International Journal of Psychosocial Rehabilitation, Vol. 24, Issue 7, 2020
ISSN: 1475-7192

Waste Analysis of Isolating Cook Production Processes Through Manufacturing and Ergonomic Lean Approaches (Case Study Pt Pindad (Persero) Bandung

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Abstract: *The company has a standard time in the production process, so delays are something that must be avoided. PT Pindad (Persero) is a manufacturing industry company that produces military and non-military products in Indonesia. The Isolating Cook product is a part of the Railway Air Brake System which is produced by PT Pindad (Persero) in the railway facilities department of the forging and railway division. The Isolating Cook production process has a one minutes delay for one product, so a waste analysis is needed to eliminate unnecessary activities so that the production process becomes smoother. This research uses ergo waste analysis method which is then approached through the REBA method as a recommendation for a better work posture. The results obtained from the initial research using the REBA method obtained a score of 4 to 6 which means it has a medium risk value and after the improvement is done, a score of 3 indicates a low risk in work posture. Based on the results of the study using the waste analysis method, the dominant waste is in the form of waste of motion. The results of improving work posture using the REBA method show the results of scores that are in the range of low risk, so that production operators avoid work risks that can hinder the production process. The application of work posture recommendations, 5S and proposed improvements that have been recommended in the Isolating Cook production process in the form of eliminating movements deemed as waste and also recommendations to regulate the placement of work tools so that they are easily accessible to workers as a cause of the emergence of wasteful movements, so that the production process it becomes faster or the actual time after repairing becomes balanced with the estimated time given.*

Keywords: *Ergo Waste, REBA, Production Time, Waste of Motion.*

I. INTRODUCTION

One branch of science that combines the application of the principles of Lean Thinking approach called Lean Ergonomics Ergonomics. Lean Thinking has a goal to increase revenues by reducing costs and increasing productivity. Ergonomics approach also has the same goal, namely Lean Thinking is to increase productivity. Because the common purpose of the two concepts is then created by the merger of the two methods are known as Lean Ergonomics.

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Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

One way of structuring and arranging your work area to create a comfortable workplace by implementing 5S working attitude is: Seiri (quick), Seiton (neat), Seiso (rehearsal), Seiketsu (hospitalization), and Shitsuke (diligent). 5S concept is very influential on the manufacturing industry and if executed properly then the work will go smoothly.

5S work attitude much like Lean Ergonomics, which is to increase labor productivity. Lean Ergonomics is a method that serves to minimize or even eliminate the movements yabg important not based on the science of ergonomics. 5S job attitudes useful for improving employee discipline and create a comfortable workplace. Comfortable workplace is very influential in the labor movement of employees, and therefore the working attitude 5S can support the use of methods of Lean Ergonomics.

PT. Pindad (Persero) is a manufacturing company engaged in the manufacture of military products and other commercial products or non-military products in Indonesia. Products produced by PT Pindad (Persero) has been marketed internationally and for export and became a military weaponry to complete the national defense and security. Not only in the field of defense and security, on business Industrial products such as air brake system already has certification from knor Brems and has become a manufacturer for PT KAI and PT INKA.

Isolating Cook is one component of the Air Brake System, the Isolating Cook production there is a problem at the time of production. Based on observations obtained through interviews of which there is a difference between the total time given by engineering with real time work time work observation and interviews. The time difference has a delay of time specified by engineering.

Such conditions may cause delays in production which result in a late charge to the consumer. Forging the necessary research on Casting and Tools division Railways Railway Facility particular department that produces Isolating Cook for Waste Ergonomic analysis-based map production work Isolating Cook. Which is expected to memempercepat production time and improve the performance of the operators.

