

Reducing Manufacturing Cycle Time of Milk Tanks by Work Study Technique in Small Scale Fabrication Industry

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ABSTRACT: Work study is the scientific research involving work techniques with the objective of identifying the best way of doing a work. This study performs a work study analysis at the audio division of with the aim to offer suggestions to improve its operational and production efficiency. Primary data was collected from seven work stations of audio manufacturing process, through observation method (i.e., video-recording without the knowledge of the workers). The analysis reveals that the cycle time of all seven work stations is not equal, and the electronic equipments were often found hanging due to high temperature on production shop floor. The study identifies several reasons behind the increase in the cycle time, and accordingly offers suggestions to improve the production efficiency at the audio division.

KEYWORDS : Work study Techniques, Time Study, Cycle Time,

INTRODUCTION

In the beginning of 20th century work study emerged as a technique that main aimed is to assess work, emphasis was on economy of motion and movement because of this it was also known as time and motion study. **Work Study** is the systematic examination of the methods of carrying out activities such as to improve the effective use of resources and to set up standards of performance for the activities carried out.

Work Study

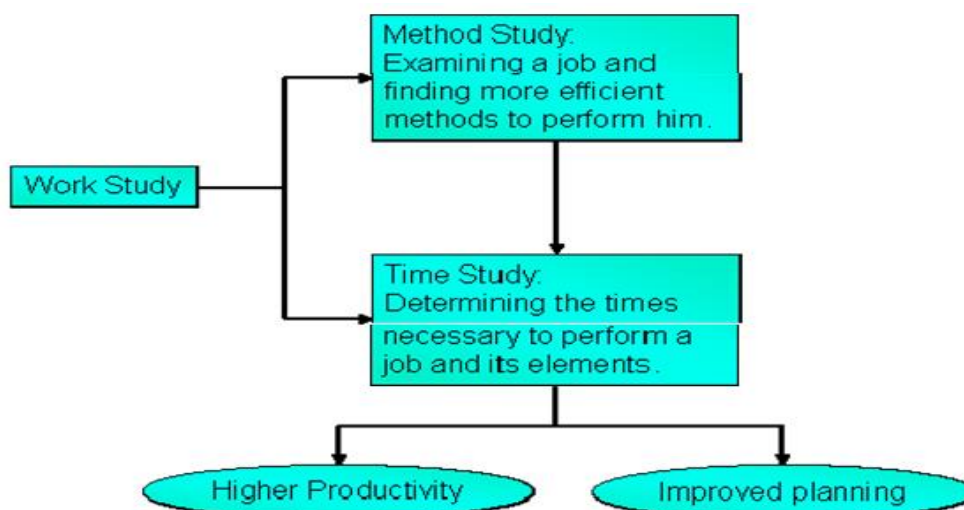


Figure 1: Components of Work Study

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Another definition of Work Study could be: A generic term for those techniques, particularly method study and work measurement, which are used in the examination of human work in all its contexts, and which lead systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement'.

This has to do with Productivity Improvement, but also improvement of Quality and Safety.

II.METHOD STUDY

This has been defined as:

"The systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and costs".

The objectives are:

- The elimination of unnecessary movements.
- The arrangement of the sequence of motions in their most efficient order.

Method study can be usefully applied in planning layouts, for example, kitchen, restaurant, bar, etc., and also in organising work procedures, for example the method of cleaning a room, preparing dishes, etc.

There are six basic steps in a method study investigation, which will be discussed-below:

Select the job to be studied (identify the problem).

There are three factors which are involved here, economic, technical and human.

The first factor is concerned with finance, as Work Study is an expensive and time consuming activity, the gains which are realised may not necessarily exceed the costs of the study. This, will of course, depend on whether the savings are monetary instead of improved conditions or improved morale, and whether the investigation is a long term project.

The second factor is concerned with products or processes and whether, technically, there are reasons why a job has to be done in a particular way.

