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Improvement of supply chain process using Maynard Operation Sequence Technique and Manpower planning for an Electric Vehicle manufacturing unit

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Abstract - *Maynard Operation sequence is most effective tool for any enterprise to determine accurate time of the process and improve the productivity of workforce. The work was carried out in spares department of the company. The company provides the Spares parts to retail. Centers & experience centers.*

In spares stores, excess of manpower than the estimation. The workers are working in an Ergonomic risk environment and in the layout multiple movement for completion of Single process. According to the data, cost incurred for the current workforce is 11.2lakhs. It is evident that, there will be an optimization of productivity workforce by using MOST technique, REBA and Single flow technique are implemented.

Further, the project can be used as standard to reduce the workforce cost in a spare's stores. This will result in a future cost reduction of manpower and also Improvement of Productivity.

Key Words: **Electric Vehicle, Maynard Operation Sequence Technique (M.O.S.T), Rapid Entire Body Assessment (REBA), AutoCAD 2D, Goods Receiving Nodes (GRN), Yamazumi chart.**

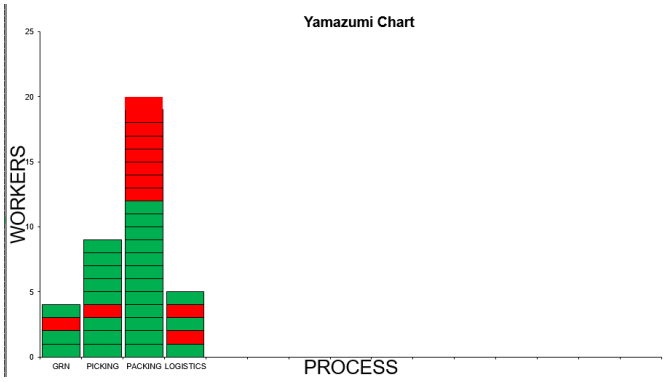
1. INTRODUCTION

The project is carried out in the spares department of the company. The observations and statistics of data collected regarding labors productivity, concluded that there is excess man power in the department. It is observed that the workers work in ergonomically risk environment in the department by analyzing the movements of workers using Rapid Entire Body Assessment technique. The process in the spares department includes Non-Value Added (NVA) activities which is to be eliminated and the further work for the improvement of the process.

2. PROBLEM STATEMENT

From one week of observation of spares stores process using yamazumi chart for each process in different timings, its identify that in each process the idle workers are in each process and workforce is not utilized effectively in spare stores.

Fig-1: Yamazumi Chart



The yamazumi chart is drawn for workers v/s process in the chart. Inference drawn is the idle workers in each process. The inefficient manpower planning was identified.

The multiple movements consume more time for the completion of the process.

Workers in the packaging department are working in ergonomic risk environment was noticed by high score of **REBA** so that leads to chances of causing Musculoskeletal diseases in future to the workers.

3. OBJECTIVES

To Improve the productivity of workforce and standardization of process activities in the spares department.

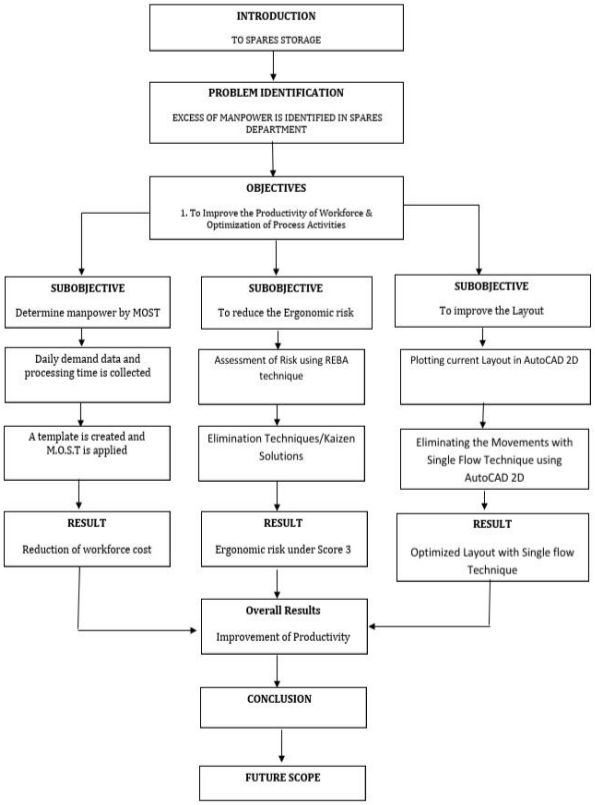
1. Manpower planning for spares stores by applying Maynard Operation sequence Technique.

