Presented by : ARROW Group
Durgam Sandeep Kumar Goud 1873893
Gupta Sandeep Kumar Omkarnath 1844011
Sooraj Francis Mani 1642365

Lean Operations

Case Study of Kaizen adopted by TATA Motors

About TATA Motors

MISSION: We Innovate Mobility Solution with passion to enhance quality of Life

VALUES:

- Integrity
- Teamwork
- Accountability
- Customer Focus
- Excellence
- Speed

Tata Motors Group (Tata Motors) is a $45 billion organisation. It is a leading global automobile manufacturing company. Its diverse portfolio includes an extensive range of cars, sports utility vehicles, trucks, buses and defence vehicles. Tata Motors is one of India's largest OEMs offering an extensive range of integrated, smart and e-mobility solutions

VISION: By 2024 we will become most aspirational Indian auto brand

- Driving sustainable Mobility solutions
- Exceeding customer expectations
- Creating highly engage workforce

Ref: Tata Motors Sustainability Report, Website

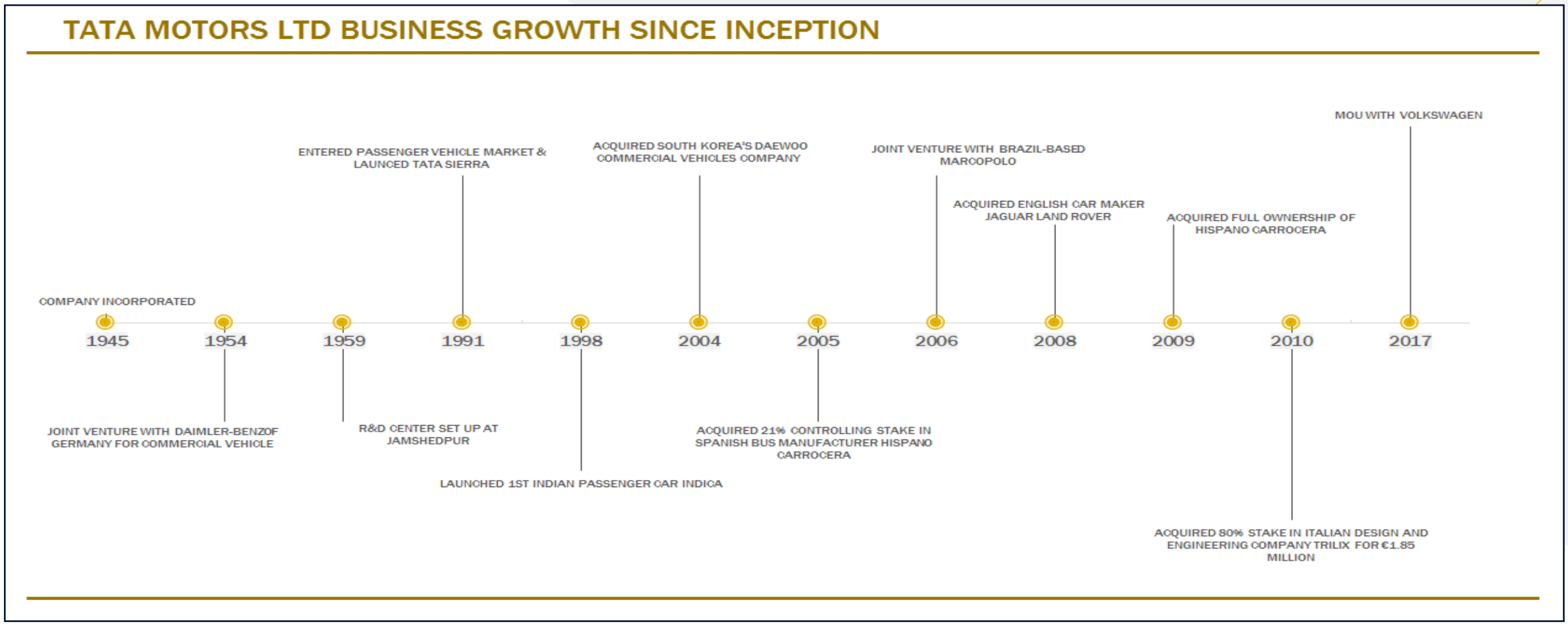
- The growth of TATA motors is deep understanding of economic stimuli and customer needs
- TATA Motors has strong global network of subsidiaries and associate companies include Jaguar & Land Rover in UK, Tata Daewoo in South Korea
- TATA has design units in India, UK and Italy specialized in various latest designing activities like clay modelling, digital modelling, styling, architecture, packaging
- TATA Quality management system (QMS) uses tools for defect prevention and reduction of variation and waste in supply chain.

Ref: Website : https://www.tatamotors.com/

Market Analysis

With over **8.5 million** Tata branded vehicles plying globally, we offer a wide spectrum of vehicles that are customised for local conditions and meet the highest standards for quality, safety, environment norms and user comfort. We have been expanding our international footprint through exports **since 1961**. Today, Tata Motors is present in **over 175 countries**, with a worldwide network comprising **over 6,600 touch points**. With vast global experience, the company brings deep understanding of customer expectations from diverse markets, and is well positioned to cater to ever changing automotive norms and consumer trends across the globe.

Background & Timeline



Ref: https://rmoneyindia.com/research-blog-traders/cyrus-and-crisis-are-they-synonyms-for-tata-motors-ltd/

The Lean Road of TATA Motors

- Tata Motors founded in 1945 by JRD Tata
- First Commercial vehicle developed in 1960 with Daimler Benz
- In early 90's, when demand increase Tata Motors decided to improve process flow –Tata introduced production system derived from TPS
- Lean Production helps the production to be Continuous and reduces waste
- Kaizen is Japanese term for Improvement or change for the better – focus on continuous improvement by improving standardized activities and process
- By using COMMWIP Identification sheet and kaizen Technique – MUDA was identified

Ref: https://www.tatamotors.com/ , https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

- Kaizen – continuous improvement – standardized process – waste reduced
- Cycle time reduced
- Takt time reduced
- More vehicles delivered as per demand
- JIT helps in continuous Material flow and Inventory flow
- Tata motors forced the suppliers to follow lean principles – supply chain more efficient – Green transportation