The Third Factor Is Probably The Most Critical.. There May Be Reaction From The Workforce Whatever The Merits Of The Investigation. The Timing Is Crucial. An Investigation Should Not Be Started At A Time Of Unrest, End It Is Necessary To Avoid Building Up Resistance Or Else The Study Will Be Sabotaged.

METHOD STUDY TECHNIQUE

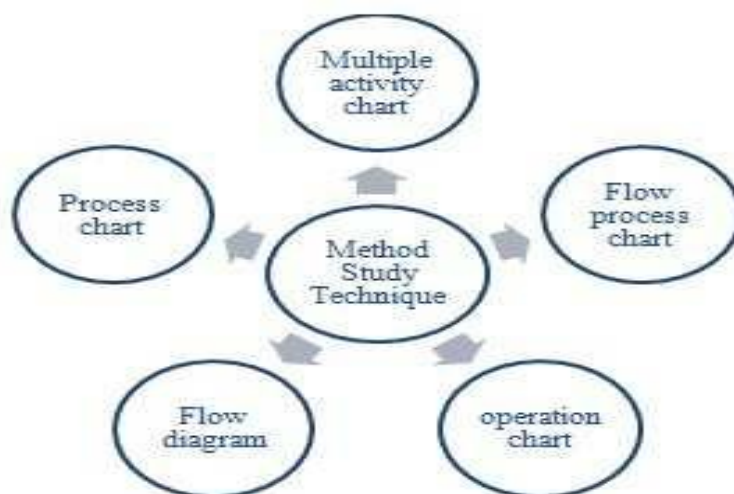


Figure 2 : Method Study Technique

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Stainless Steel Fabrication Flow process chart

Production of casting involves various processes such as Material Cutting, Welding, Finishing, polishing etc. That is particular Milk Tank process chart, the overall process to making Tank. Based on various researches find best fabrication process in which included all the activity.

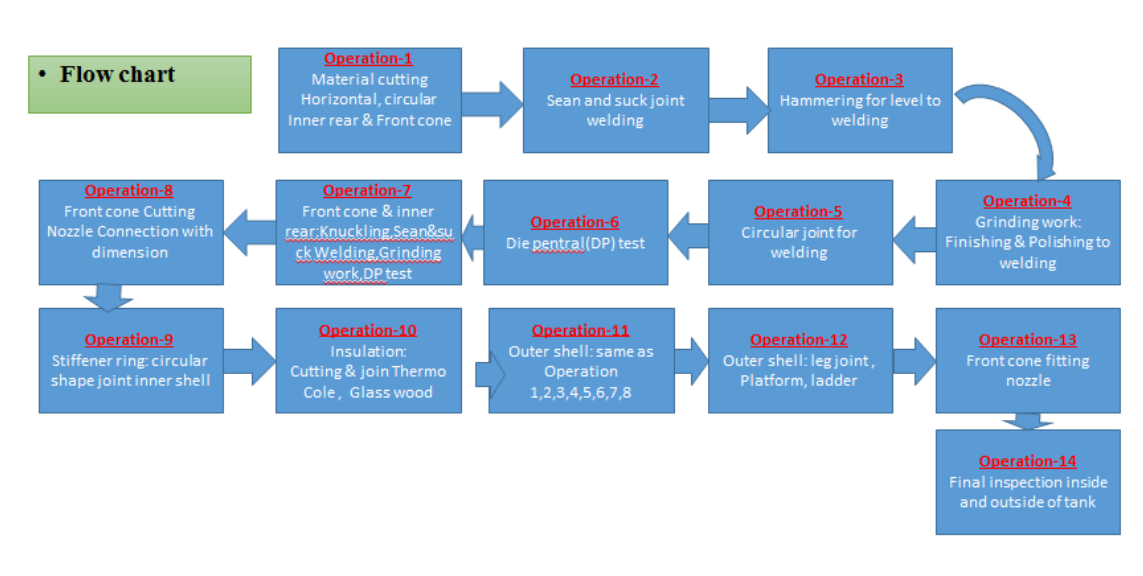


Figure 3 Fabrication process chart for milk tank

Fabrication process is the mostly used process in manufacturing industries to work metal process. Fabrication process: **Changing raw materials into some specific form**

- Sheet metal > milk tank circular Shape > insulation > Fitting Nozzle > Polishing

Assembly process

- Assemble parts to components, put Milk tank inner shell into a insulation, Fitting Nozzle into require hole.

