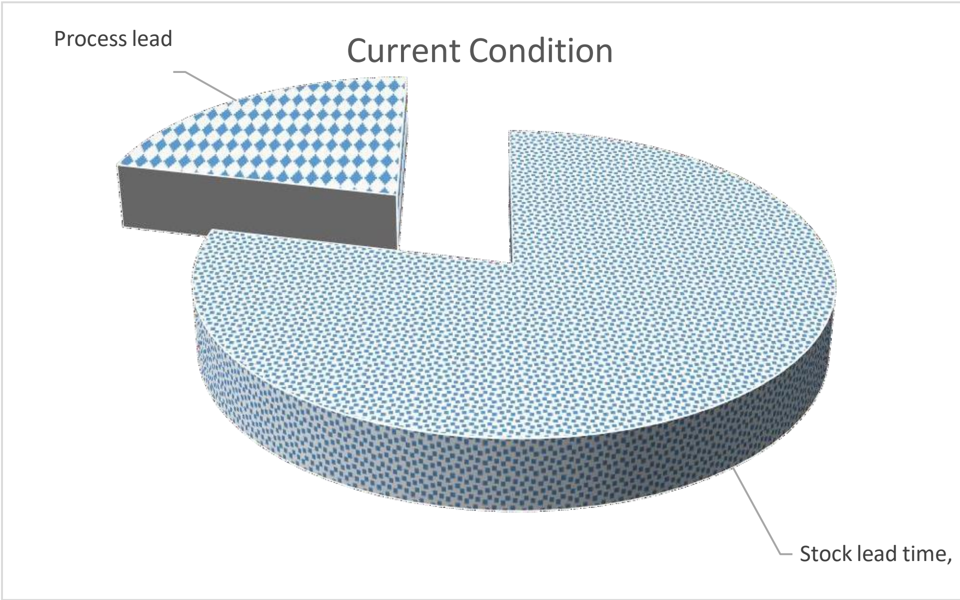
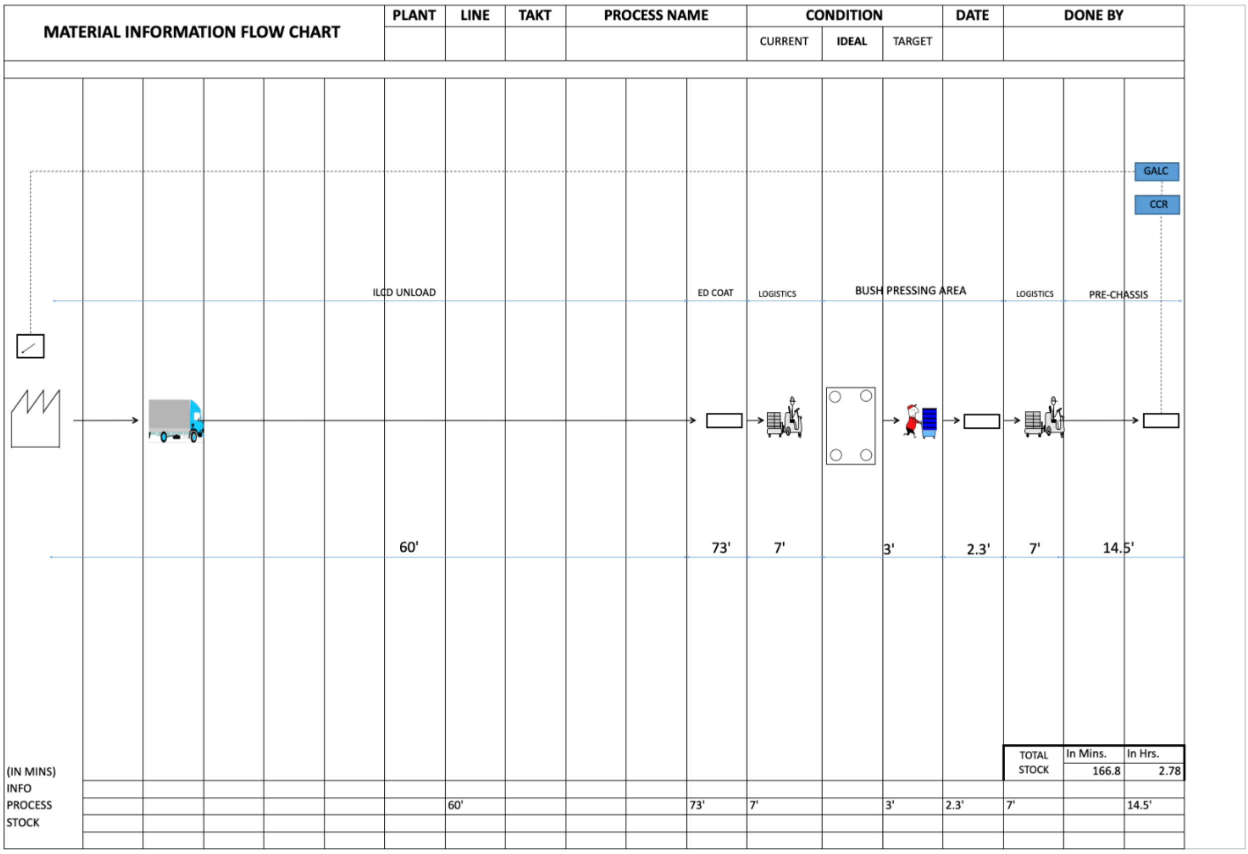


