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A Case Study on Process Standardisation with Work Study Tool in Industry

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ABSTRACT

Standardisation is a technique of reducing, simplifying and organising a matter. There is always difference between theoretical and actual performance in any process, but it is allowed with certain limits. When performance of any process exceeds the upper limits then adaptation for the standardisation is needed. Process standardisation is being used to address increasing efficiency, developing the process and reducing the cost. It Benefits to reduction in cost, avoids accidents and save time. Drawback is, it changes the mind of operator against the work and behavior toward change. In this paper the main objective is standardise the process to reduce ineffective time during operation. This process improvement uses work study management tool. The work study involves techniques like method study and work measurement. In present work, for the data collection method is implemented using work study tool, as procedure description sheet and operation description sheet. The precise and accurate data collection is required for the detailed study of the existing system. The examination and analysis are done with the help of 5W2H method for finding solutions to improve the process. This analysis shows the opportunities to find problems occurred in process. With help of brain storming, suggested solutions from the operatives and literature studies solutions are founded for the problems. In present work solution are suggested in to save the time by changing the procedure. The significant results are observed in reducing the operation time. A difficulty in implementing the solution for standardisation is conflicts between the management and operatives due traditional thinking of the operatives.

Key word: Standardisation, Work study, Method study, Work measurement, 5W2H.

I.INTRODUCTION

One of the most challenging issues of traditional manufacturing industries in India is working with standard work process with safety and discipline [1]. In present industry, employees work traditionally without safety and ergonomics consideration. This results in number of mistakes and causes reworks and also making a habit of working unsafely without ergonomics consideration. So that purpose process standardisation is necessary. Industrial standardisation represents the standardisation in industrial sector and is adopted as national industrial standard. Therefore main objective of this work is standardising the work procedure. Standardisation involves selection of process, record current process, analyse the process, develop the solution, implement and continuous improvement. For the standarisation of any process work study tool is mostly used, which are used in the examination of human work. As per the ILO [2] work study is a generic term for technique method study

and work measurement which lead systematically to investigate of all the factors which affects the efficiency and economy of situation being reviewed in order to seek improvement. Method study is the systematic way of recording and critical examination of existing and proposed way of doing work. As a means of developing and apply easier way to improvement. Work measurement is the application of technique designed to establish, time standard required by a qualified worker to carry out a specified job at a defined level of performance [3].

The methodology adopted for standardisation is Selection of the process to standardise, Record the process with designing the sheets for data collection, critical examination and observations using 5W2H method, developing the solution, implement the developed solution or improved method, continuous improvement.

II. LITERATURE REVIEW

In this section literature study is done as per the objective of the project. This section involves study of all types of operations, related to manufacturing process are to be standardised. Such as plasma cutting, butt welding etc. study of the different types of layout and work study tool used for standardisation which is also discuses. Furthermore the study of skill matrix is done for identification training needs, for the employee. Attempt has been made to standardise the manufacturing process.

2.1 STANDARDISATION

Standardising is process of improvement, development and implementation of current executed process, processes like manufacturing, services etc. Kauffman et al.[4] evaluated the traditional approach of evaluating standards and standardisation via one dimensional analysis of any industry is insufficient due to the complexity to process standardisation.

Lamb and Rodes [5] provides the motivation for role of standardisation of process and barrier to it. At the team and organizational level also present the case study based on interview and survey to gather data for standardisation on aerospace industry.

2.2 STUDY OF EXISTING MANUFACTURING PROCESS

The review involves the detail study of existing system of manufacturing. Manufacturing system involves study of product details, manufacturing process, machinery and equipments. The manufacturing process has operation like plasma cutting, shot blasting, submerged arc welding (SAW) and lateral welding operations.

In present industry mostly welding and fitting operation is performed, Kalpakjain[6] elaborates different welding joint and types of process with equipment details. In this industry mostly but and T joint is performed using conventional or semi automatic specially designed submerged arc welding machine [7].

2.3 WORK STUDY

The British standard defines the work study tool used to process mapping techniques; those techniques are method study and work measurement. The systematic recording and analysis of process, it is way of doing things in order to do improvement in system. Work study is a management tool to achieve higher productivity in any organisation whether manufacturing tangible products or offering services to its customer. Is also determines the best or most effective method of accomplishing a necessary operation. Work study benefits to reducing cost, better working condition, provide standard of performance.

2.4 METHODOLOGY OF WORK STUDY

Methodology adopted for the standardisation is shown in figure 1, and steps for as per given below [].

