

# Productivity Improvement Using Kaizen -Muda Elimination

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**ABSTRACT:** Aim of every manufacturing institute to reduce lead time and improve productivity. This paper introduces the use of Muda elimination technique in bulk material handling, based on lean management and standardized processes. Significant portion of work content and cycle time got spend in non-value adding activities. So this paper showing, how muda elimination is useful to reduce or eliminate these types of unwanted activities to make coal unloading at CHP easier and lean.

**KEYWORDS:** Muda Elimination, Productivity, Lean management, Bulk Material Handling, CHP.

## I. INTRODUCTION

Lead time reduction and Productivity improvement can be a tough task because many factors that affects and those factors also have complex and close relationship. [1] But anyhow each and every company wants to improve its productivity for betterment of market value and to gain more and more profit. And this can be done by two ways : 1<sup>st</sup> to get more output by providing the same input to the system, and 2<sup>nd</sup> proving less input to get same output. These are the methods to improve productivity of any industry. So for high productivity we need to remember some points like lead time should be minimum and operations or process should have minimum number of waste activities or non-value adding activities so that the resources employed (like man, machine etc.) in the process can be used most efficiently. Waste in any production process of any type like overproduction type , processing type , time waste , inventory type or any other type of waste. These wastes are called as muda. And these muda can be effectively controlled by a lean management technique called “MUDA Elimination”. Lean Management is currently the most acceptable and dominating management philosophies, both in industrial and service Sectors. The main and appropriate reason for such a success is its simplicity. Its whole concept is laid on a common sense idea of so called waste (Muda). “Muda” is one of technique of lean management. Which is used to identify the waste, eliminate waste, optimize delivery time and reduce the cost of operation or process.

It's very simple technique to identify Non-value adding activity and reduce or eliminate them without affecting other activities of any production operation.

Example: - Electronic Blood Pressure Measuring Machine.

Some years before the blood pressure of the human body is measured by using a set of equipment having mercury scale, a pumping device, a stethoscope and want an extra skilled person to measure blood pressure of a patient. This process was very time consuming and if the patient is critical than this time consumption of the machine can consumes a life, So, by the use of muda elimination we can found out the best solution of this time wasting machine as by replacing it by a newly developed electronic blood pressure measuring device. And by employing those in place of all old machines we can save time as well as lives also.

In the given figures, fig 01, represents the old blood pressure measuring device in which a skilled man measuring blood pressure of a patient by using number of devices simultaneously.



Figure .01 BeforeMuda Elimination

In the second figure, fig 02, a simple device is there by which patient herself is measuring blood pressure by just a single machine by one press only.



Figure.02 AfterMuda Elimination

So, the example shows it clearly muda elimination method makes the process simple and easy to perform by introducing new invented technologies or devices and by eliminating various types of wastes.

### History of MUDA Elimination

Production process or any type of operation is necessarily causes some wastes to occur.Muda means “Waste”. Muda elimination implies an “on going” and systematic reduction or elimination of waste.[2]  
The use of such waste removal to drive competitive advantage inside organizations was pioneered by Toyota’s chief engineer, TaiichiOhno, and *sensei* Shigeo Shingo [3,4] and is oriented fundamentally to productivity rather than to quality. The reason for this is that improved productivity leads to leaner operations which help to expose further waste and quality problems in the system. Thus the systematic attack on waste is also a systematic assault on the factors underlying poor quality and fundamental management problems [5].

In an internal manufacturing context, there are three types of operation that are undertaken according to Monden[6].

- These can be categorized into:
- (1) non-value adding (NVA);
  - (2) necessary but non-value adding (NNVA); and
  - (3) value-adding (VA).



Non value-adding operations are those which are unnecessary for end-customers. These contribute to waste, incur hidden costs, and should be eliminated.

Non value-adding, but necessary may be wasteful but are necessary under the current operating procedures. These are usually harder to eliminate because while classified as non-value adding, they may still be necessary.

Value-adding operations involve the conversion or processing of raw materials or semi-finished products or finished products through the use of manual labour. This would involve activities such as: sub-assembly of parts, forging raw materials and painting body work.

There are seven commonly accepted wastes in the Toyota production system(TPS):

- (1) overproduction;
- (2) waiting;
- (3) transport;
- (4) inappropriate processing;
- (5) unnecessary inventory;
- (6) unnecessary motion;
- (7) defects.

