IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Continuous Improvement study at two-wheeler industry

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ABSTRACT

A study analysis conducted at the industrial setting reveals several areas for improvement. It identifies production losses and ergonomic risks units as key challenges. These problems affect operational efficiency, leading to line losses and hindering productivity. The study identifies the negative impact on a worker's health and safety and Recommended Weight Limit. The repetitive lifting movements has been identified as the main cause.

To address these issues, measures such as minimizing damages and scratches during the manufacturing process through improved training and expertise have been suggested. Remapping the production assembly line has also been suggested with the revised conditions followed as per the company protocol and requirements. ISO questionnaire conducted among workers reveals concerns such as back pain from repetitive lifting movements. To address these issues, a new accessory design is proposed, leveraging CAD designing software. This redesigned cart aims to provide ergonomic solutions by reducing stress on the worker's body during material handling tasks.

Implementing the new cart design is expected to enhance worker safety, reduce injuries, and improve productivity by minimizing physical strain and fatigue. By implementing these recommendations, the aim is to reduce the time required to address production delay problems, thus improving overall operational efficiency. The newly designed accessory will help reduce the Lifting Index and thereby ensuring a higher safety and health for workers. The takt time reduction also takes place due to redesigned process line.

KEYWORDS: 1) HMSI-Honda Motorcycle and scooter pvt. Ltd.
2) MS-Material Service
3) PPC- Production planning and control
4) Logistics
5) Optimization

1.0 Introduction

1.1 General

This introduction provides an overview of the continuous improvement study analysis conducted on various industrial challenges. The studies are focused on Honda Motorcycle and Scooter India's Narsapura facility, which include line loss problems in the industry and material handling issues. The analysis performed aims to identify problems, propose recommendations, and implement measures to enhance operational efficiency, worker safety, and cost-effectiveness. The studies began with an exploration of Honda Motorcycle and Scooter India's Narsapura plant, a crucial manufacturing facility for Honda motorcycles and scooters in India. The plant adheres to global manufacturing standards and emphasizes efficiency, quality control, and continuous improvement initiatives. The plant has three functional divisions namely the Material Store, Production Planning and Control, Logsitics. Under these three divisions there are subdivisions for each. For the Material Store division there are sub-divisions namely Tapukara plant control subdivision, Storage subdivision, Empt Bins Trolley subdivision, Part Quality Control subdivision and Material Dispatch subdivision. The material store division is at one end of the plant where the material gate is situated at.

For Producstion Planning and Control Divison there are sub-divisions namely Pre-Sub-Assemblies, Sub-Assembly, Assembly Engine, Assembly Frame, Quality Control, Paint Store and Machining Shop.

For logistics the sub-divisions are namely Storage and Retrieval, Dispatch and Planning, Forecasting and Dealership care. The logistics is at one end of the plant, near the dispatch gate.

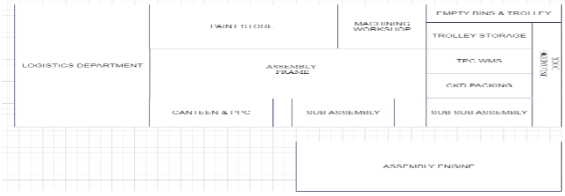

Fig 1.1 Plant Layout Existing Structure

1.2 Existing Process at HMSI

The current process at HMSI begins with the intake of materials at the material gate, where trucks are managed for efficient flow. Upon arrival, the materials are unloaded and segregated at the gate before entering the system. Based on the type of materials, they are further categorized into New Daily Line (NDL) and Direct Line (DL). DL parts are sent for storage after undergoing quality checks, while NDL parts are batch tested and then stored. TMPS (Tire Pressure Monitoring System) parts are directed to the warehouse management system, and consumables are stored in the vertical carousel.
In the next stage, all the necessary raw parts required for vehicle assembly are stored. These parts are classified into NDL and DL types. DL parts undergo quality checks in the Production Quality (PQ) department to identify any defects, while NDL parts are directly sent to storage. The process continues with the Sub Sub Assembly stage, where components such as brake wires are assembled and loaded onto a chain conveyor called the marshal. The marshal carries the assembled parts towards the Assembly-Final (AF) section, where all the parts are assembled to form the vehicle. The assembled vehicle then undergoes a series of quality checks in the Assembly Quality (AQ) department. Once the quality checks are completed, the finished vehicle is handed over to the logistics department, where it is organized based on model, color, and manufacturing month. Finally, the vehicles are transported to dealers based on their specific requests and distribution needs.