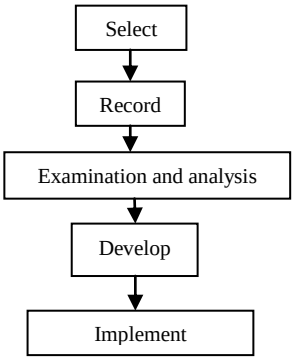

Figure 1 Methodology of work study

Step 1: Select the process of product for standardisation

Step 2: Record the existing procedure of process (Method study and work measurement)

Step 3: Examinination and critical analysis (5W2H), examinination and analysis of existing procedure for find the opportunity to improvement.

Step 4: Develop the solution, from the opportunities develops the alternatives to improve the existing procedure.

Step 5: Install the alternatives, implement the developed solution and observe the improvement.

2.5 METHOD STUDY

Method study is designed for determine to best way to complete a repetitive job. The method study involves process charting and outlining in the form of symbols like operation and inspection. Process charts are the pictures of a process. A flow process chart is setting out the sequence of the flow of process, by recording all events under review using appropriate process chart symbols. Outline charts is to obtain bird's eye view of

whole process or activity before embarking on detail study [2,3]. Related symbols for the method study are shown in Table 1

Table 1 Symbols used in Method study[2]

Symbol	Name	Activity
	Operation	Indicates main step in a operation, method or procedure
	Inspection	Indicates inspection for quality or quantity.
	Combine activity	Indicates activity performed at same time

2.6 WORK MEASUREMENT

Work measurement refers to estimation of time standard, which is the time allowed for completing one piece of time using given method. For the recording of the process and the time proper method and equipment is required, the method time study uses for the measurement of the time and rate of working element. For time measurement time measurement equipment is required like stop watch [2,3,5]. Steps of conducting time study is shown below [8].

2.6.1 Obtaining and recording all the information available about the job, operator and soundings.
2.6.2 Recording a complete description of the method, breaking down the operations.
2.6.3 Examine the details breakdown to ensure that the most effective method and motions are being used and determining the number of cycles to study.
2.6.4 Measuring with timing devices (stop watch) and recording the time taken by the operative.
2.6.5 Assessing the effective speed of work
2.6.6 Extending observation times to basic times.
2.6.7 Determining the allowance and standard time for the operation.

2.7 SAFEY AND ERGONOMICS CONSIDERATION

In shop floor the hazardous fumes and gases are generated during an operation. The different methods to control and minimise the fumes and gases are studied with safety and ergonomics consideration are to be followed, Lemon et al. [6] monitored the welding environments and gases generated during operation for different welding method. They concluded different techniques and method to minimise the gases and improve working environment.

On shop floor different working positions are to be made by operator like top welding, ground welding, manual material lifting etc. Agrawal [7] presented the different body postures of operators in small scale industries and shows different postures required while performing a welding process.

III. DATA COLLECTION

For the standardisation of process the data is collected in the following way.

3.1 SELECTION OF THE PROCESS FOR STANDARISATION

While selecting a product or operator following consideration is considered strictly. There are three factors that should be kept in mind when selecting a job operator.

3.2 ECONOMIC CONSIDERATION

Operation involves repetitive work using a great deal of labor and once that are likely to run for ling time. Thus labor cost contributes to selection of process. Cost related to equipments required in implementing new method. Cost of repeatation.

3.3 TECHNICAL CONSIDERATION

The One of the most important consideration is the technique or method used for standardisation of process. Which type of equipment is required and their training for use that equipment.

Human consideration

Certain operations are often a cause of dissatisfaction by workers. They may induced fatigue or repetitiveness or may be unsafe or awkward to operate. The level of satisfaction should point to need for work study. In such operations are addresses by work study specialist as a part of an overall work study program. The benefit of work study can become more apparent to work force. In similar vein, a choice of a particular job study may lead to conflict or ill-feeling.

3.4 RECORD

As per the requirement and the company policies against the privacy regarding information of the product, so the management allows showing the information regarding trolley assembly only. The next in the basic procedure is recording of all facts after selection of work to be studied. The success of whole procedure depends upon the accuracy with which facts are recorded, because they will provide the basic for critical examinination and development. The recording is carried out in two phases, first is rough sketches or charts (Primary) for the study the current process. Second (secondary) is more formal and accurate charts.