Ref: https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

COMMWIP IDENTIFICATION SHEET

Area/Line : Line 3 Date: 24th Feb,2015 Station Name/No. : AC Head Pipe Fitment

Types of Muda		Observations			
	Correction	1		4	
		2		5	
		3		6	
	Over Production	1		4	
		2		5	
		3		6	
	Motion	1	Bringing Clamps, fastners from Tool Box.	4	
		2	Going to Kitting Trolley to get Pipes.	5	
		3		6	
	Movement	1	Bringing AC pipes from trolley.	4	
		2	Walking to get runner.	5	
		3	Going to put Runner to Runner Stand.	6	
	Waiting	1	Waiting for others to give Space to put AC Pipes on frame.	4	
		2	Waiting time for a operator while other is working.	5	
		3	Waiting for runner to be free.	6	
	Inventory	1		4	
		2		5	
		3		6	
	Processing	1	Making assemblies of clamp, nuts, washer & bolt.	4	
		2		5	
		3		6	
	Over Burden	1		4	
		2		5	
		3		6	

Ref: https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

Kaizen – Lean Tool

Kaizen is based on making changes anywhere improvements can be made

Kaizen is an approach that,

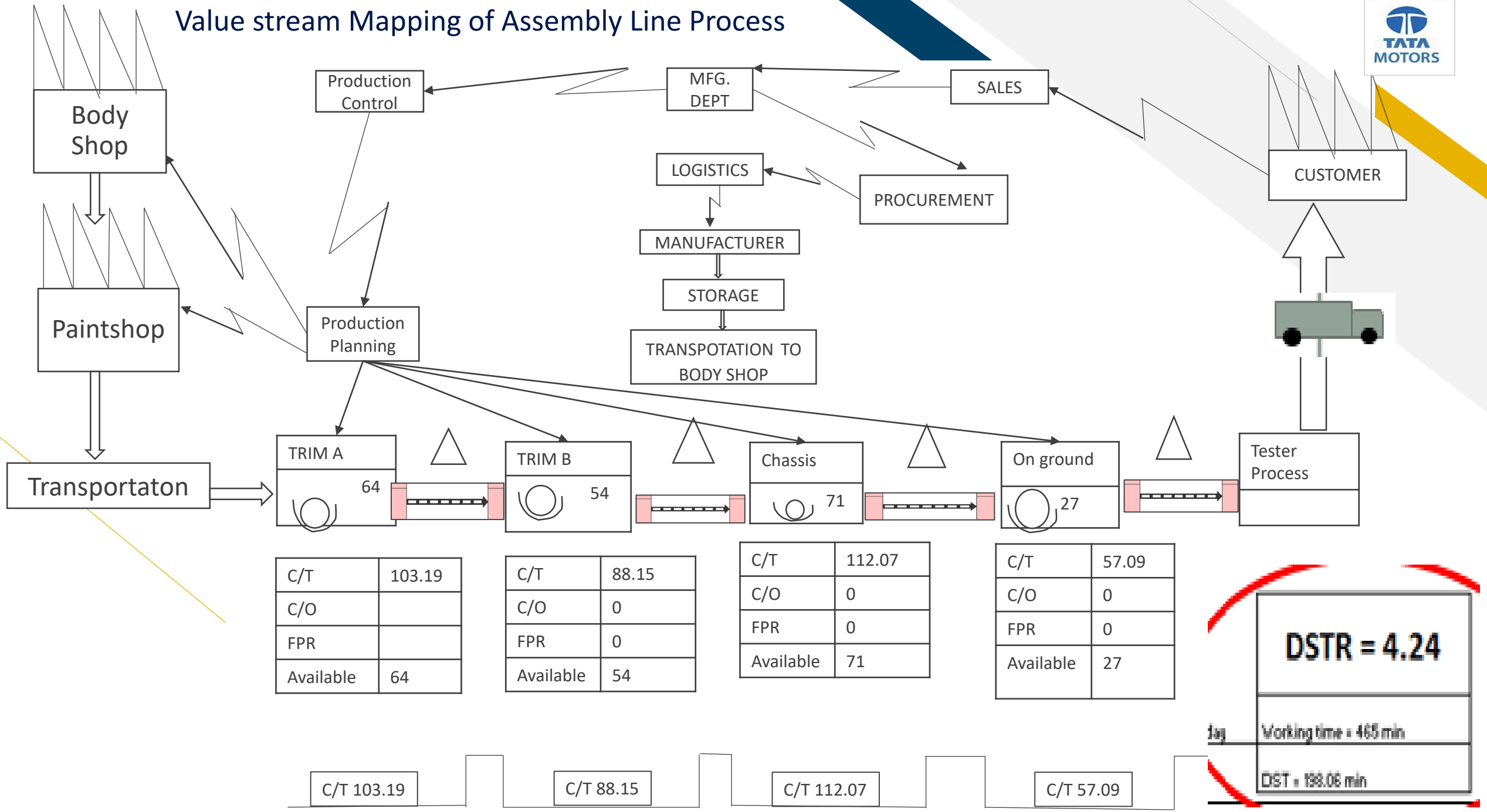
- Starts with people.
- Focuses its attention on people‘s efforts.
- Processes are continually improved.
- Improved processes will improve results.
- Improved results will satisfy the customers.

Ref: International Conference on Ideas, Impact and Innovation in Mechanical Engineering (ICIIIME 2017), Volume: 5 Issue: 6, ISSN: 2321-8169 ,677 –683

Assembly Line

Ref: Website : https://www.tatamotors.com/

Value stream Mapping of Assembly Line Process



C/T	103.19
C/O	
FPR	
Available	64

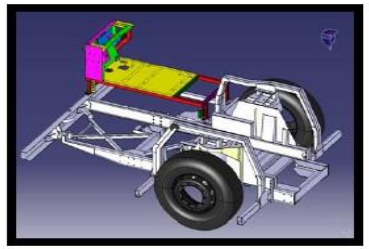
C/T	88.15
C/O	0
FPR	0
Available	54

C/T	112.07
C/O	0
FPR	0
Available	71

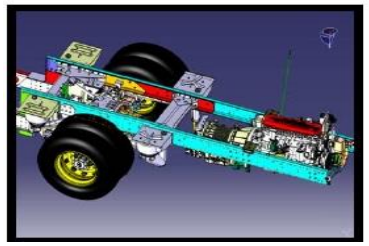
C/T	57.09
C/O	0
FPR	0
Available	27

Lean on Product Design

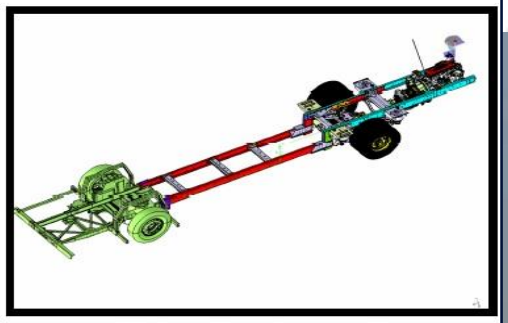
- Advanced Module Platforms are the standardized and modular product design architecture for Tata Motors
- Base structure without exterior body can make in 15 modules
- Customizable according to demand
- Reduce takt time
- Reduce Lot size
- Increase quality