Testing process

- For Quality of products, Good ones surface finishing.

Time Study

F W Taylor known as a father of a clock. Taylor was the first person who used the stop watch time study to appraise the work content; his purpose was to define “a fair day’s work.” Among his study “Taylor Shovelling Experiment” which he studied between 400 and 600 men that using their own shovel from home to moving material from mountain of coal, coke and iron ore in around two mile long yards. Taylor goal was to identify which shovel was the most efficient among all different size of shovel. He collected all the data with the help of stop watch and analyzed it. The results were incredible which reduced time, saving number of workers and budgeting for every year.

Time Study is the analysis of a specific job by a qualified worker in an effort to find the most efficient method in terms of time and effort. Time Study measures the time necessary for a job or task to be completed using the best method. Accumulative time study is made for determining time standards.

Establish *reasonable* productivity targets for experienced workers,

- Provide productivity *goals* for training purposes,
- Eliminate *waste*,
- Make processes more consistent,
- Reduce variability, improve quality

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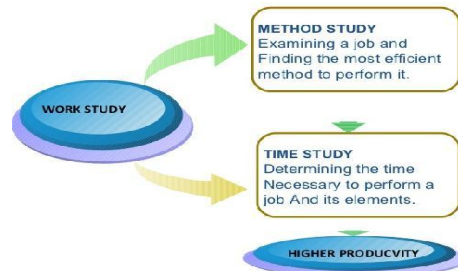


Figure 4 Work study Approach

III.TIME STUDY PROCEDURE

Time study conducted for measuring work in process. Before making this time study each operation was broken into definite number of elements, which are not large or too short in time, then selected average cooperative operator(s)

The stopwatch time study is used to analyze a specific process by qualified workers in an effort to find the most efficient ways in terms of time. Moreover, this method measures the time necessary for a work process to be completed using the best ways. The time was measured using snapback stopwatch equipment because it is easier and faster in data recording. Moreover, this type of stopwatch is suitable for this research because it can develop accurate data. This allows the element times to be entered directly on the time study sheet without the need for subtractions.

Observe operators performing a task: record time taken for each element, over several cycles. Our objective is to record the time taken to perform an activity and to give the ratings of that activity. Assign appropriate allowances (e.g. Allow time for necessary but non-productive activities, such as rest, cleaning eyeglasses, etc. Determine appropriate work standards, with the objective to eliminate idle activities and to set a new standard time to calculate the standard time of each operation.

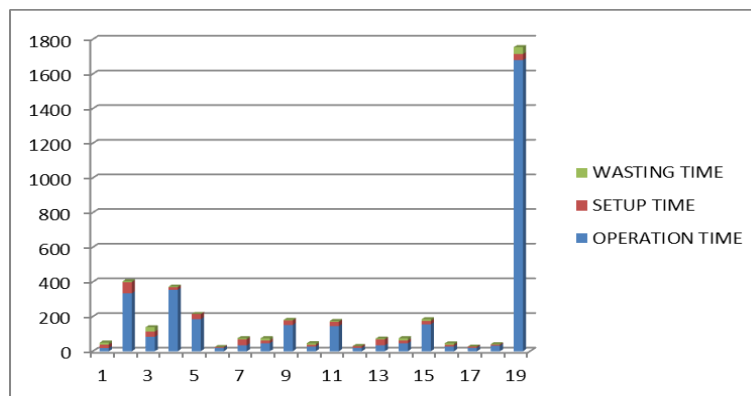


Figure 5 Result obtain After Study

Figure shows Fabrication Cycle time analysis is the process of finding the 19 operation time (insulation process) highest time use and taking necessary steps to reduce the Cycle and to improve the Milk tank Production.