In this study the recording method is used for the rough record of all process in the form of charts. This chart is called as the “Procedure description sheet”. After recording the rough charts the formal and accurate recording is done. These recorded sheets are call as “Operation description sheet.”

3.5 PROCEDURE DESCRIPTION SHEET

Procedure description sheet is detailed study of existing system it contains rough information of the existing process, it consist detailed study of the particular process or operation and their procedures. It can be very

helpful for the understanding the existing procedure of the process. It also contains the information for part details, equipment used, house keeping, detailed safety instruction and ergonomics considerations. For the details refer the Table 2.

Table 2: Format for procedure description sheet

Process Name	Tasks In the Process	Procedure for the Task	Safety and Ergonomics

3.6 OPERATION DESCRIPTION SHEET

The operation description sheet provides broad view of the work sequence at particular operation. It records such elements like job description, process sequence, and operation time. The operation description sheet is a visual representation of work sequence, listing elements of job, what sequence they are performed and how long it takes to perform the work. The operation description sheet is also used as production slip. It can be best suited those area where operations are required to work on job is in fixed position. As per the requirement organisation the format for the OD sheet is designed and developed. See the Table 3 for the more information about format. This format try to cover the almost thing to performed during operation. The advantage of this format is, it covers variation observed in the process and also covers the responsible for that variation. OD sheet helps to understand the different safety and also major document for past records itself.

Table 3: Operation description sheet

<table>
<tr><td colspan="3">Operation Description Sheet</td><td colspan="4">COMPANY NAME</td></tr>
<tr><td colspan="2">Prepared date</td><td>Revised Date:</td><td colspan="2">Checked By:</td><td colspan="2">Confirmed by:</td></tr>
<tr><td>Step No</td><td>Part Input</td><td colspan="2">Methodology</td><td>Equipments</td><td colspan="2">Quality issue</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td><td colspan="2"></td></tr>
<tr><td colspan="2">Variance Report</td><td>Team Details</td><td>Essential PPEs</td><td colspan="3">Time</td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>TST</td><td>MH</td><td>LT</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="2"></td><td rowspan="2"></td><td>Department</td><td colspan="3"></td></tr>
<tr><td colspan="2">Responsible for Variance</td><td>Status of Variance</td><td>Area</td><td colspan="3"></td></tr>
<tr><td colspan="2" rowspan="3"></td><td rowspan="3"></td><td>Operation</td><td colspan="3"></td></tr>
<tr><td>Job No</td><td colspan="3"></td></tr>
<tr><td>Sheet No</td><td colspan="3"></td></tr>
<tr><td colspan="3">Previous Operation</td><td colspan="4">Next Operation</td></tr>
</table>

3.7TIME SHEET

Time sheet designed to record the time consumed for an operation and the format for the time sheet is shown in Table 4. It time sheet includes setup time, operation time, inspection time and equipment used. It shows which part of trolley is fitted by whom, on which date, day and time. For the better time data how many cycles are to be recorded is determined from the Table 5[5]. For the current product, data is collected three times for collecting the cycle time.

Table 4: Format for the operation description sheet

Department	Supply Operation	Crane Code:			
Area		Operation Name			
TL Name			Part Name		
Members		Start Date		End Date	
Note: Duration in Minutes		Start Time		End Time	
Content	Setup	Operation	Inspection	Equipment Used	

Table 5 Guide line to number of cycle observed

Cycle time (min)	No of Cycle
5-10	10
10-20	8
20-40	5
40- above	3

IV. ANALYSIS AND SUGGESIONS

In this chapter collected data in the previous chapter is analysed. From collected data in the form of OD sheet is formulate in Table 6 and it shows the information about activity and consumed time, and is used for further examination and analysis is made with help of 5W2H.

Table 6 Present procedures with required Time

No	Activity	Duration
1	Frame inspection[@]	
2	Trolley frame setup	120
3	Quality inspection[@]	
4	Wheel mounting and setup	202
5	Inspection[@]	
6	Water leveling reverse the trolley	65
7	Layout marking	128
8	CT Gear box fitment + Wheel shaft coupling + Break	360
9	Quality inspection[@]	
10	CT motor fitment + Shaft coupling motor and gear box	480
11	Hoist motor installation	240
12	Hoist drum fitment	330
13	Hoist gear box fitment and shaft couplings+ Break	480
14	Accessories fitments*	958
	Total	3363

Summary

- Total duration in hours: 3363 ÷ 60 = 56 hours
- Total man hrs: 26 × 3+16 × 6 = 174 man hrs

In activity number 14 man power increased from 3 to 6 operatives for performing simultaneous operation

@ No specific time allowed for inspection and it is not considered in standard time.