Front Module



Rear Module



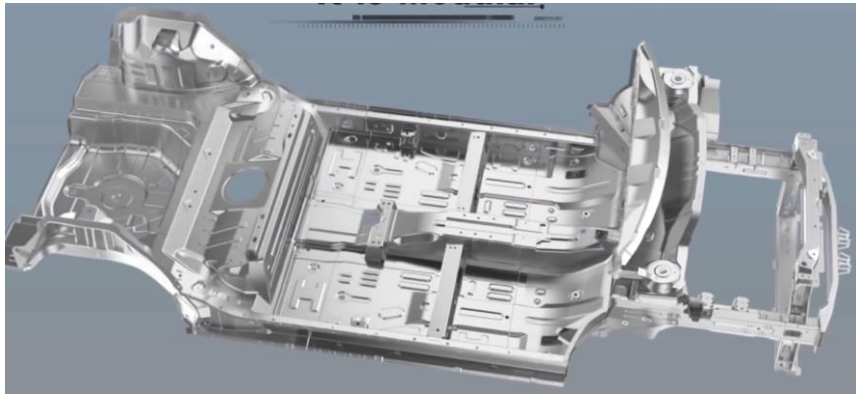
Integrated Chassis

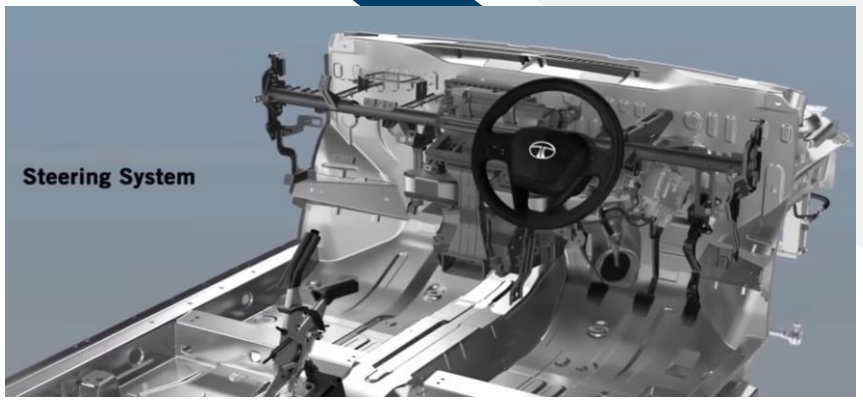
EXCLUSIVE

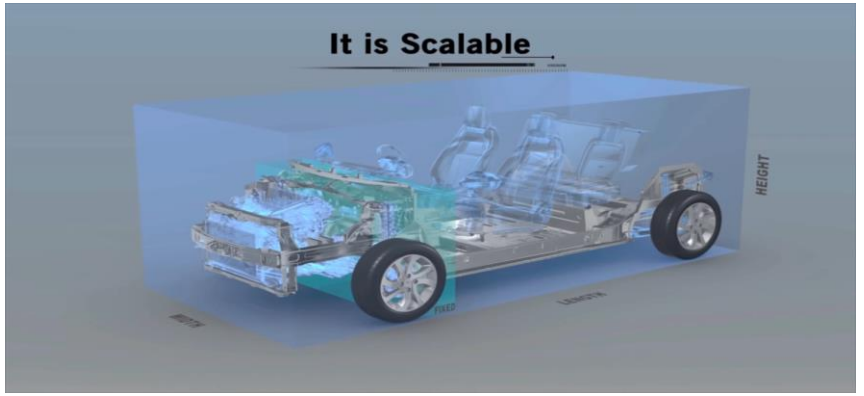
Rajendra Petkar: 'Going forward, modularity is going to be a way of life at Tata Motors.'

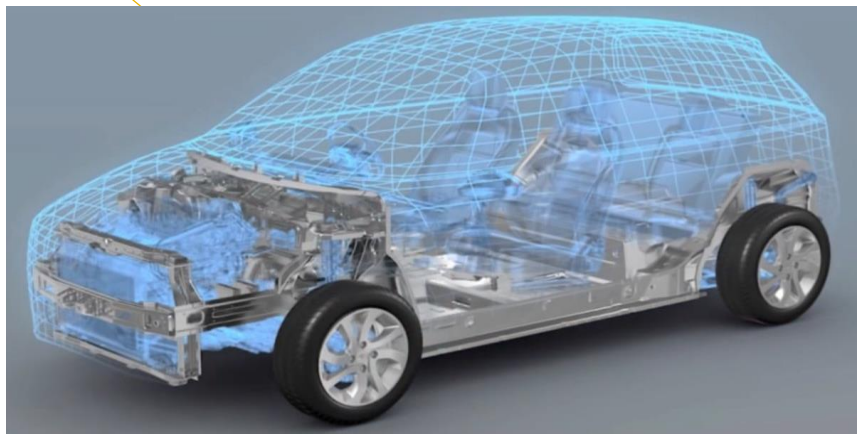
Tata Motors' Advanced Modular Platform can be adapted to build cars and SUVs of different shapes and sizes.

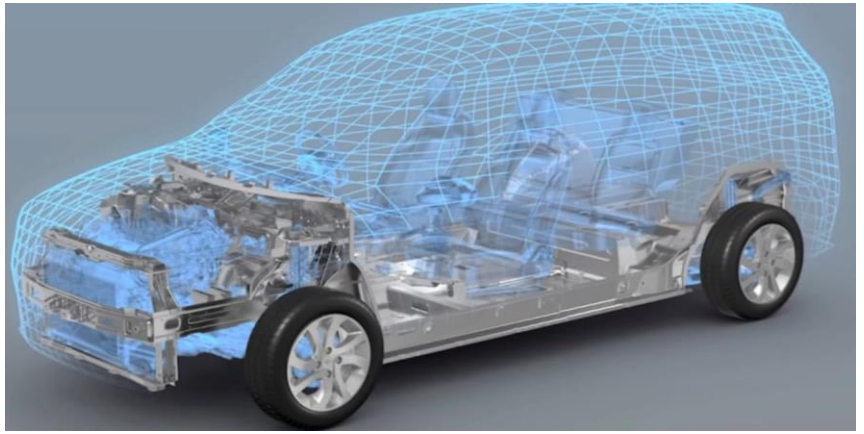
Ref: https://www.autocarpro.in/interview/eaton-india%E2%80%99s-shandar-alam-%E2%80%98we-have-to-get-ready-as-per-the-new-norms-and-regulations-coming-in-the-market%E2%80%99-41656