IV.LITERATURE REVIEW

Different Paper give idea about which tools and technique used in steel foundry industry and also give information about implementation of end solution in industry. Also given information about how to implement that tools in research work .And mention introduction of author and journal .

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Table No -1 literature review

Sr.no	Title	Journal/conference	Volume-year	Author	About paper	Review on paper
1	Implementation Of Lean Manufacturing For Productivity Improvement In Malaysia	International Conference on Industrial Engineering and Operations Management, Dubai	March 3-5,2015	Abdul Talib Bon, Tan siok Kee	Lean manufacturing and productivity improvement	Lean Manufacturing implementation had known as an unified system that enabled organization in various industries to eliminate wastes in all business processes for continuous improvement.
2	Evaluation Of Worker Productivity Improvement Using ISM And FAHP	IEEE	2007	Y.L.Cheng, M.L Tseng, Y.H. Lin	This Methodology improve worker performance and productivity	That use for justification of worker productivity improvement.To apply most large sized real world problem. This study acts as a tool for top management to understand the variables of worker.
3	Improving Direct Labour Productivity Through Minimizing Time Wastage Approach	ISSM paper	Vol.1, April 2007 ISSN: 114-118	Soon onn look , Hanif Mohamed	Improving labour productivity by minimizing time wastages caused by non-value added activity.	By changing the ways of working in the fab, we are able to reduce the workload of operators by removing non-value added activities such as walking up and down a bay to check on metrology tools availability.
4	Analysis Of A Steel Frame Fabrication Process For The Automation Of Building Construction	International Conference on Control, Automation and Systems	Oct. 17-20, 2007	Hun-Hee cho, Sung-Hoon An, Joong kim	Improvement in technology and steel fabrication works	We have developed a concept design for an automation system for steel frame fabrication, andbelieve that this will be very helpful in designing a steel frame fabrication automation system..
5	Improving Quality And Productivity In Manufacturing Process By Using Quality Control Chart And Statistical Process Control Including Sampling And Six Sigma	Global journal of researches in engineering: g Industrial engineering	Volume 14 issue 3 version 1.0 year 2014	Ghazi abu taher & md. Jahangir alam	Control charts, pareto chart, cause & effect diagram.	In spur gear manufacturing by applying pareto analysis they found that major problem is undersized hole around 40%. Based on that problem cause and effect diagram is drawn and improper drilling is taken as a main cause.
	A Simulation Solution For Improvement Of Quality And Productivity In	Proceedings of the International Conference on Communication and Computational	India 27-29, Decemb er 2010. Pp – 17-	K.saravanan, C.Karthikey an	Total productivity management ,process, equipment	The developed methodology has an aim to bring the competitive advantages and exploitation increase of mechanical equipment of an industry to analysed increase