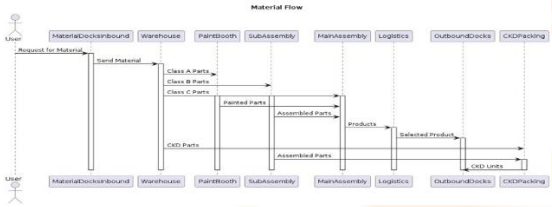

Fig- 1.2: Material Flow depiction in HMSI

1.3 Problem Statement

1. Huge difference between Target production and Actual Production causing a loss of total capacity of the production plant and limiting the total production per day. The losses are caused by various reasons at multiple places.

2. The negative impact of manual material handling on worker health and safety, specifically regarding back pain due to repetitive lifting movements. The objective is to find a solution that reduces the Lifting index for workers while maintaining productivity.

1.4 Objectives

•Find causes of Line loss in production line
•Reduce takt time vs cycle time difference
•Calculate Recommeded Weight Limit for Material Handling of Class C parts
•Reduce Lifting Index for MMH of Class C parts

2.0 Methodology

2.1 Methodology to mitigate production loss

The detailed methodology production line loss problem is explained in the following steps.

- Interacting with production planning and control department at HMSI, including section managers at each work station to gain an understanding of the current production process and enlisting the problems mentioned by the PPC department.
- Observing the production process and flow of materials in the production line and discussing it with the section managers to get insights of value added and non value added process.
- Once all the information was collected, a detailed blueprint of the current production process was established. This current state of production process could then be used as a basis to suggest a better process.
- A value stream map was created based on the current production process. This was done to understand the value of each process involved in the production process; to identify bottlenecks that were either inefficient in the process or taking too long and thus increasing the duration of the production process.
- Research paper study was then carried over the course of multiple days to list all possible solutions to the problems poised from the earlier interactions.
- Based on the objectives, a list of possible solutions are selected to be suggested.
- All the data required for this project is collected from PPC department and the MS department.
- After receiving the data, it is segregated in order to understand the line losses. Data mining is carried out in order to gain insights from the data which could help understand the production takt time, and decode the factors behind a production loss.
- Data analytics is carried out with the help of 3rd party software such as microsoft excel solver. The insights gained were immensely helpful in constructing charts and improving production process.
- One of the final steps involves creating a value stream map for the improved production process in order to demonstrate the efficiency improvement achieved by removing a non-value-added process which is Sub Assembly, giving us extra two seconds for each vehicle.

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2.2 Methodology to mitigate Ergonomic Issues

The movements of a material handling employee during an 8-hour day shift are observed and recorded. They are then categorized, and the ISO Quick Assessment is applied. Based on the results, the appropriate ISO standard is

implemented, and a risk assessment study is conducted. Using the NIOSH equation, the Recommended Weight Limit and Lifting Index are calculated. Mind Mapping is utilized to brainstorm ideas and develop a design. The design is prototyped, and a study is conducted to record new movements. The Recommended Weight Limit and Lifting Index are then calculated for these new movements.

2.3 Identifying Actions and Movements

In order to identify the different movements and categorise them, we observe the movements which are repitetive in the course of performing one action (.ie Loading / Unloading) and record the distance using a fixed scale. For horizontal movement hypotenuse of the 2 axis movements is taken and calculated as one.

The actions are mainly categorized into 4,

1. Loading material onto push cart from storage: The material is transferred from the storage onto the push cart. This is a very complex action and is composed of multiple steps and movements. This also includes stacking of materials on top of each other. Thereby increasing the vertical distance moved.

2. Loading and Unloading at AF Point 1 : The top stacking is done in such a way that the material that has to be loaded off first, is near the top. This makes it easier for the worker to grab material at a more comfortable height without complex movements.

3. Loading and Unloading at AF Point 2 : Once the materials are unloaded at the first site, the remaining material along with other materials below are unloaded onto the floor and unpackaged before being palced at site. Then the materials are loaded again.

4. Loading and Unloading at AF Point 3 : The last delivery site is where all material gets placed on the floor and unpackaged material is picked each by hand and delivered at site.

3.0 Results and Discussion

3.1. Production loss:

After identifying the production loss issues, probable solutions have been proposed to HMSI .One notable improvement highlighted in the value stream map is the removal of the sub-assembly and merging it with the AF process, resulting in a reduction of total time by 66.6 minutes. This change signifies a significant improvement in efficiency and productivity. By streamlining processes and eliminating unnecessary steps, HMSI can enhance the overall assembly line performance and reduce production losses. The value stream map provides a visual representation of these improvements and serves as a roadmap for implementing the suggested changes.

3.2. Ergonomics Results

The new accessory placed at a height of 70cm from the floor will reduce the Vertical Distance, the Total Average Distance Movement has been reduced by 42.5cm and Vertical movement is from a much higher height. This leads to a increase in the Vertical Multiplier Factor and Distance Multiplier Factor in the RWL equation. The resultant decrease in LI is from 0.93 to 0.73, that is a flat 0.20 decrease. This reduces the risk from moderate to less. Thus, ensuring a healthier and a safer work environment for the workers in the industry.