II. REVIEW OF LITERATURE

A. Lean Ergonomics

Lean a systematic methodology and be able to identify a problem and be able to eliminate all kinds of problems one example, namely waste an activity of non-value added (non-value-added) in an industrial process. Methods of lean discuss eight types of waste are defects, over production, waiting, not utilizing the talent, transportation, inventory, motion, Exces processing or what we often hear the word DOWNTIME. Each waste which appears to have an impact on all processes or services or industrial work areas. Activities and system processes that are not in accordance with the principles of lean methods ergonomics. Activities of non-value add can be removed to reduce waste using Lean methods ergonomic. Activities and system processes that are not in accordance with the principles of Lean methods ergonomic. Of the 8 existing waste, listed as a waste of ergonomic namely transportation and motion. Ergonomics tested may shrink fatigue as well as an indication of injury. Ergonomics plays an important role for the purpose mengapai lean thinking through the reduction of costs and increase productivity, using some kind of motion by cutting waste that are not needed (unnecesary motions) and turn prevents the formation of a mistake by raising quality.

B. Waste

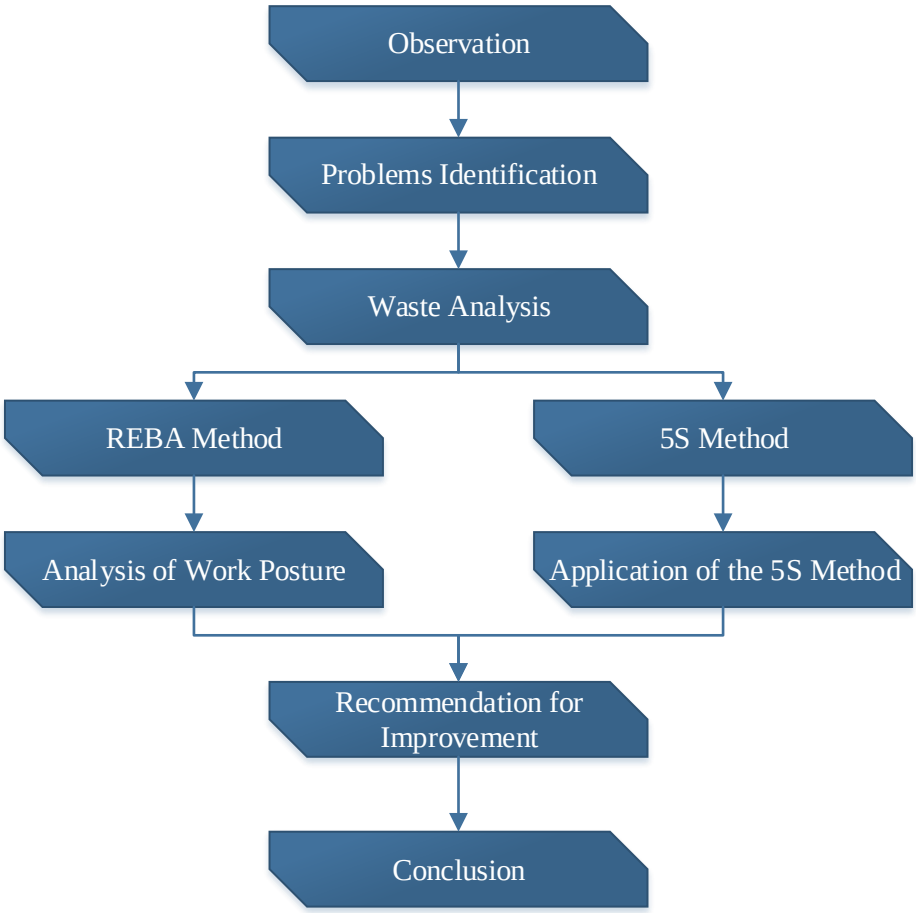
In general waste is classified into seven types: Overproduction, Delays (Waiting time), Transportation, Process, Inventories, Motions, and Defective Products. According to this waste Seventh known as The Seven Waste. But along with the times in general waste is categorized into eight types. The eighth type of waste known as The Seven Plus One Waste. (Capstick, 2010).