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6	Failure Taxtile Industry	Intelligence	21		effectiveness	of productivity,Quality..
7	Technological Advance And Productivity Growth In The Us Engineering And Scientific Instrument Industry	IEEE International Engineering Management Society Conference	AUGUS T 10-13, 2000Pp: 125-155	Jhn R. , Cecile W. fu	Analyzes advance technology, Growth productivity	We Determined that mechanical play very import role in the rapid growth of instrument industry. That traditional estimates of technology change and productivity growth upwards..
8	Impact Of Work Design Concept On Manufacturing Performance: A Process Sector Case Study	Department of Mechanical Engineering, University of Moratuwa	IEEE 2011 Pp: 1805-1810	P.PG.N. Vilasini, U.P. kahangamag e	Productivity,Time study, work design	The work design concept can be applied effectively to in- crease the effectiveness of work planning and to determine the manning level. here is around 25% excess worker level in each production line and the best recommendation for such situation is job enrichment which is a key factor in good work design.
9	Reducing Cycle Time By Optimizing Your Product Portfolio	Principal, Product Development Consulting(PDC)	2011 ISBN: 2-12	John carter	Check sheet of new product.	Studies have shown that the top two drivers of development schedule slips in new product development are (1) the poor definition of product requirements and (2) unanticipated technical difficulty.
11	Quantifying The Benefits Of Cycle Time Reduction In Semiconductor Wafer Fabrication	IEEE Transactions On Electronics Packaging Manufacturing	Vol.,23 No., 1 January 2000	Reha M. , Ekif akcali	Cycle time, economics, wafer fabrivation	This case study faster feedback from probing test to the fab is identified as an important factor in yield improvement. This type of study would be helpful for manufacturers making a decision as to how much to invest in their rationalization tools.
12	Implementation Of Statistical Quality Control (S.Q.C.) In Welded Stainless Steel Pipe Manufacturing Industry	International journal of research in engineering and technology	eISSN: 2319-1163	Kapil banker, amit patel, diptesh patel	Control charts, flow chart.	It is observed that in X bar and R chart, if the process is out of control, then some assignable causes are there. That was the main disadvantage in the company to increased overhead cost due to trial and error method to solve the problem.
13	A Review Of Industrial Engineering	International Journal of Management,	Vol. 2,	Darshak a desai, Ankur	Industrial Engineering, Work Study,	The application of work study is not limited up to the manufacturing industries but also

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	Technique: An Application And Future Scope Of Work	Information	Issue 3, Mar 2014, 29-36	D Mehta	Productivity, Standard Time	in service organizations, health care centre, bank and etc.. IT software further increases the capability of work study to solve the real life problem and make it more valuable tool for management.
14	An Effort To Apply Work And Time Study Techniques In A Manufacturing Unit For Enhancing Productivity	International Journal of Innovative Research in Science, Engineering and Technology	Vol. 2, Issue 8, August 2013	Patange Vidyut Chandra	Productivity, process improvement, work study, time study, method study	Increases in productivity also can influence society more broadly, by improving living standards, and creating income. They are central to the process generating economic growth and capital accumulation. Productivity helps an organization to not only in increasing economy at micro level benefiting at both financial as well as labor performance output standard.

SUMMARY OF LITERATURE REVIEW

Another Manufacturing client was experiencing difficulties in meeting orders and labour was in short supply locally. There were frequent stock-outs and excessive amounts of overtime were being worked. Weekend working was also the norm, leading to adverse cost variances. To overcome the situation following solutions were recommended: (i) Revising the factory layout to ensure that production flowed smoothly (ii) Reorganizing the raw materials stores allowing stocks to be reduced and parts located (iii) Devising a system of "kitting-up" so that each job 40 could be prepared in advance and processed accurately (iv) Producing a series of key performance indicators and reports to monitor and control labour productivity. As a result, factory efficiency improved from 52 to around 85 performances and productivity was improved by 60 Percent.

For a long-established manufacturer from a traditional UK industry, during the past few years sales turnover had been static and profits declining, mainly due to an influx of cheaper products from the Far East. Although several new machines had been installed, the operations and processes from within the remainder of the production facility had not been examined for many years. The goal was to review all aspects of manufacturing and raise productivity. To achieve this goal following changes were recommended: i) Changing shift patterns ii) Re-deploying surplus manpower iii) Improvements in working methods iv) Devising a series of KPI's. The client is now operating at the same level of output, but with fewer staff and less overtime and shift premiums thus resulting into overall productivity improvement.