4.0 Conclusion and Future Scope

4.1 Conclusion of Current Project Work

In The study successfully achieved its objectives in improving the production process and material handling at the facility. By thoroughly understanding the production process flow and conceptualizing a redesign, the takt time was significantly reduced, resulting in increased efficiency. The value stream mapping exercise provided valuable insights into the current state and proposed method, enabling better decision-making for process improvement. The study also ensured compliance with ISO guidelines for material handling, enhancing safety and operational effectiveness. Additionally, the redesigned manual push cart successfully addressed difficulties faced by workers, enabling easy and safe movement of parts. Overall, these improvements have positively impacted productivity, worker satisfaction, and overall operational efficiency.The Lifting index has been reduced for Material handling from **0.93 to 0.73.**

4.2 Future Scope

By implementing the suggested changes and solutions, HMSI can pave the way for future improvements and advancements in their assembly line processes. Here are 10 points outlining the future scope:
By embracing these future scope points, HMSI can drive ongoing improvements, stay ahead of the competition, and ensure the long-term success of their assembly line operations. In conclusion, the study successfully achieved its objectives in improving the production process and material handling at the facility. By thoroughly understanding the production process flow and conceptualizing a redesign, the takt time was significantly reduced, resulting in increased efficiency. The value stream mapping exercise provided valuable insights into the current state and proposed method, enabling better decision-making for process improvement. The study also ensured compliance with ISO guidelines for material handling, enhancing safety and operational effectiveness. Additionally, the redesigned manual push cart successfully addressed difficulties faced by workers, enabling easy and safe movement of parts. Overall, these improvements have positively impacted productivity, worker satisfaction, and overall operational efficiency.

References

[1] Priya, S. & Vijayarangan, Jayakumar & Kumar, S.. (2019). Defect analysis and lean six sigma implementation experience in an automotive assembly line. Materials Today: Proceedings. 22. 10.1016/j.matpr.2019.11.139.

[2] Muhammad Ragil Suryoputro* , Khaerul Wildani, and Amarria Dila Sari Universitas Islam Indonesia, Jl. Kaliurang KM 14.5, Yogyakarta, Indonesia. Analysis of manual material handling activity to increase work productivity (Case study: manufacturing company)

[3] Dhake, Rajesh. (2013). Productivity Improvement on 2 Wheeler Cluster Assembly Line.

[4] Radin umar, radin zaid & Ahmad, Nadiah & Halim, Isa & Lee, Poh & Hamid, Malek. (2019). Design and Development of an Ergonomic Trolley-Lifter for Sheet Metal Handling Task: A Preliminary Study. Safety and Health at Work. 10. 10.1016/j.shaw.2019.06.006.

[5] Wollesen, Bettina & Argubi-Wollesen, Andreas & Leitner, Martin & Schulz, Sören & Keuchel, Martin & Mühlemeyer, Christoph & Klußmann, Andre & Mattes, Klaus. (2017). Development and Testing of an Ergonomic Handle and Wheel Design for Industrial Transport Carts. www.imedpub.com. 1. 9

[6] National Institute for Occupational Safety and Health (NIOSH) Centers for Disease Control and Prevention. It

was distributed under the provisions of the Library Distribution Act and Government Code Section 11096. Published 2007 by the California Department of Industrial Relations.
[7]. A. Biswas, S. Mondal, and S. Mukherjee, "Ergonomics study of two-wheeler assembly line workers: A case study," 2016 IEEE Calcutta Conference (CALCON), Kolkata, India, 2016, pp. 17-34.

[8]. K. A. Karim and S. A. Nasir, "Evaluation of ergonomic factors in 2-wheeler assembly line using Rapid Upper Limb Assessment (RULA)," 2018 IEEE International Conference on Innovative Research in Engineering and Technology (ICIRET), Coimbatore, India, 2018, pp. 10-16.

[9]. B. Dhanapal and R. Balasubramanian, "Ergonomic study and redesign of a 2-wheeler assembly line using simulation," 2017 IEEE International Conference on Engineering and Technology (ICETECH), Coimbatore, India, 2017, pp. 42-47.

[10]. A. Aditya and P. S. Satsangi, "Evaluation of material handling practices in a 2-wheeler manufacturing plant: A case study," 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI), Udupi, India, 2017, pp. 1460-1466.

[11]. Q. M. Esteban, J. M. Villareal, K. Yoo, E. S. Magon, and M. J. J. Gumasing, "An Ergonomic Design of Six-Wheeled Trolley for Transportation of a 100-kg Weight Load," in Proceedings of the 5th NA International Conference on Industrial