Ideal MIFC of the material flow from Supplier to Pre-Chassis:



This is the ideal condition of material flow from Supplier to Pre-Chassis, where it is supplied from the supplier and after entering the TKM is manifested in the ED Coat area, then after thecoating it is sent to the bush pressing area and processed before being supplied to the pre- chassis.

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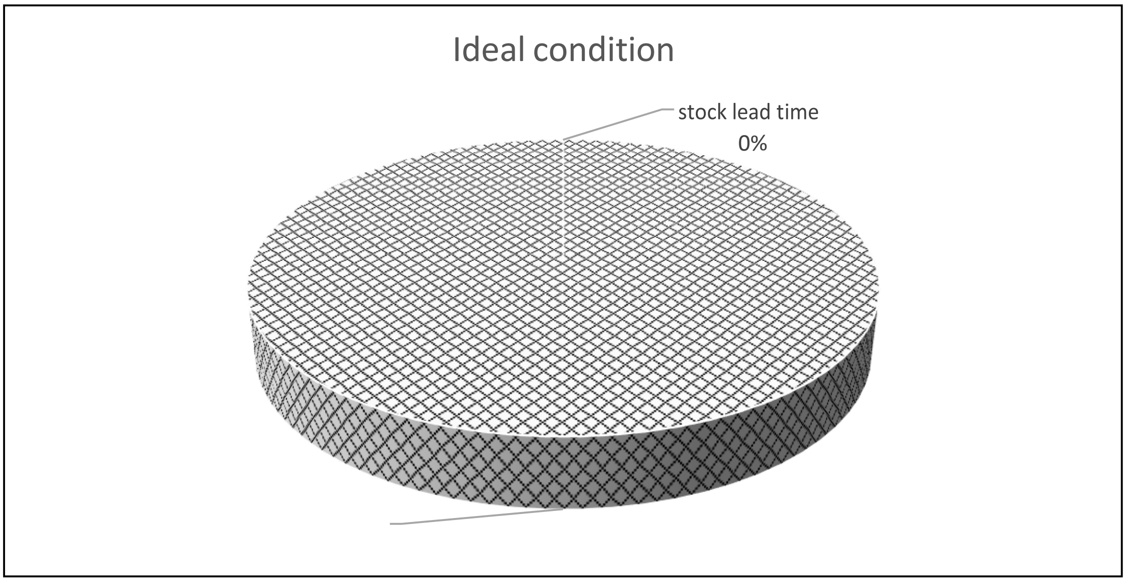
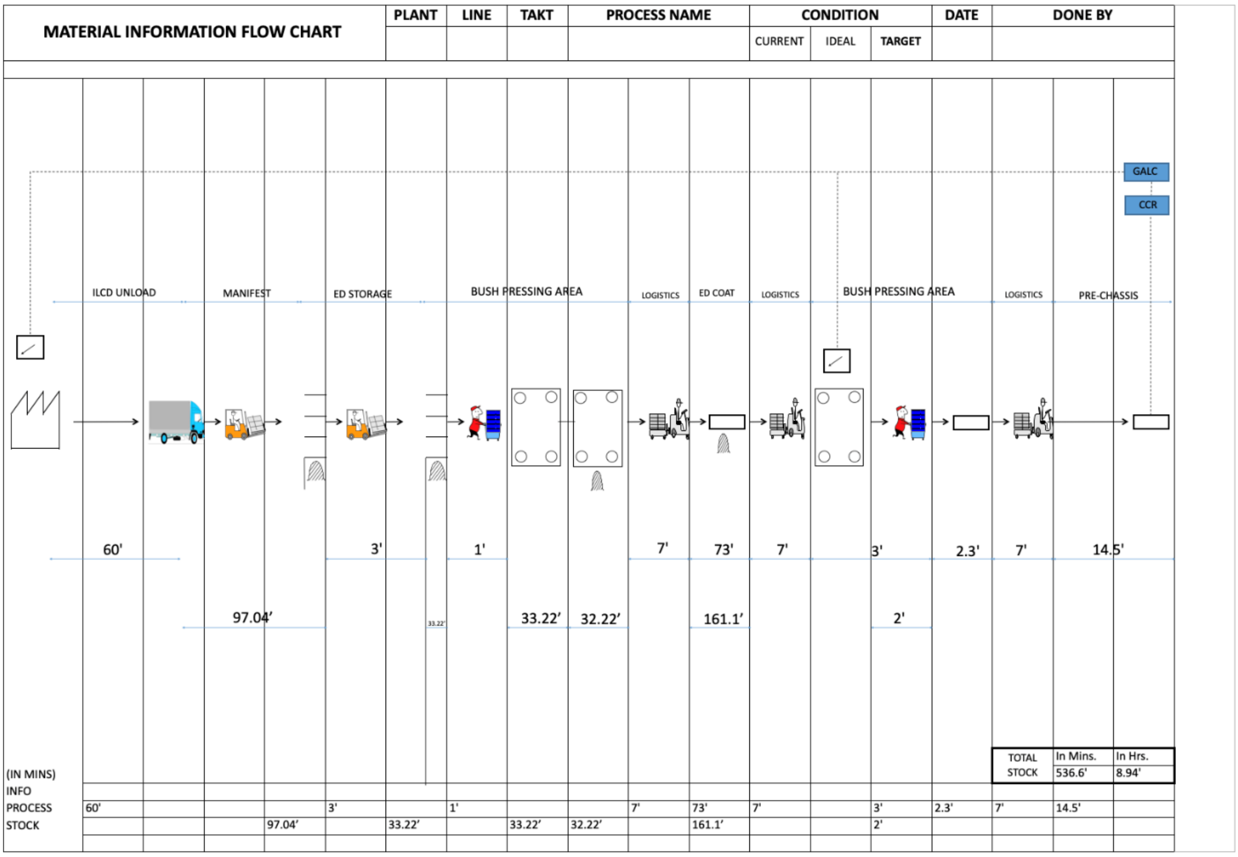