In systems such as the Toyota production system, it is the continuous and iterative analysis of system improvement using the seven wastes that results in a *kaizen*-style system. As such, the majority of improvements are of a small but incremental kind, as opposed to a radical or breakthrough type.[7]

**About the company:** Sterlite Energy limited (SEL) is a part of vedanta resources Plc,a London listed FTSE 100 diversified metal and mining major with Aluminum,copper, zinc and Iron ore operations in India, Australia, Zambia and a subsidiary of Vedanta group flagship company,Sterlite Industries (India) Limited.

Sterlite Energy Limited was established to develop, construct and operate power plant also. For this SEL has set up a 4×600 MW coal based thermal power plant at JharsugudaOdisha.

**Overall process and components of Thermal Power Plan:**

Process of this plant starts with coal. Coal from mines is transported to power station by means of railway wagons. This coal of non-uniform size is crushed to fine particles so that air is able to transport it. This coal then come to furnace and fired inside it. Temperature inside the furnace reached to approx. 1300°C. The boiler is water tube boiler so the flue gasses transfer heat to water inside the tubes at different locations to different instruments. In this process the water starts converting to steam and also gain high temperature and pressure. This steam passed through high, medium and low pressure turbines subsequently. This mechanical energy of turbines is converted to electrical energy and supplied to the consumers.

In this way, the chemical energy of coal is converted to mechanical and then electrical energy supplied for further use.

Below is the list of equipment used in a thermal power plant.

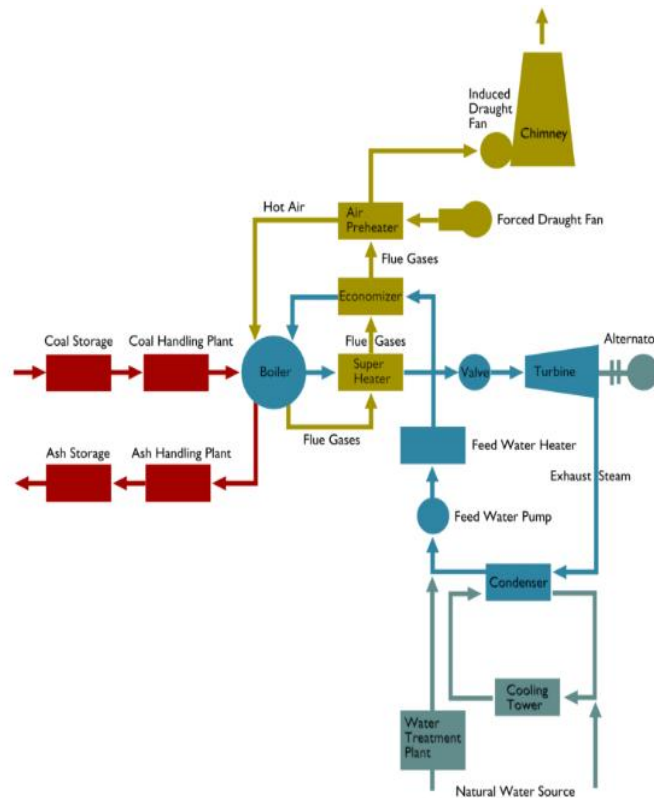
|   |
|---|
| Coal Preparation (Dryers, Magnetic separators, conveyer devices etc.) |
| Air Preheater   |
| Economizer  |
| Reheater  |
| Steam turbines  |

|                           |
|---------------------------|
| Condenser                 |
| Feed Pumps                |
| Cooling Tower             |
| Draught System Or Fans    |
| Ash Handling Plants       |
| Generator                 |
| Cooling Tower             |
| Other Auxiliaries Devices |

**Coal Handling Plant (CHP)**

Our Study only concerns with coal handling in thermal power plant so that it is necessary to discuss coal handling in detailed view. Coal received from mines prepared to burn in CHP and then after burning in furnace flue gasses pass through water tubes in a sequence of evaporator, final super heater, platen super heater, low temperature super heater, Reheater, Economizer, Air preheater, draught system and to atmosphere from chimney. In this way the flue gas cycle perform its work and heat the water at different stages in a power plant and remaining burned coal send to ash handling plant for treatment.

This diagram shows different cycles in a thermal power plant.