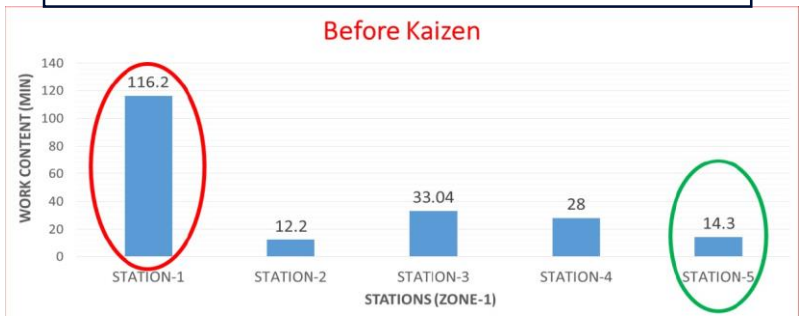


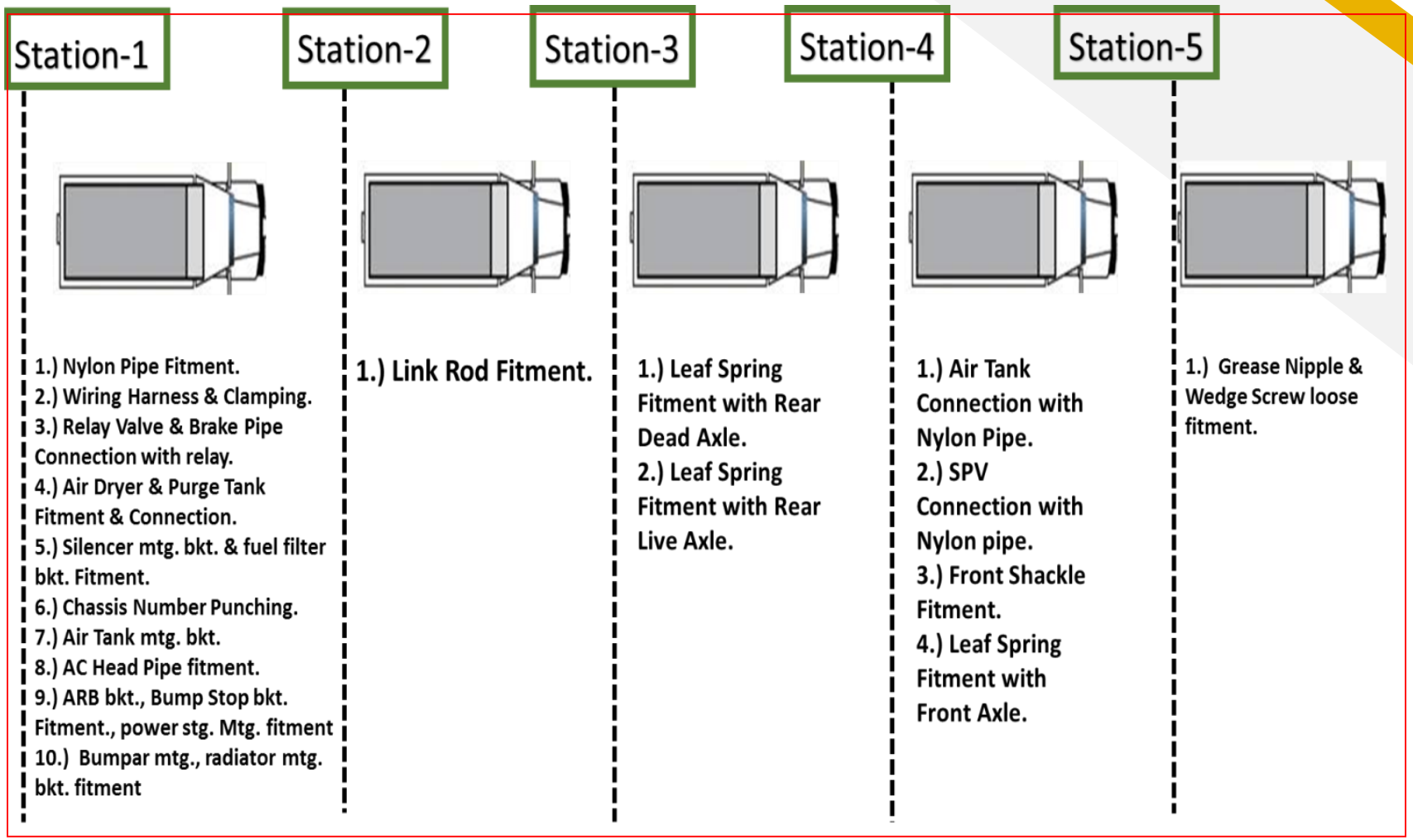


Ref:https://www.youtube.com/watch?v=D3HbxDEsosE

Lean – Process Design

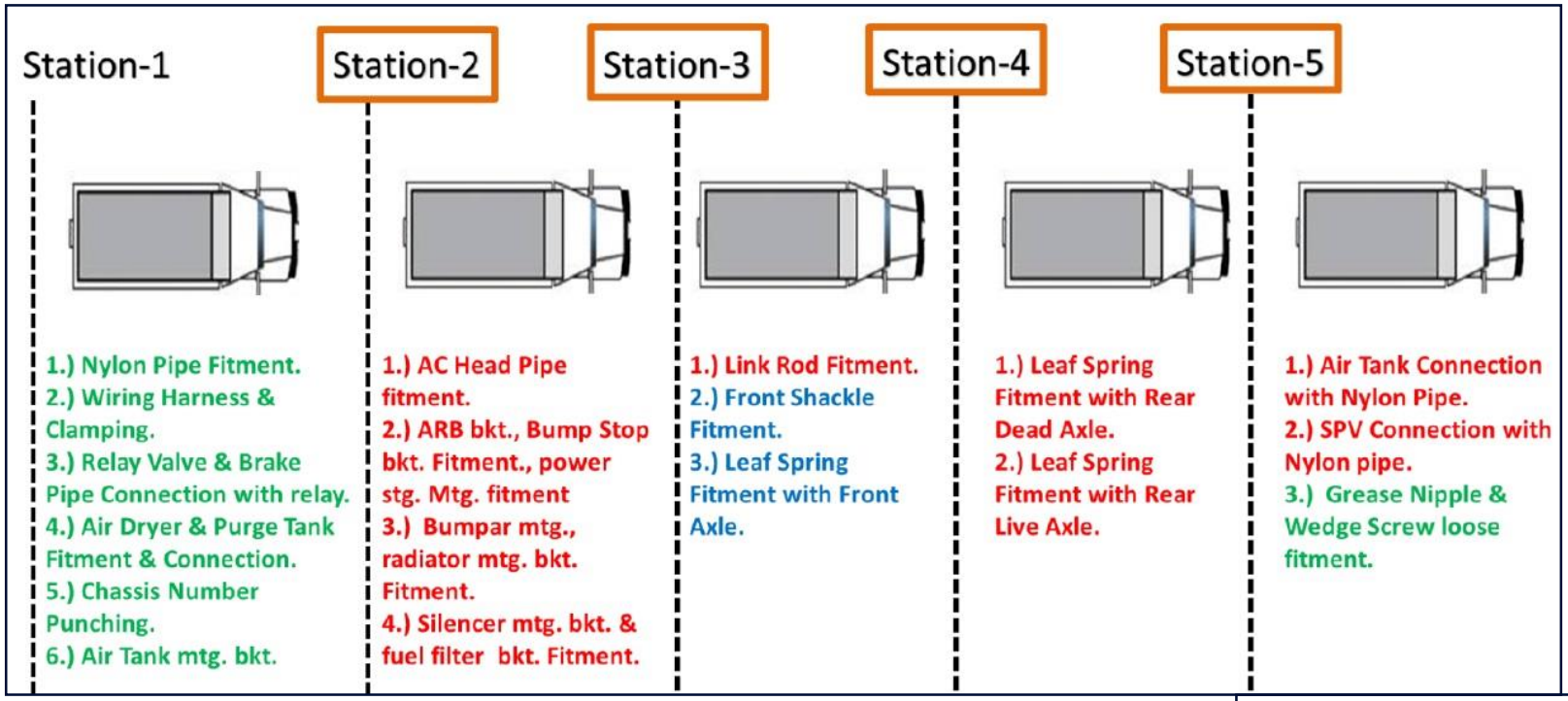
- Assembly line divided into 19 stations
- Roller chained slat conveyors
- Speed: 0.1-2.2m/min
- Each line can accommodate 24 vehicles