Expected result:



This is the current state of material flow from Supplier to Pre-Chassis, where it is supplied fromthe supplier and after entering the TKM it is manifested and sorted(stock), then it is stored at ED Storage(stock), then it is loaded in skid for ED(stock) at bush pressing area and sent to EDCoating(stock) after the coating it returns to bush pressing area and gets processed before beingsupplied to pre-chassis, where there are no stagnations in pre-chassis.

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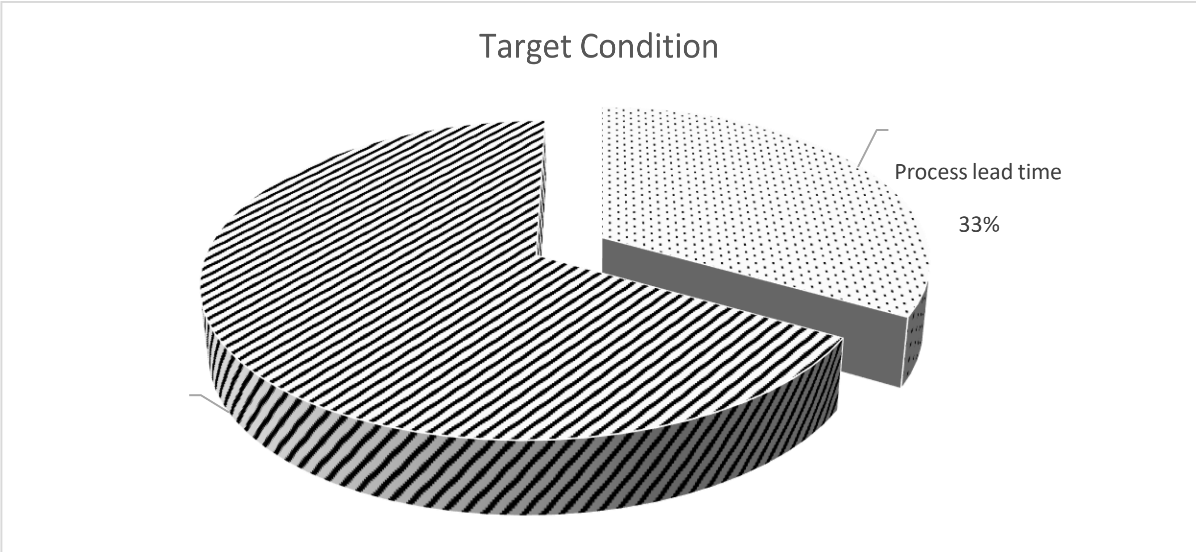
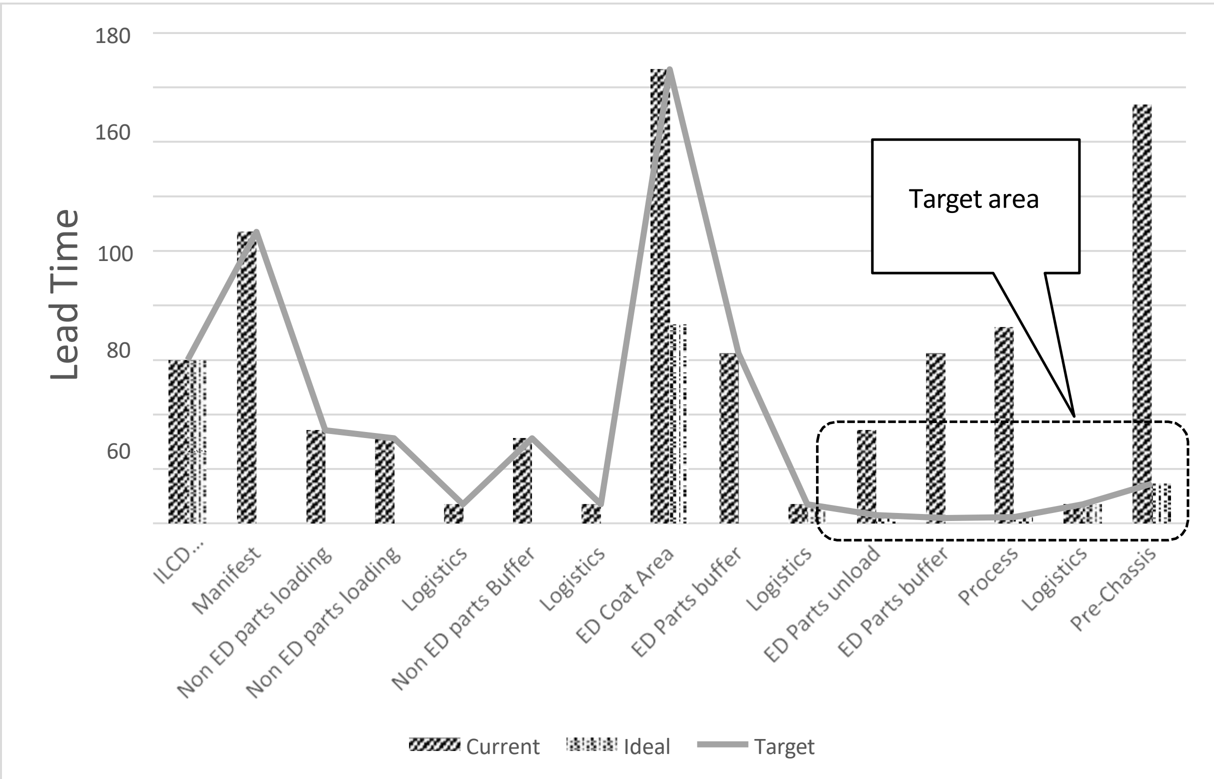


Comparison of Current, Ideal and Target condition:



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Stagnations in Current Condition are at below mentioned area:
Manifesting
ED Storage
Skid unloading
ED coating
Skid unloading
Bush pressing process
Pre-Chassis

Stagnations in Target Condition are at below mentioned area:

Manifesting
ED Storage
Skid unloading
ED coating

Stagnations in Target Condition are eliminated at below mentioned area:
Skid unloading
Bush pressing process.
Pre-Chassis

Stagnations in Ideal Condition are being totally eliminated and Ideal Condition has theleast lead time.

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Findings and Conclusion:Pre-Chassis kaizen viewpoints:

PRE-ChASSIS KAIZEN VIEW POINTS								CONVEYENCE			MOTION					WAITING			
SL. NO	PART NAME	MODEL/TYPE	DOLLY CAPACITY	CONSUMPTION PER DAY	REPAIR	OVER PRODUCTION	OVER PROCESSING	LONG DISTANCE	MANY METHODS FOR 1 ROUTE	STOCK	MANY TIMES OF RETURNS	MANY WORK POSITION TRANSFER	PARTS AREA OVER WORKING AREA	POOR WORK POSTURE	DOUBLE HANDLING	PROCESS INTERFERENCE	MULTI PROCESS WORK TOGETHER	POOR RELATION OF MEN & MACHINE	WAIT CYCLE TIME LOWER THAN TAKT TIME
1	Lwr arm RH	F	14					✓							✓				
2	Lwr arm LH	F	14					✓							✓				
3	knuckle RH	F	4												✓				✓
4	knuckle LH	F	4												✓				✓
5	absorber assy, shock FR LH	I	4												✓				
6	absorber assy, shock FR RH	I	4												✓				
7	upr control with bracket	I	28			✓		✓		✓					✓				
8	upr control without bracket	I	28			✓		✓		✓					✓				
9	lateral rod	I	12			✓		✓		✓					✓				
10	upr control with bracket	F	16			✓		✓		✓					✓				
11	upr control without bracket	F	16			✓		✓		✓					✓				
12	lateral rod	F	12			✓		✓		✓					✓				
13	upr arm RH&LH	F	14					✓							✓				
14	modular 4x4	F(AT)	24									✓							
15	modular 4x5	F(MT)	24									✓							
16	knuckle RH	I	8												✓				✓
17	knuckle LH	I	8												✓				✓
18	Lwr arm RH	I	14					✓							✓				
19	Lwr arm LH	I	14					✓							✓				
20	RR differential	I	4					✓			✓	✓			✓				
21	RR differential	F	4					✓			✓	✓			✓				
22	RR differential	F	4					✓			✓	✓			✓				
23	RR differential	F	4					✓			✓	✓			✓				
24	RR differential	F	4					✓			✓	✓			✓				
25	RR differential	F	4					✓			✓	✓			✓				
26	RR differential	F	4					✓			✓	✓			✓				
27	bar stabilizer FR	I	18																
28	bar stabilizer FR	F	10																
29	bar stabilizer RR	F	30																
30	spring coil RR	I	45		✓														
31	spring coil RR	F	40		✓							✓	✓						
32	link assy power	F	8					✓			✓	✓							
33	link assy power	I	12					✓			✓	✓							
34	band, fuel tank, FR	F																	
35	band, fuel tank, FR	F																	
36	fuel tank	I	4					✓			✓	✓							
37	fuel tank	F	4					✓			✓	✓							
38	fuel tank	F	4					✓			✓	✓							
39	brace sub-assy, engine	I	32																
40	tube, RR brake	F	19																
41	propeller (70)	I	5												✓				
42	propeller (QK) (QC)	F	5												✓				
43	propeller (BC) (TC)	F	5												✓				
44	propeller (BL) (TA)	F	5												✓				
45	propeller (NC)	F	5												✓				
46	propeller (ND)	F	5												✓				
47	knuckle RH	F	4								✓	✓	✓						
46	knuckle	F	4								✓	✓	✓						

Small parts kaizen view points:

SMALL PARTS KAIZEN VIEW POINTS

SL NO	PART NAME	MODEL/TYPE	DOLLY CAPACITY	REPAIR	OVER PRODUCTION	OVER PROCESSING	CONVEYENCE: LONG DISTANCE	CONVEYENCE: MANY METHODS FOR 1 ROUTE	STOCK	MOTION: MANY TIMES OF RETURNS	MOTION: MANY WORK POSITION TRANSFER	MOTION: PARTS AREA OVER WORKING AREA	MOTION: POOR WORK POSTURE	MOTION: DOUBLE HANDLING	WAITING: PROCESS INTERFERENCE	WAITING: MULTI PROCESS WORK TOGETHER	WAITING: POOR RELATION OF MEN & MACHINE	WAITING: WAIT CYCLE TIME LOWER THAN TAKT TIME
1	Lwr arm RH	F	14		✓				✓	✓	✓			✓				
2	Lwr arm LH	F	14		✓				✓	✓	✓			✓				
3	upr control with bracket	I	28		✓				✓	✓	✓			✓		✓		
4	upr control without bracket	I	28		✓				✓	✓	✓			✓		✓		
5	lateral rod	I	12						✓					✓		✓		
6	upr control with bracket	F	16		✓				✓	✓	✓			✓		✓		
7	upr control without bracket	F	16		✓				✓	✓	✓			✓		✓		
8	lateral rod	F	12						✓					✓		✓		
9	Lwr arm RH	I	14		✓				✓	✓	✓			✓				
10	Lwr arm LH	I	14		✓				✓	✓	✓			✓				
11	reinforcement	I	32						✓					✓				
12	upr arm RH	F	14		✓				✓	✓	✓			✓				
13	upr arm LH	F	14		✓				✓	✓	✓			✓				
14	upr arm RH	I	14		✓				✓	✓	✓			✓				
15	upr arm LH	I	14		✓				✓	✓	✓			✓				