CHP has number of task to perform. These tasks are as follows:

1. Dealing with Coal vendors
2. Maintain Proper arrangement of coal transport and maintain its continuity.
3. Unloading of coal from transport vehicles.
4. Collect and store coal at perfect storage space.
5. Convey this coal to crusher continuously in enough amounts.
6. Pulverization of coal.
7. Sending of pulverized coal to the furnace by the use of primary air through nozzles.

## II. LITERATURE REVIEW

A study is conducted in Larsen and Toubro company that produces switch gear panels in 2020. This study carried out at maintenance department. Researcher implemented Muda concept on the hand pallet trucks which comes to maintenance at maintenance department. These trucks are used to movement of the material inside L&T plant. After maintenance a problem arises every time that which pallet belongs to which department of the company. Due to this lot of time is waste in identifying the perfect department of a HPT. In his study after implementing MUDA concept researcher identified the time waste muda in this maintenance department. After the analysis of this waste they suggest that color coding of each HTP as per different departments having pallets inside L&T plant. The different department have different color to identify their hand pallet truck due to this time is saved and work is done efficiently. By following this L&T Company has made the project on color coding of hand pallet truck in order for easy handling, care and rules have been implemented. As the L&T company is multinational there is lot of work more than 50 pallet are been use. As various department use the pallet for different purpose. [8]

HardeepChahal and FayzaChowdary said in their study, the hospitals can improve its level of sustainability-economical, social and ecological by the use of mixed method approach for muda/waste identification, measurement and suggestions for controlling muda/waste in the hospital. They performed their study on a hospital “Achyara Sri Chander College of Medical Sciences (ASCOMS)” this is a private hospital, opened in the year 1994 in Jammu city. They used this quantitative approach for measuring the patients’ perception towards kaizen muda/waste and organisational sustainability while qualitative approach used for gathering patients view points for controlling these wastes. The results revealed five types of mudas/waste namely, overproduction waste, defects, transportation waste, waiting time waste and motion waste present in the hospital environment. After discussion with patient they suggest some solutions to the hospital to minimize these wastes. Like this they attempt to identify, measure and analyse the organisational waste and sustainability concepts in a hospital using qualitative approach. By this they also provide a platform for further research to be conducted at a larger, both cross sectional and longitudinal studies for the development and validation of the muda/waste identification and organisational sustainability scale for healthcare sector.[9]

## III. PROBLEM

The main aim of Each and Every organization to work continuously to find and remove the unwanted or non-value adding activity from their working process to complete the process or operation on time. This reduces waste and also increases productivity of the organization. Like this

I found an operation performed by CHP in above text company that is, Unloading of coal from transport vehicles which is responsible for loss of some revenue by using railway track more time to unload coal from rail wagon rack and also in terms of unused labor. In its unloading process company uses wagon tippler technique to unload the rack. In which each wagon box of the rack unclamped from the rack and fitted to the tippler to tilt it at the required angle. After the box get tilt at the required preset angle the coal inside the box dumped to the mesh and if some coal remains inside the box (due to wetness) is being unloaded by labor. When all the coal from the box gets empty to the grid, labor broke that to perfect size to pass coal from the square mesh of 250mm\*250mm to the underground inventory and conveyor area. Parallely box of the rack moved to the previous situation and fitted to the rail rack again, like this the rack moved forward and the next box come to unload. Same process continues till the whole rack to get unload. In this process each time the every wagon unclamped from the rack and again fitted to the rack and rack unloading depends on quality

of coal also because some parts of it is pulled and break by labors. So it take more time to unload the whole rack that's why it costs to company to use of railway rack more than of given time. On the other hand when the movement of the box of coal from unclamping from rack and after unloading to the re-clamping to the rack, labor is free from work



and company is not able to use this man power in this period. So we have the problem to how to minimize this unloading time and use labor perfectly so that loss of revenue can be optimize.



Figure .03 Wagon Tippler

#### IV. RESEARCH METHODOLOGY

The methodology used for this study is based on lean management approach. After analyzing the problem we got the point and can say that, The reason for delay in unloading process can be wastes or non-value adding activities. So we try to adopt muda elimination technique to identify different muda in this process. And by this we identified various muda like motion muda, waiting muda, time muda and transport muda mainly affecting this process and make it more time taking as compared to the other available techniques available to unload bulk material in current world. That's why we are suggesting to use track hopper technique in place of wagon tippler to eliminate these muda. The benefit of using track hopper in place of wagon tippler can be that, the non-value adding activities would get eliminate and the time taken by CHP to unload a rack of coal can be reduced significantly. With the use of it the workers will enjoy the work by perform the same thing in less time. As the other issue of proper use of labor can also be improved so the productivity of coal handling plant can be increased, Which will also increase the overall productivity of the power plant.