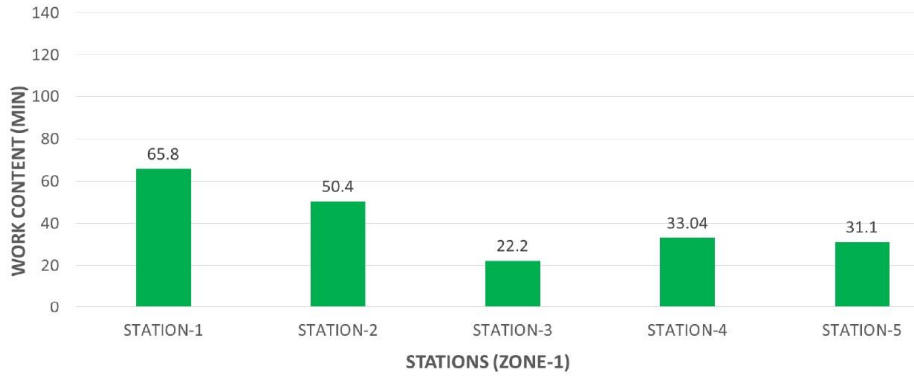




Ref: https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

AFTER KAIZEN

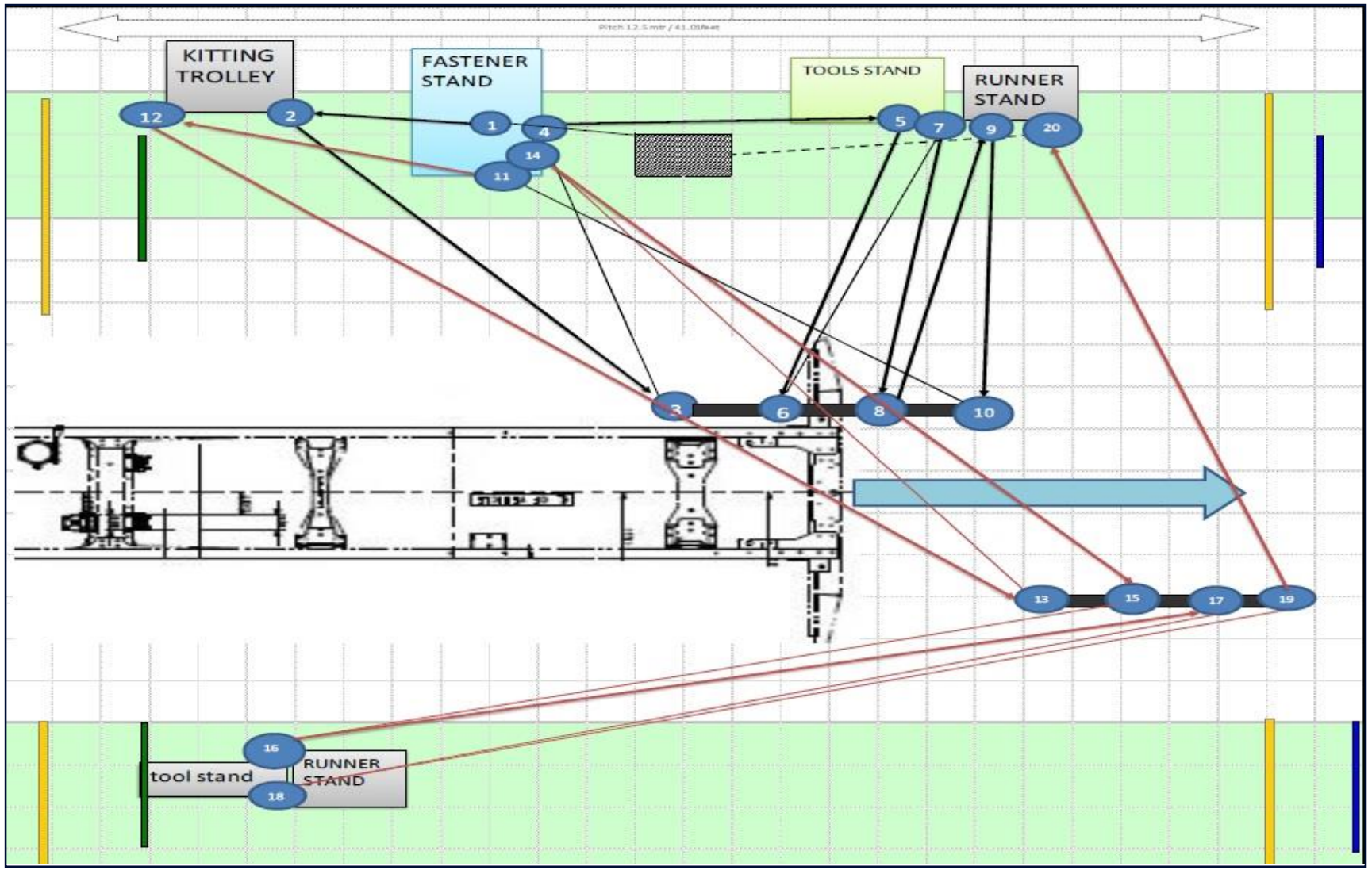




- Stickers are marked on the shop floor – which explain work to each operator
- Stickers starts with green and ends in Red
- Depend on the speed these work interchange