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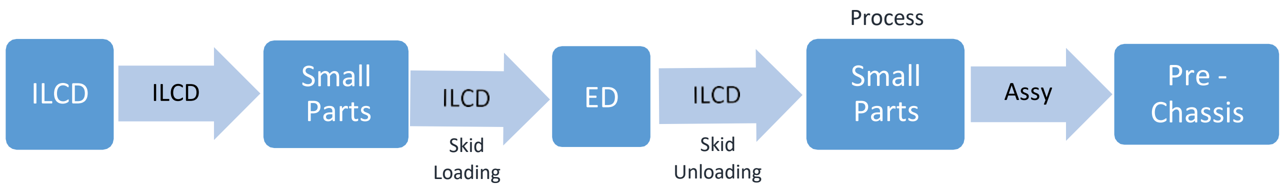
Proposed Counter measures

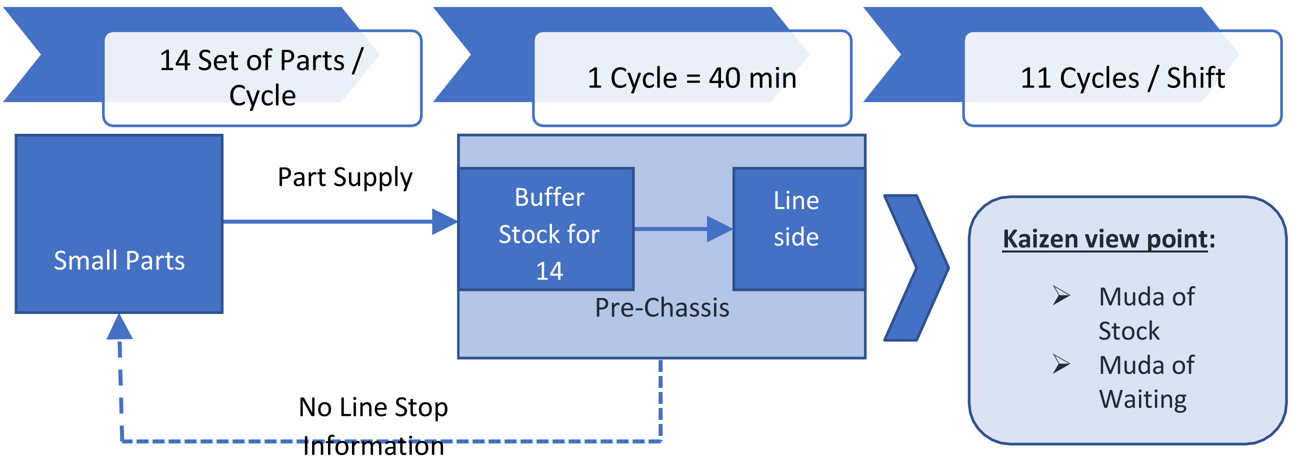
Pre-chassis to Small Parts Trigger System Implementation

Parts Flow



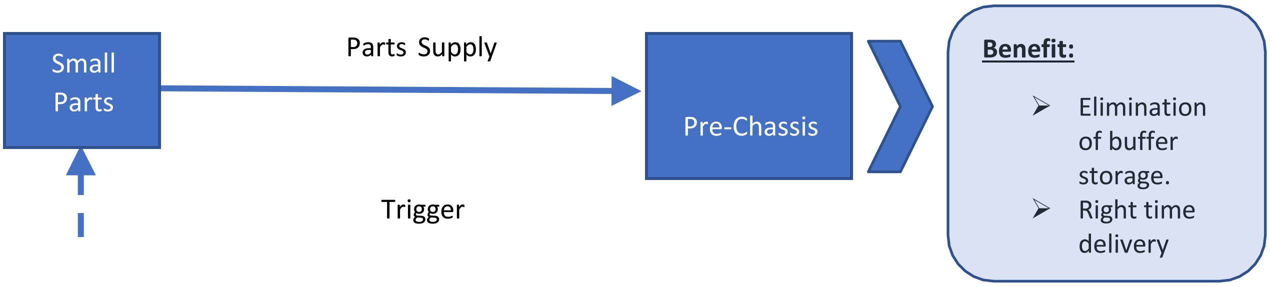
Current Condition

> Fixed Time, Fixed Quantity.



Target Condition

> Variable Time, Variable Quantity.