2. To reduce the ergonomic risk environment using REBA.

3. Improve the layout and set single flow technique in spares stores using AutoCAD 2D.

4. METHODOLOGY

Fig 2: Methodology flow diagram



The methodology as shown in the figure 2, describes the flow of project. Methodology includes introduction to Company profile, problem identification, objectives and sub objectives and the process flow to achieve the sub-objectives thereby achieving the objective.

5. M.O.S.T PROCEDURE

The M.O.S.T procedure followed in order to obtain the accurate time results.

1. Observe the activities that is performed. As a result, you'll be able to record the video and use it as a future reference and calculation tool.
2. Use standard charts to calculate index values.
3. To get TMU, add the index values together. Add all of the index values together to get the grand total.
4. Because it's a multiplication factor, multiply the grand total TMU by 10. Convert TMU to seconds, minutes, and hours as needed.

5.1 STEPS TO APPLY THE M.O.S.T FOR THE PROCESS

Fig -3: Steps to implement M.O.S.T

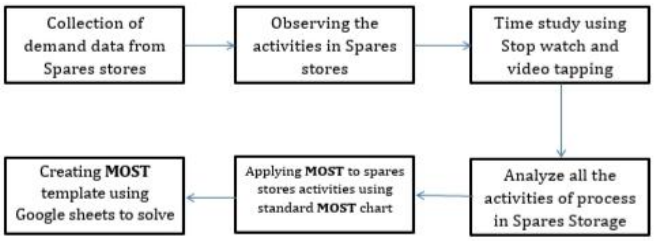
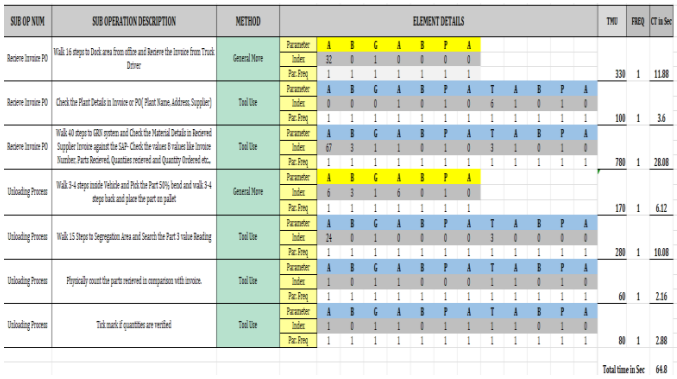


Fig – 4: M.O.S.T result table for an activity of GRN Process



SUB OP NUM	SUB OPERATION DESCRIPTION	METHOD	ELEMENT DETAILS													TMU	FREQ	CT in Sec
Receive Invoice PO	Walk 16 steps to Dock area from office and Receive the Invoice from Truck Driver	General Move	Parameter	A	B	G	A	B	P	A								
			Index	12	0	1	0	0	0	0								
			Par.Freq	1	1	1	1	1	1	1						330	1	11.88
Receive Invoice PO	Check the Plant Details in Invoice or PO(Plant Name, Address, Supplier)	Tool Use	Parameter	A	B	G	A	B	P	A	T	A	B	P	A			
			Index	0	0	0	1	0	1	0	6	1	0	1	0			
			Par.Freq	1	1	1	1	1	1	1	1	1	1	1	1	100	1	3.6
Receive Invoice PO	Walk 40 steps to GRN system and Check the Material Details in Received Supplier Invoice against the SAP- Check the values & value like Invoice Number, Parts Received, Quantities received and Quantity Ordered etc.,	Tool Use	Parameter	A	B	G	A	B	P	A	T	A	B	P	A			
			Index	67	3	1	1	0	1	0	3	1	0	1	0			
			Par.Freq	1	1	1	1	1	1	1	1	1	1	1	1	780	1	28.08
Unloading Process	Walk 3-4 steps inside Vehicle and Pick the Part 50% bend and walk 3-4 steps back and place the part on pallet	General Move	Parameter	A	B	G	A	B	P	A								
			Index	6	3	1	6	0	1	0								
			Par.Freq	1	1	1	1	1	1	1						170	1	6.12
Unloading Process	Walk 15 Steps to Segregation Area and Search the Part 3 value Bearing	Tool Use	Parameter	A	B	G	A	B	P	A	T	A	B	P	A			
			Index	24	0	1	0	0	0	0	3	0	0	0	0			
			Par.Freq	1	1	1	1	1	1	1	1	1	1	1	1	280	1	10.08
Unloading Process	Physically count the parts recieved in comparison with invoice.	Tool Use	Parameter	A	B	G	A	B	P	A	T	A	B	P	A			
			Index	1	0	1	1	0	0	0	1	1	0	1	0			
			Par.Freq	1	1	1	1	1	1	1	1	1	1	1	1	60	1	2.16
Unloading Process	Tick mark if quantities are verified	Tool Use	Parameter	A	B	G	A	B	P	A	T	A	B	P	A			
			Index	1	0	1	1	0	1	1	1	1	0	1	0			
			Par.Freq	1	1	1	1	1	1	1	1	1	1	1	1	80	1	2.88
																Total time in Sec		64.8