C. Work Attitude 5S

Received: 10 Nov 2018 | Revised: 20 Dec 2018 | Accepted: 02 Jan 2019

In general, work attitude 5S is a way to determine the selection of a workplace, penatan, cleaning, maintenance as well as a habit it takes for the job to run well. 5S originated from 5 first letter of the Japanese language, namely Seiri, Seiton, Seiso, Siketsu and Shitsuke while in Indonesian is the selection, arrangement, pemebersihan, stabilization, and habituation.

III. RESEARCH METHODOLOGY



Picture 1 Flowchart Research

Broadly speaking lean strategy ergonomics hierarchy starting from identification of activities, identify waste, waste classification and analysis of improvement.

A. Identification of Activities

Describing the stages who want to see and analyze all activity when the production process occurs. This stage wearing some tools that can help in the analysis of such yiatu, labor and engine map, and maps of the left hand right hand

B. Identification of Waste

This phase is intended to determine the countless activities that do not add value using 1H 4W. The analysis was done by using the map work and the REBA.

C. Classification of Waste

Mnegindentifikasi waste by means pendeketan ergonomics. Waste ergonomic problems that result in so-called waste of ergonomic.

D. Analysis and Proposed Improvements

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This section is made analysis of ergonomic improvements to the waste contained in the work station as well as matching indikaor before and after renovation.

4. Results and Discussion

A. Waste analysis

Isolating Cook produced by PT Pindad (Persero) is a product that is not produced in its entirety by PT Pindad (Persero), but most of the components are imported from abroad. Isolating Cook production process generally consists of the assembly process components that are already available. The analyzes were performed using the map production activities are taken from interviews conducted on operators and direct observation. Waste identification and comparison of data estimates with the actual time period can be seen in table 1 and 2.

Table 1 Waste Identification on Isolating Cook Production

No.	Activity Production Process	Machine Type	Waste Activity	Type of Waste	Waste of Ergo
1	Components provide Isolating Cook.	Manual	Making components more can happen 2 or 3 times a repetition in making components.	Transportation	yes
2	Bus components given Locktite, tide on the Isolating Cook Housing.	Press Machine Hand	Additional components can Locktite when time runs out, so it needs to take a new locktite	Motion	yes
3	Pen components by Locktite then plug in the last Concluding the press until airtight.	Press Machine Hand	The pressing process requires precision and high precision	Process	yes
4	Replace the O - Ring on the ball segment, feedback on operating results 2 were shut down by the operating results 3 tighten with torque of 250 Nm till airtight.	Manual	Decision Tool Twist Moment with long distance, thus inhibiting the production time	Motion	yes
5	Put gasket on the operating results of 4 then pair Ventilation Bolt with 100 Nm torsional moment.	Manual	Decision Tool Twist Moment and Tools Bolts Ventilation with greater distances,	Motion	yes

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			require precision in installation		
6	Put gasket on the results of operations 5, Install flange and then fastened with Baud, Nut and Ring.	Manual			no
7	Put Spring A and Spring B at the Stake, then covered with rings. Further input to Handel and tied with a Pen.	Manual			no
8	Testing: Given a leakage test pressure of 10 bar (air)	Machine. Test	If there are items that are leaking, the goods referred to Reject	Defect	no
9	Pair Pen on operating results 6 and attach the results of operations 7 tied with the Pen.	Manual			no
10	Replace the protective cover.	Manual			no
11	Inspection.	Manual			no

Table 2 Comparison Isolating production time Cook

Operation Number	1	2	3	4	5	6	7	8	9	10	11	Total
Estimated Time (minutes)	1	1	1	1.5	1	1.5	1.5	6	2	0.5	1	18
Actual Time (minutes)	1	1	1	2	1.5	1.5	1.5	6	2	0.5	1	19

B. Waste of Ergo

Research carried out is about the waste of ergo because the waste is one of the things that cause delays in production. Analysis of waste of ergo performed as the method used to identify workers' activities in conducting production activities will then be given the proposed improvements through ergonomics approach. Waste of ergo is the most dominant waste and the reason researchers chose to investigate this waste because there are many use manual material handling. If the waste is ignored can lead to delays in production as well as some of the possible occurrence of fatigue, illness, until an injury to the operator while working.