Ref: https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

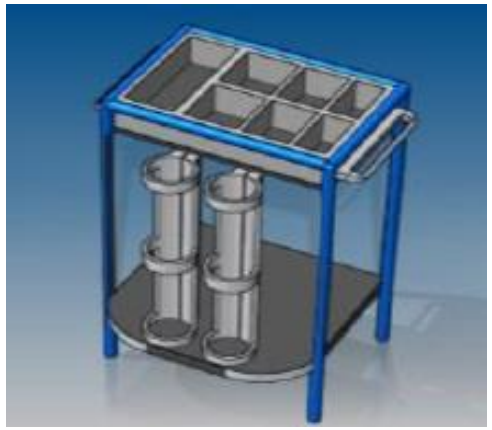
Kaizen in shock Fitment



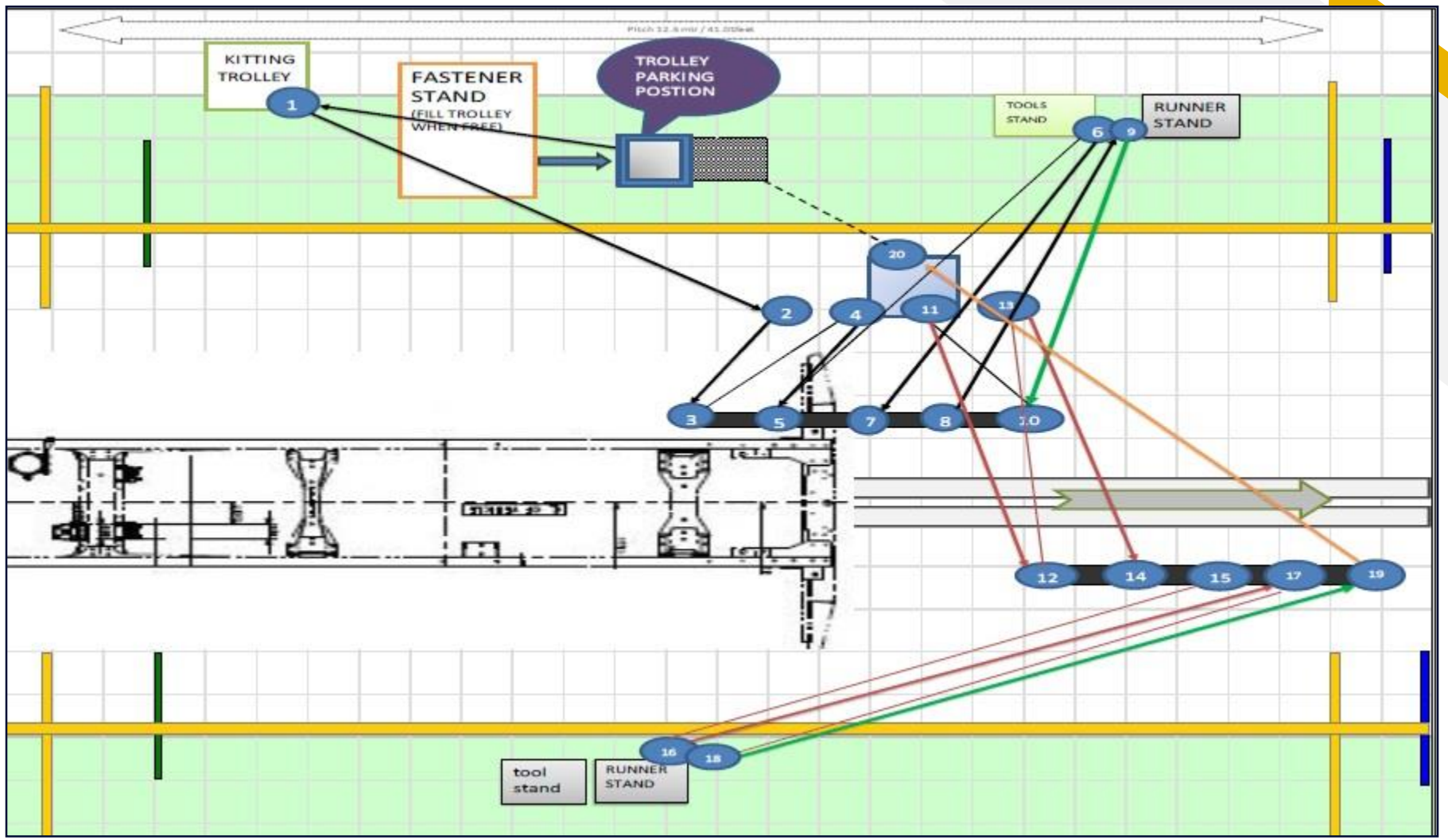
- Before using fastener trolley operator took around 360sec to complete the shock fitment
- In order to make this process standardization new trolley designed to carry shock parts

Ref: https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4

Kaizen in shock Fitment



- Now operator can save 85 sec in this station
- Takt time reduced
- Cycle time reduced



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Quality tools in Tata motors

Poka Yoke – Error free functioning of plant

- Fail safe: They are installed from safety point of view
- Fool proof: They are installed from quality point of view

Total of 130+ Poka Yoke installed in the TCF shop with 80+ fool proof and the rest of them being fail safe

FIFO(First In First Out)

- The parts used while assemblies were stored in bins
- The bins were kept on the surface according to their manufacturing dates, which would create a flow and the object which was old was used first thus avoiding the stacking up of old parts.

Ref: International Conference on Ideas, Impact and Innovation in Mechanical Engineering (ICIIIME 2017), Volume: 5 Issue: 6, ISSN: 2321-8169 ,677 –683