Productivity was improved by capacity planning in warehouse and dispatch function for medium-sized engineering company. Management observed problem in capacity planning and the control of manpower levels. The objective of the project was to (i) investigate into how time was being spent and to recommend upon staffing levels and departmental capacity (ii) to highlight where the processes and operations could be improved. To achieve these objectives, an activity sampling exercise was conducted covering a complete shift for the entire completent. This defined the manpower levels for the various delivery volumes and enabled Management to plan resources accordingly. The exercise also helped to highlight any waste within the processes. The project yielded labour savings of around 15% due to enhanced capacity planning and productivity improvement of 10% as a result of improved ways of working.

V.CONCLUSION

All the developed countries have higher Manufacturing. Rise in Manufacturing results in higher production, which has direct impact on standard of living. It reduces time per unit and enables reduction in cycle time. It increases wages for workers and increased productivity for organization. Therefore, improvement in productivity is important for country like India because it can minimize level of poverty and unemployment. Labour, material, machine, capital are the indices of fact or productivity. Models such as Craig and Harris, Taylor Devis and APC are well known in the field of manufacturing.

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After preferring paper select some of tools and technique for future work like Work study techniques are quite expensive to implement in a small scale industries but this method gives better results than any other technique. These techniques can be useful not only to reduce the cycle time but also in various other departments in industries like inventory control, productivity, quality, labour work, at various machines in machine shop to get process variation etc.

REFERENCES

1. George Kanawaty (1986). Introduction to Work Study. Forth revise edition, International Labour Office (ILO) Publication, Geneva.
2. Khalid S. Al-Saleh (2011). Productivity improvement of a motor vehicle inspection station using motion and time study techniques. Journal of King Saud University, Engineering Sciences, (23) 33-41.
3. Lawrence S. Aft (2001). Work Measurement and Method Improvement. John Wiley and Sons Inc., New York.
4. Mayank Dev Singh, Shah Saurabh K, Patel Sachin B, Patel Rahul B & Pansuria Ankit P (2012). To improve productivity by using work study & design a fixture in small scale industry. International Journal on Theoretical and Applied Research in Mechanical Engineering, 1(2), 75-81.
5. Metin Dağdevirena, Ergün Eraslanb,*, Fatih V. Çelebic (2011). An alternative work measurement method and its application to a manufacturing industry. Journal of Loss Prevention in the Process Industries 24, 563-567.
6. Abdul Talib Bon1, Aliza Ariffin. An impact an impact time motion study on small medium enterprise organization.
7. Barnes R. M., (1970). Motion and Time Study - Design and Measurement of Work, John Wiley & Sons, New
8. V.H.Tatawawadi, J.P.Modak (2005). Measurement of productivity of a small scale industry manufacturing electric motor, remaining within the domain of time study, method study and ergonomics, Udyog Pragati, October-November, 29(4) 1-19.
9. Abdul Talib Bon, Daiyanni Daim (2010). Time motion study in determination of time standard in manpower process. 3rd Engineering Conference on Advancement in Mechanical and Manufacturing for Sustainable Environment April 14-16, Kuching, Sarawak, Malaysia.
10. Ann Hendrich, Marilyn P Chow, Boguslaw A Skierczynski, Zhenqiang Lu (2008).A 36- Hospital Time and
11. Hussain Bux Marri and Ghulam Yasin Shaikh (2012).The Role of Productivity Improvement Tools and Techniques in the Textile Sector during Manufacturing. Proceedings of the 2012 International Conference on Industrial Engineering and Operations Management Istanbul, Turkey, July 3 – 6,
12. R. Hedman, R. Sundkvist, P. Almström, A. Kinnander (2013).Object-oriented modelling of manufacturing resources using work study inputs. Forty Sixth CIRP Conference on Manufacturing Systems 2013, Procedia CIRP a.7, 443 – 448.
13. Omid Nejati, Mohammad Rafei, Amir Shahbazi Gandomkari, Ahmad Asadi Amirabadi (2013).Determining the Optimum Number of Locomotives in the Steel Industry Using Motion and Time Study Techniques, J. Basic. Appl. Sci. Res., 3(3)939-943.
14. Shikdar A.A., Das B. (2003). The relationship between worker satisfaction and productivity in a repetitive industrial task. Applied Ergonomics 34,603–610.
15. David W Cheetham and John Lewis (2001).Productivity, Buildability and Constructability: Is Work Study the Missing Link?, 17th Annual ARCOM Conference, 5-7 September 2001, University of Salford. Association of Researchers in Construction Management, 1, 271-80.
16. Brown S. (1994).The Role of Work Study in TQM. The TQM Magazine, 6(3), 9 -15.
17. A.M. Genaidy, A. Mital and M. Obeidat (1989).The validity of predetermined motion time system in setting production standard for industrial task. International Journal of Industrial Ergonomics, 3, 249-263.
18. <http://www.themethodsengineer.com/2012/09/measuring-work.html>.
19. <http://en.wikipedia.org/wiki/workstudy>.
20. Noriah Yusoffa, Ahmed Jaffarb, Norliana Mohd Abbasc, Nor Hayati Saadd (2012).Work Measurement for Process Improvement in the Car Seat Polyurethane Injection Manufacturing Line. International Symposium on Robotics and Intelligent Sensors, Procedia Engineering, 1800-1805.
21. Darshak a desai, Ankur D Mehta. A Review Of Industrial Engineering Technique: An Application And Future Scope Of Work. International Journal of Management, Information Vol. 2, Issue 3, Mar 2014, 29-36.
22. www.slideshare.net/vishakeb/work-study-presentation-650617