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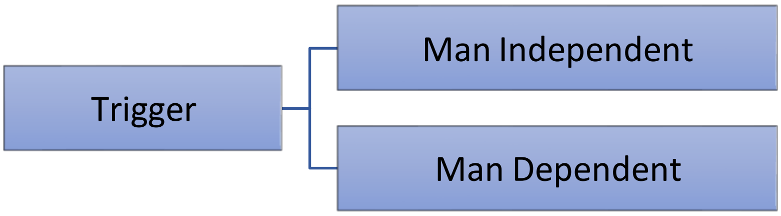
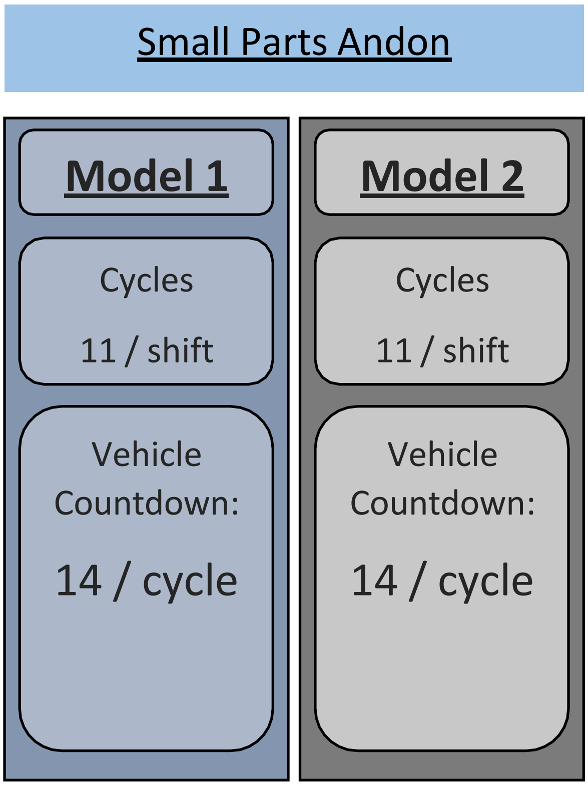
Trigger System:



Man Independent



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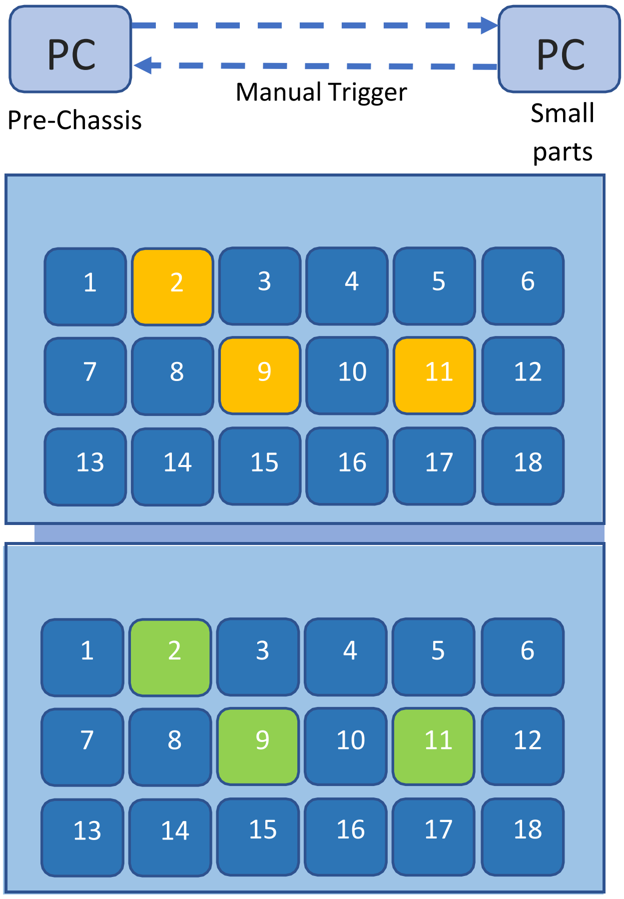
Man Dependent



Elimination of manpower:
Elimination of one manpower from skid unloading process.
This helps in eliminating the stock in between the unloading process and bushpress process.
It Reduce cost.
Eliminates double handling.

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Budget for the proposed condition:

Requirements	Budget (Rs)
Personal computer	3,50,000
Monitor	4,00,000
Push button	4,00,000
Programming	2,50,000
Total	**14,00,000**

Elimination of one manpower per shift:

Particulars (in Rs)	
Cost of one manpower per month	1,00,000
Cost of one manpower per year **(1,00,000 * 12)**	**12,00,000**
Shifts per day	3
Actual saving per year **(12,00,000 * 3)**	**36,00,000**
Investment for the proposed condition	14,00,000
Total saving for the year	**22,00,000**