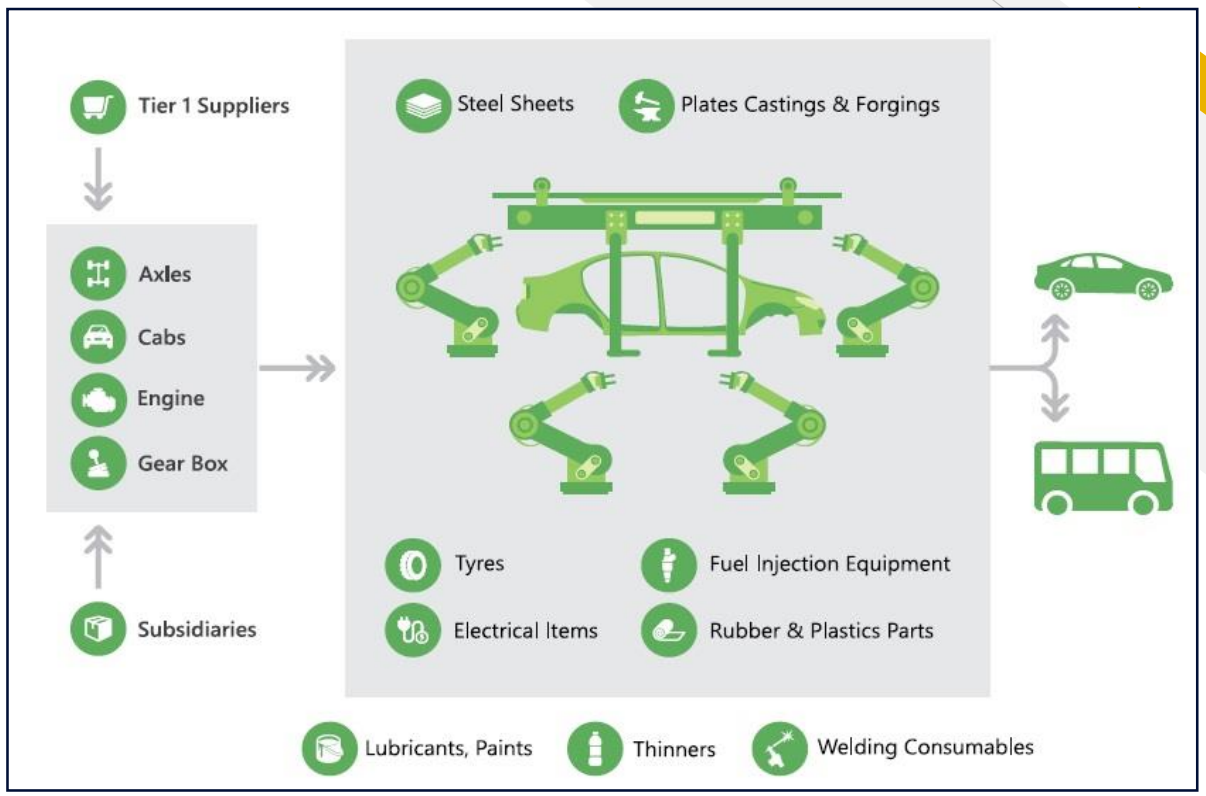
Lean – Organizational Element

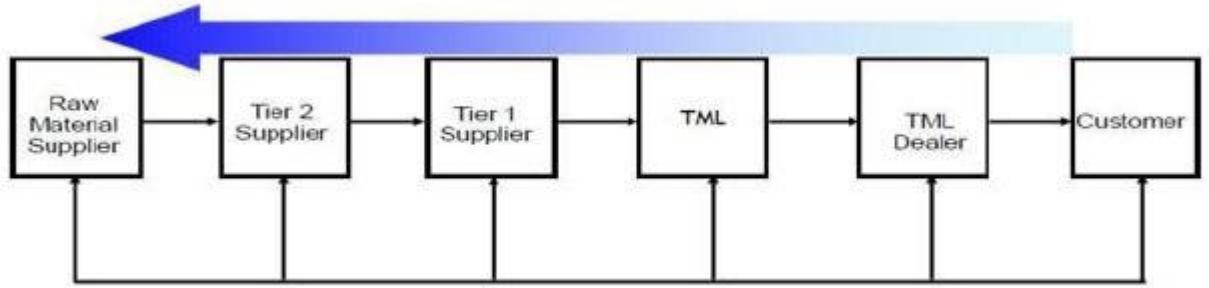
- Lean tool used - Kaizen
- Kaizen is a system that involves everyone – upper management to the cleaning team
- In Tata Motors there is Kaizen Department with a manager in top who has several years of experience/training under Japanese consultants
- Front line Employees are in 1st place to identify opportunities for improvement
- Front line employees fill these details in COMMWIP (Problem Identification Sheet) – sent to supervisor – analyze these operations
- Seniors Managers/Executives have the task to set the stage for kaizen and provide necessary support and resources
- Also give the training to first line employees to adapt the changes

Ref: Tata Motors Sustainability Report

Lean – Production /Service Planning and control

- According to the demand - Lean tool like JIT – company goes for Local sourcing
- Tier 1 suppliers as primary raw material supplier
- Since company implement JIT and to make the work flow continuous – company has online database for lean inventory follow up - cFolder





Ref: Tata Motors Sustainability Report

- **CRM-DMS** (Customer relationship management – Dealer Management System) – centralized online system to monitor finance, inventory dealer level service, parts and complaints at customer level
- Tata uses regular maintenance checkup
- Uses steel rack for transporting the parts – reduce damages – required amount already available in each stations

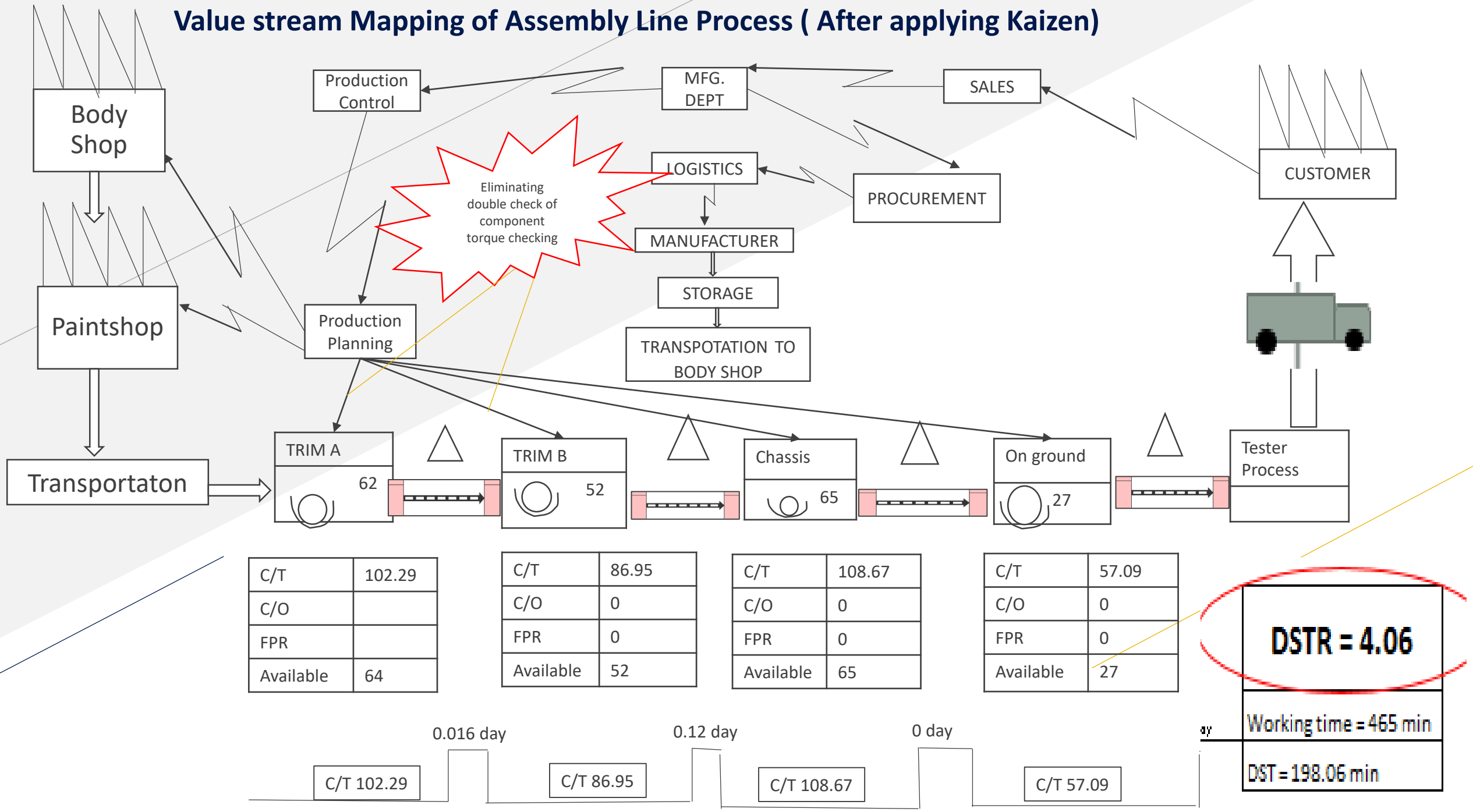
Ref: Tata Motors Sustainability Report, https://www.slideshare.net/niranjannahak/tata-motors-30398980