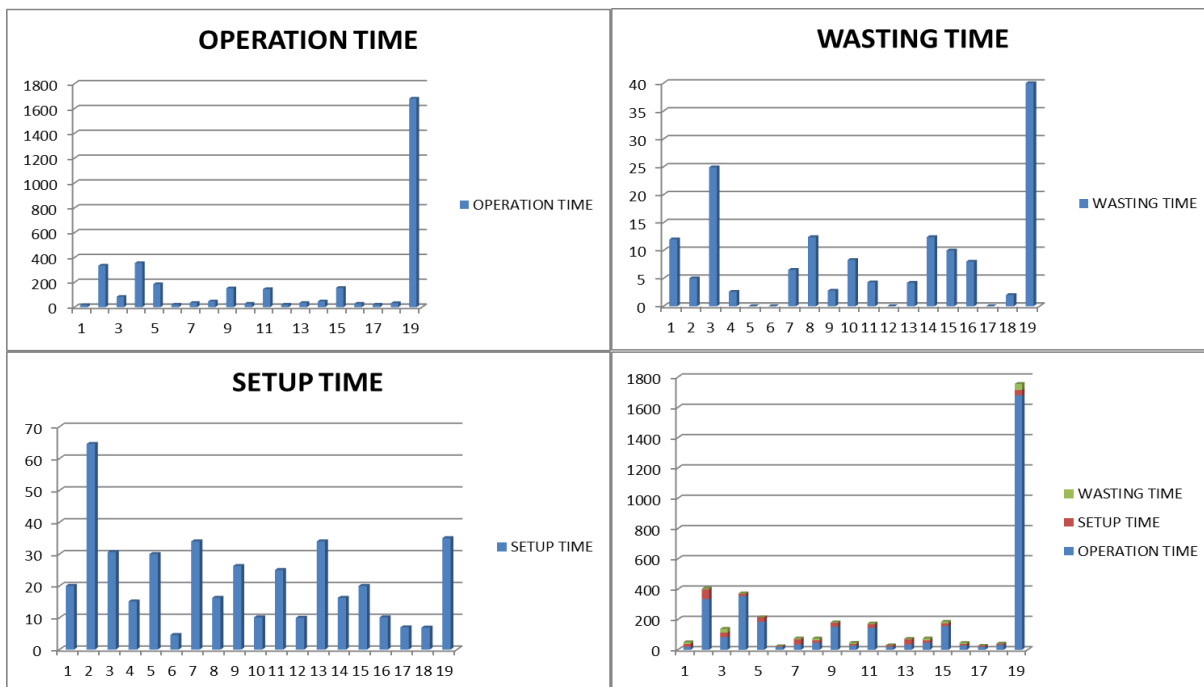
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Data Collections: Table No. 2 Inner shell of milk tank