Inference after MOST calculation

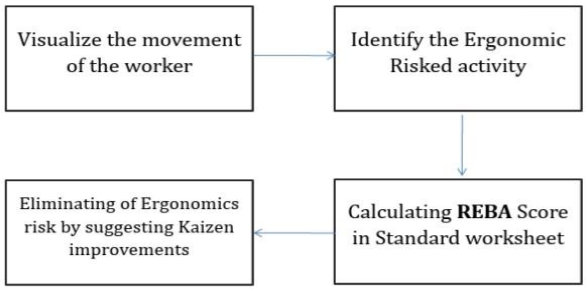
The activity time is reduced from 800 mins to 458.08 mins. The required man power for the process is 29 from calculations (by considering the uncertain demand additional 10 workers is allocated). The total of **39** workforce is required for spares department by calculation using MOST.

6. REBA PROCEDURE

1.Identify a job.
2. Define and understand the tasks within the job.
3. Identify the tasks within the job you intuitively believe have the highest Musculoskeletal Disorders risk.
4. Capture the “worst” moment with a photo.
5. Complete the REBA data collection form.

6.1 STEPS TO APPLY REBA

Fig-5: Steps to implement REBA



6.2 ASSESSMENT OF RISKS USING REBA AND SUGGESTIONS

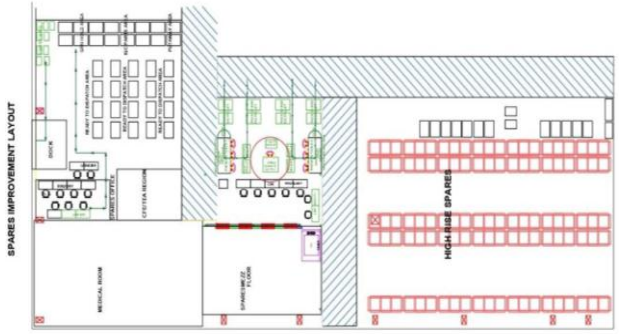
SUGGESTION 1: Necessary work table is provided with suitable and adjusted features to reduce the posture of bending while working.

SUGGESTION 2: The usage of tapes and picking trolley for packing the spare parts as it is easy to pack the parts and reduces the non-value-added activities and associated risks.

7. STEPS FOR ELIMINATING NONVALUE-ADDED ACTIVITIES BY APPLYING SINGLE FLOW TECHNIQUE

1. From the observation identified, multiple movements for completing a single process.
2. Video is captured for future reference.
3. Analyzing the current movement of the process using value stream mapping.
4. Implementing single flow technique in spares stores to remove the non-value-added activities and to optimize the process.
5. By minimal changes in the layout, adopted single flow techniques to avoid NVA and proposed the layout using AutoCAD 2D.
6. Continuous improvement/s is required in layout for better enhancement in future.

Fig-5: Optimized spares layout



In improved layout elimination of the non-value-added activities and effectively use of given space in spare store using single flow technique.

8. RESULTS

- The process time of the spares stores was reduced from 800 mins to 458.08 mins. The required workforce is 39(consider allowance manpower) for the Process. The remaining workforce is utilized for the production department of the company.
- After optimization of current layout, the multiple movements are reduced and utilization of space was done effectively. Non-Value-added Activities are eliminated and improved layout efficiency.
- Risk associated activities are eliminated and low risk of attaining Musculo Skeletal Disorders. The activities are under score 3 shows low risk of MSD.

9. CONCLUSIONS

To survive in this competitive industrial environment, it is self-evident that a company must reduce or eliminate idle and down time, improve working methods, standardize time for activity, and improve overall capacity planning. The assessment of the worker is necessary. The M.O.S.T can play a vital role in this regard. The findings show that by changing techniques and processes, competitive advantages in terms of meeting consumer demand, balancing the process flow, and ensuring economic benefits can be gained. As a result, using the M.O.S.T to predict standard durations for various fundamental tasks included in various operational activities could significantly boost an industry's productivity compared to its current level. The REBA method is mainly used for the analysis of forced postures. It is not useful for the evaluation of repetitive movements.

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