Results of Lean Tools

- Tata motors CV division has 60% market value in INDIA
- CV plant in Jamshedpur -700 meters flexible assembly line with 42 station's
- State of the art equipment and assembly lines to produce a truck every 5 mins
- Engine assembly shop capable of supplying 200 engines per day
- Modular assembly – economic
- Lean supply reduced material handling defect by 70%
- Improved relationship with vendors - Tier 1, Tier 2 suppliers – reduction in material cost
- Kaizen lean tool – continuous improvement – standardization – reduced cycle and takt time

Ref: Website https://www.tatamotors.com/, Sustainability report Tata motors, https://www.tatamotors.com/blog/commercial-vehicle/accelerating-cv-production-by-2020/

Value stream Mapping of Assembly Line Process (After applying Kaizen)



C/T	102.29
C/O	
FPR	
Available	64

C/T	86.95
C/O	0
FPR	0
Available	52

C/T	108.67
C/O	0
FPR	0
Available	65

C/T	57.09
C/O	0
FPR	0
Available	27

		Imp AB(tightening)	Imp C(tightening)
α	Built-in	HCT & Line stop	Shut-off wrench & Control the number of tightening
	Outflow prevention		
β	Built-in	HCT & Control the number of tightening	Shut-off wrench
	Outflow prevention	check by touching	check by touching (Same operator is possible for low JPH)
γ	Built-in	Torque wrench	Torque wrench
	Outflow prevention	Torque recheck	check by touching

Process Improvement

Dept	Body Shop	Trim&Chassis	Paint Shop						
			PBS	Seal	Sursand	Surfacer	Top Coat	Touch up	Under Coat
Actual time	722.95	354.94	13.6	41.51	18.88	19.21	23.86	18.92	18.45
Tact Time	2.48	2.28	2.45	2.5	2.6	2.72	1.66	2.59	2.5
Man Power	325	206	6	18	8	8	16	8	8
			92.51	92.24	90.76	88.28	89.83	91.31	92.25
Job Balancing Ratio	89.7	75.57	91.03						
DSTR	1.08	4.06	0.81						

After the analysis

Dept	Body Shop	Trim&Chassis	Paint Shop						
			PBS	Seal	Sursand	Surfacer	Top Coat	Touch up	Under Coat
Actual time	722.95	360.5	13.6	41.51	18.88	19.21	23.86	18.92	18.45
Tact Time	2.48	2.28	2.45	2.5	2.6	2.72	1.66	2.59	2.5
Man Power	325	216	6	18	8	8	16	8	8
			92.51	92.24	90.76	88.28	89.83	91.31	92.25
Job Balancing Ratio	89.7	73.2	91.03						
DSTR	1.08	4.24	0.81						

Before the analysis

Improvement in assembly line using lean principle and VSM

- We have used the Design Standard Time Ratio (DSTR) .It is a index to show the ratio of value-added in all the operation and can be used to compare the productivity of the company at the global level.
- DSTR= Actual Working Time * Man power / Design Standard Time * Production Volume .
- DSTR factor of a given company should be as low as possible because it indicate the quality. Currenlty DSTR of company is 6.13 and 4.24 of assembly shop which is very high from the other shop .
- After applying the lean principle , VSM , Waste analysis and ECRS ,the result of DSTR is 4.06 for assembly shop .
- We have eliminated the waste time and improving the DSTR time by analysis of the assembly shop . During the anaylsis we found that the duplicated work between the operator and the in-line quality assurance officer(IQA) , who is a check man for recheck of torque wrench.
- We have eliminated this this by introducing alpha level check as shown in fig.
- By adding the alpha level check we are eliminating the recheck of the torque by IQA .

Ref: Website https://iopscience.iop.org

Useful Link :

1. Tata Motor Website https://www.tatamotors.com/
2. Tata Motors Limited Sustainability Report
3. https://rmoneyindia.com/research-blog-traders/cyrus-and-crisis-are-they-synonyms-for-tata-motors-ltd/
4. https://www.slideshare.net/SushantGupta21/401207027tata-motors-57447580?qid=0f7629ef-c261-4e45-9e0c-d08b02cf4dec&v=&b=&from_search=4
5. International Conference on Ideas, Impact and Innovation in Mechanical Engineering (ICIIIME 2017), Volume: 5 Issue: 6, ISSN: 2321-8169 ,677 –683
6. https://www.autocarpro.in/interview/eaton-india%E2%80%99s-shandar-alam-%E2%80%98we-have-to-get-ready-as-per-the-new-norms-and-regulations-coming-in-the-market%E2%80%99-41656
7. https://www.youtube.com/watch?v=D3HbxDEsosE
8. https://www.slideshare.net/niranjannahak/tata-motors-30398980
9. https://www.tatamotors.com/blog/commercial-vehicle/accelerating-cv-production-by-2020/
10. https://iopscience.iop.org

THANK YOU