* Simultaneous activity, it includes pulley mounting, limit and buffer stopper fitting. Lubrication piping, electrical brackets, panel stand, coupling guard fitting and handrailing fabrication

4.1 CRITICAL EXAMINATION OF EXISTING PROCEDURE

4.1.2 5W2H METHOD

This is simplified root cause analysis technique. The 5 W's are who, what, where, when, and why. The 2 H's are how and how many. If these seven questions are answered the problem will be specifically defined, with suggestion as to what the root cause might be.

After the applying the 5W2H analysis study and with the help of some observations are made.

1. Unwanted time consumed in the making setup for water leveling.
2. Time consumed for fitment of the Hoist operation machinery.
3. Time consumed in fitment of the CT machinery is more
4. Due to unavailability of tooling like consumables time is wasted.
5. The missing of the small component of machinery is also observed.

4.1.2 DEVELOPING THE SOLUTIONS

From the examination stage, some of the observations take as problem. These problems are opportunity to improvement for standardisation. After critical examination assembly process, from different study of literatures with experienced persons guidelines. Solution suggested for further improvement. In this case the of trolley assembly the in fitment of main hoist machinery have scope for further improvement. After the group discussion with experts and brain storming with operators the suggested solution confirmed and forwarded to management.

Changing the sequence of operation no 11, 12 and 13

1. Previous Procedure

As shown in the Table 6. In the fitment of MH machinery, first installation of hoist motor (operation no 11) is done. Then after hoist drum is fixed temporary (operation no 12) and lastly the gear box (Operation no 13) is fitted permanently. After the alignment setting between three parts the water level between them is disturbed. Due to that extra time is consumed in realigning and water leveling of the points. At this step the opportunity identified for the improvement.

2. Present Procedure (Solution)

The solution for this problem is changing the operation sequence. In basic design of the gear box and rope drum, the feature of external and internal gear is observed. Internal gear on driven shaft and external gear on the rope drum shaft. This design features makes as geared meshing or coupling in between rope drum shaft and driven shaft of gear box. As per change in operation sequence, gear box installation is performed firstly, and after any one of remaining. Advantage of this change it saves the realignment time between three parts. Reason behind that is gear box's internal gear is makes a reference point for rope drums internal gear and acts as a geared coupling between shafts. This avoids resetting in between shafts.

V. RESULT

In this suggestion the operation no 13 as operation no 11 and is performed first instead of the operation no 12 the effect of the this solution is shown in Table 3

Table 3: Comparison between time Consumed in Trolley Assembly

No	Activity	Duration(min)		No	Activity	Duration(min)	
		Before	After			Before	After
1	Frame inspection			9	Quality inspection		
2	Trolley frame setup	120	104	10	CT motor fitment + Shaft coupling motor and gear box	480	174
3	Quality inspection			11	Hoist gear box fitment and shaft couplings+ Break	480	230
4	Wheel mounting	202	186	12	Hoist motor installation	240	86
5	Inspection			13	Hoist drum fitment	330	96
6	Water leveling reverse the trolley	65	76	14	Accessories fitments*	958	958
7	Layout marking	128	150		Total	3363	2313
8	CT Gear box fitment + Wheel shaft coupling + Break	360	253				

As per the suggestion the changes are made, and the significant changes are observed in Assembly of trolley. The minor changes observed in time consumption, but the operation MH machinery fitment have major changes in time consumption. The comparison between the times is show in Table 4.

- Time consumed in hours = 39
- Total man hours consumed = 164

Table 4: Comparison between Times

NO	Description	Before	After
1	Total time in min	3363	2313
2	Total time in hour	56	39
3	Total man hour	216	164

$$Percentage\ saves\ in\ time = \frac{Before\ time - after\ time}{Before\ time} \times 100$$

$$Percentage\ saves\ in\ time = \frac{56-39}{56} \times 100 = 30\%$$

VI.CONCLUSIONS

Present work is performed for standardising of the manufacturing of the crane assembly. For that purpose the data collection of current system is performed with the help of work study management tool and finds the different solutions.

On the basis found solution and result the conclusions are drawn

- By changing the fitment sequence of MH machinery, the total time of trolley fabrication is reduced up to 30% of consumed time earlier.
- As per the customer requirement every trolley is customized also changes the quality standards customer to customer, because of that work study management tool unable to standardise the whole process.

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