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Identification that has been done is the result of direct observation and there is waste in the six assembly peroses namely transportation, motion, process, and defects. Waste of motion requiring repair to get results faster assembly so that the need for more analysis of the waste of motion using REBA method. The results of the analysis and improvement of working posture using REBA method are shown in Table 3.

Table 3 Analysis and Repair Result on REBA Methode

Operation Number	Score REBA Before	Score REBA After
1	4	3
2	5	
3	6	
4	5	
5	5	
6	3	
7	3	
8	4	
9	3	
10	2	2
11	2	2

Analysis of REBA score before repairs are in the range of numbers from 2 to 6, which means the score is in the low range to the medium risk, the risk level of work can be seen in Table 4. Repair work postures done to reduce the risk of employment so that workers become more productive and to avoid the risk fatigue and activities that do not have added value. This improvement results show the score that is in the range of low risk level so as to have a minimal level of risk.

Table 4 Risk Level Score

Action Level	Score	Level of MSD Risk
1	1	Negligible risk, no action required
2	2-3	Low risk, change may be needed
3	4-7	Medium risk, further investigation, change soon
4	8-10	High risk, Investigate and implement change
5	11+	Very high risk, implement change

(Source: ErgoPlus www.ergo-plus.com)

C. Proposed improvements

Proposed improvements in this case are:

1. Applying the 5S method, this method is derived from the Japanese language seiri (整理), Seiton (整頓), Seiso (清掃), Seiketsu (清潔), And Shitsuke (躾). The use of this method is used to familiarize the workers in the organization and maintenance of intensive work areas.

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2. Put the tools and support components to the assembly production process so that no wastage of time due to the need to take the tools and support components are located far apart at the operating table.

3. Recommend the use of material handling that can facilitate in making components to the workbench, both in terms of handling and the number of components that are taken.

4. Provide education to the workers about the working posture and its effects on labor productivity

5. Fixing work posture using REBA risk by lowering the risk level of work being low risk.

Comparison of time in the production process Isolating Cook can be seen in Table 5. The difference this time has a very good influence, because the production process becomes smooth and actual production time according to the time estimate

Table 5 Comparison of actual time

Number of Operations	1	2	3	4	5	6	7	8	9	10	11	Total
Estimated time (min)	1	1	1	1.5	1	1.5	1.5	6	2	0.5	1	18
Actual Time Before (min)	1	1	1	2	1.5	1.5	1.5	6	2	0.5	1	19
Actual Time After (min)	1	1	1	1.5	1	1.5	1.5	6	2	0.5	1	18

IV. CONCLUSION

The results of data processing have shown the cause of the delay in the production of Isolating Cook in the railroad facilities department of PT Pindad (Persero) is due to the wasteful activity that occurs in the production process. Work posture processing results show a score of 4-6 which indicates the level of medium risk. Based on the results of the study using the waste analysis method, the dominant waste is in the form of waste of motion. Improvement of work posture using REBA method obtained score 3 which is one of the efforts to reduce work risk and is in the low risk range one of the efforts to reduce work risk. The work posture improvement results show the results of scores that are in the range of low risk, so that production operators avoid work risks that can hinder the production process. Application of work posture recommendations, 5S and proposed improvements that have been recommended in the Isolating Cook production process in the form of eliminating movements deemed as waste and also recommendations to regulate the placement of work tools so that they are easily accessible to workers as a cause of the emergence of wasteful movements so that the production process becomes faster or the actual time after repairing becomes balanced with the estimated time given.

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