In case the process plants are located nearer to the mines or to the port and dedicated rail tracks are available between the plant and mine / port, it would be certainly preferable to adopt the track hopper system with dedicated wagons and loco.[10]



Figure .04 Track Hopper opening



Figure .05 Square mash

## V. CONCLUSION

On the basis of our study we can say that, the muda elimination technique is best to improve the productivity as well as to decrease the wastage. The implementation of the technique is simple and the effect of it on productivity is really attractive. We see that, the wastage percentage got reduced significantly by the use of this concept. By our case study, we can say that if the company is taking 100% to unload a rack of coal before applying this technique, so after implementing of it the time can be reduced to 50-60%. So with the help of muda elimination we can improve our working ability manifold and company's sustainability in the market as well.

## REFERENCES

- [1] IngaleMahesh.Vishwanath, Sunil J Kadam ,PanditShamuvel.Vinod , Mulla M.L “Improvement of Productivity by New Approach-Lean Enterprise by MOST Way” , International Journal of Innovative Research in Science, Engineering and Technology, Vol. 3, Issue 6, June 2014.
- [2] Chapter 3 – “PRODUCTIVITY IMPROVEMENT TECHNIQUES AND IT’S RELATIONSHIP WITH WORK STUDY” {[https://shodhganga.inflibnet.ac.in/bitstream/10603/13108/8/08\\_chapter%203.pdf](https://shodhganga.inflibnet.ac.in/bitstream/10603/13108/8/08_chapter%203.pdf)}
- [3] Japan Management Association, *Kanban: Just-in-Time at Toyota*, Productivity Press,Cambridge, MA, 1985.

- [4] Shingo, S., A Study of the Toyota Production System from an Industrial Engineering,Viewpoint, Productivity Press, Cambridge, MA, 1989.
- [5] Bicheno, J., 34 for Quality, PICSIE Books, Buckingham, 1991.
- [6] Monden, Y., *Toyota Production System: An Integrated Approach to Just-in-Time*, 2nd ed.Industrial Engineering and Management Press, Norcross, GA, 1993.
- [7] Peter Hines and Nick Rich,*Lean Enterprise Research Centre, Cardiff Business School, Cardiff, UK*, “The seven value stream mapping tools” WATERFORD INSTITUTE OF TECHNOLOGY, 25 February 2016 (PT)
- [8] SagarSasane ,Sr. Engineer, Larsen & Toubro ltd, Ahmednagar , DilipAdhav, Deputy General Manager, Larsen & Toubro ltd, Ahmednagar, “ To Eliminate the Muda in HPT in Panel Manufacturing” International Journal of Engineering Research & Technology , ISSN: 2278-0181 , Vol. 9 Issue 02, February-2020 .
- [9] HardeepChahal and FayzaChowdary, PG Department of Commerce,University of Jammu, India “An exploratory study on kaizen muda and organisational sustainability: patients’ perspective”
- [10] H RAMAKRISHNA, Tata Consulting Engineers Limited Bangalore, India, “WAGON LOADING AND UNLOADING SYSTEM”.
- [11] Ramkumar P N , Dr.Satish K P , Government Engineering College, Thrissur, Kerala, 680009, India , “Ranking of the seven wastes (Muda) for Lean Six Sigma Implementation in Indian SMEs” International Journal of Applied Engineering Research ISSN 0973-4562 Volume 14, Number 6 (2019) pp. 1269-1274.
- [12] The Kumaramanglam Committee, GOVERNMENT OF INDIA MINISTRY OF RAILWAYS, Particular specification No. G-73 (Rev. – 1 of Oct., 2005 ), “INSTRUCTIONS FOR OPERATION AND MAINTENANCE OF BOGIE OPEN BOTTOM RAPID DISCHARGE HOPPER WAGON - TYPE ‘BOBR’/ ‘BOBRN’”ISSUED BY : RESEARCH DESIGNS & STANDARDS ORGANIZATION LUCNOW – 226 011.