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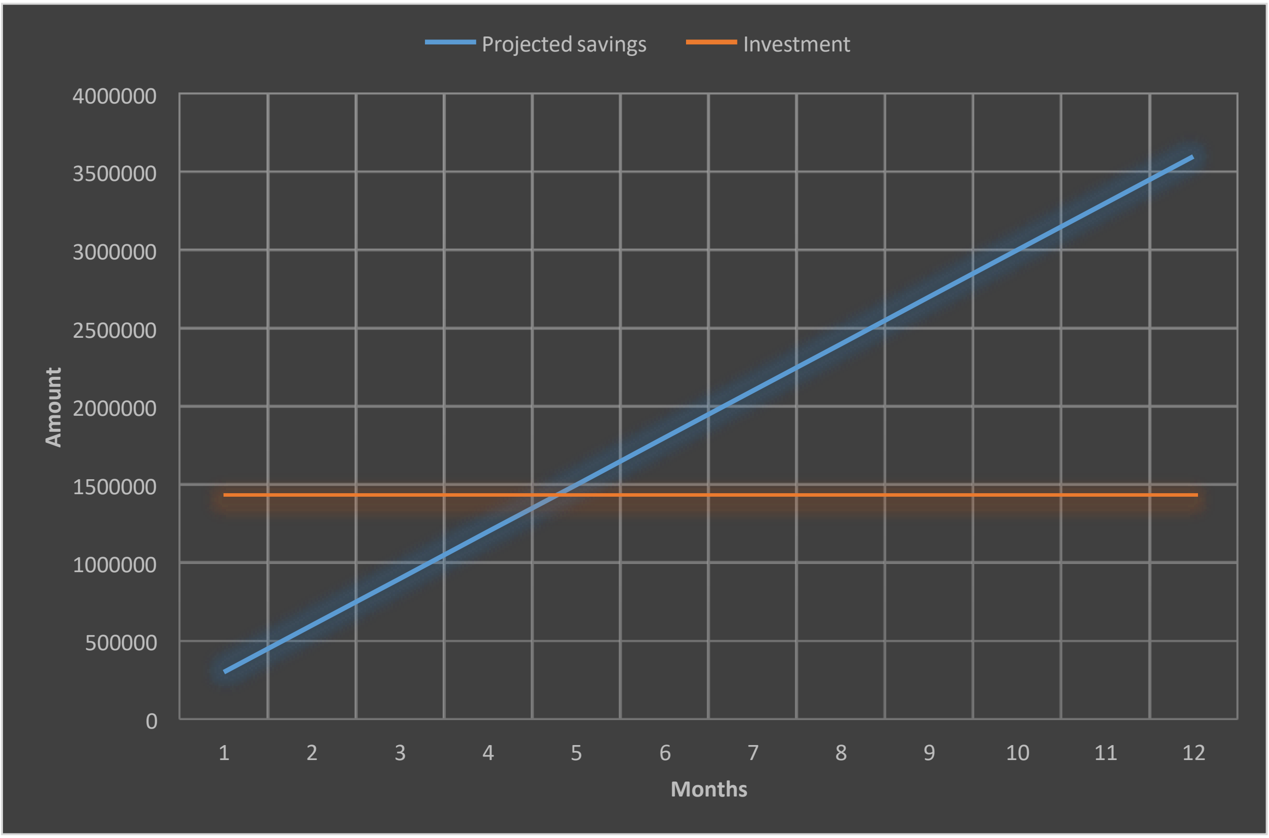
Break even chart:



The Break-even point has been meet within 5 months.
That means 14 lakhs initial investment is been covered within 5 month.
First year savings will be 22 lakhs.
From the second year the savings will be 36 lakhs.

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Conclusions

In conclusion, MUDA (waste) in our stock management procedures has been successfully identified and eliminated as a result of the installation of the Material InformationFlow Chart (MIFC). We have been able to identify areas of waste and inefficiency because to the MIFC's clear and visual portrayal of the movement of goods and information.

We have been able to pinpoint typical waste sources, such as surplus inventory, overproduction, wasteful transportation, and waiting periods, by analyzing the MIFC. With this knowledge, we have put specific measures in place to get rid of certain waste types and improveour stock management techniques.

We have gathered a variety of viewpoints and creative waste reduction solutions by incorporating team members from other departments in the study and analysis of the MIFC. Increased staff engagement and more efficient solutions are the outcomes of this collaborativeapproach.

We now have a strong framework for locating and removing MUDA in our stock management procedures thanks to the MIFC. We were able to streamline operations, cut expenses, and boost overall effectiveness as a result of its adoption. We are confident in our ability to maintain these good developments and further optimize our stock management practices by embracing the ideas of continuous improvement and utilizing the MIFC's insights.The initial lead time of 837.06 minutes was considerably cut to 536.6 minutes. By eliminatingone man power from one shift we save 22 lakhs in the first year and for the second year we cansave 36 lakhs. The investment is covered with in 5 months.

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