SR. NO.	PROCESS	EQUIPEMENT	MINUTE	MINUTE	MINUTE
			OPERATION TIME	SETUP TIME	WASTING TIME
1	INNER SHELL Material Cutting	GM	18	20	12
2	INNER SHELL Sean and Suck Welding Joint & Hammering	WM	334.23	64.62	5
3	INNER SHELL Grinding on full welding	GM	83.28	30.6	24.9
4	INNER SHELL Finishing on full welding by grinding	GM	355.12	15.12	2.6
5	INNER SHELL Joint circular shape for welding	GM	185.02	30	0
6	INNER SHELL DP tests (Die Pentral) for welding	Manual	20	4.6	0
7	Front cone material cutting	GM	35	34	6.52
8	Front cone Knuckling process on cone plate	m/c	46.39	16.24	12.39
9	Front cone Sean and Suck Welding Joint & Hammering cricular	WM	152	26.27	2.8
10	Front cone Grinding on full welding cricular	GM	27.76	10.13	8.3
11	Front cone cutting Nozzle connection with dimension	GM	145	25	4.3
12	Front cone DP tests (Die Pentral) for welding	Manual	20	10	0
13	INNER cone material cutting	GM	35	34	4.2
14	INNER CONE Knuckling process on cone plate	M/C	46.39	16.24	12.39
15	INNER CONE Sean and Suck Welding Joint & Hammering cricular	WM	155.32	20	10
16	INNER CONE Grinding on full welding cricular	GM	27.76	10.13	8
17	INNER CONE DP tests (Die Pentral) for welding	Manual	20	7	0
18	Stiffener ring: circular shape joint inner shell	Rolling M/C	32.18	6.9	2
19	Insulation: cutting and join Thermocole ,Glass wood	Manual	1680	35	40
			3418.45	415.85	155.4



Table

no. 3 Outer shell of milk tank

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SR. NO.	PROCESS	EQUIPEMENT	MIN. OPERATION TIME	MIN. SETUP TIME	MIN. WASTING TIME
1	OUTER SHELL Material Cutting	GM	24	20	12
2	OUTER SHELL Sean and Suck Welding Joint & Hammering	WM	330.25	23.56	6.25
3	OUTER SHELL Grinding on full welding	GM	150	30.6	24.9
4	OUTER SHELL Finishing on full welding by grinding	GM	357.25	10.12	3.69
5	OUTER SHELL Joint circular shape for welding	GM	180.25	25.36	2.79
6	OUTER SHELL DP tests (Die Pentral) for welding	Manual	20	4.6	0
7	Front cone material cutting	GM	36	25	5
8	Front cone Knuckling process on cone plate	m/c	52.21	15.32	10.66
9	Front cone Sean and Suck Welding Joint & Hammering cricular	WM	163	27.62	3.7
10	Front cone Grinding on full welding cricular	GM	30	10.25	0
11	Front cone cutting Nozzle connection with dimension	GM	200.23	30	4.5
12	Front cone DP tests (Die Pentral) for welding	Manual	20	10	0
13	INNER cone material cutting	GM	36	25	5.6
14	INNER CONE Knuckling process on cone plate	M/C	40.23	10.23	5.75
15	INNER CONE Sean and Suck Welding Joint & Hammering cricular	WM	170.51	20	10
16	INNER CONE Grinding on full welding cricular	GM	36	10.13	8
17	INNER CONE DP tests (Die Pentral) for welding	Manual	20	7	0
18	Outer shell: leg joint , Platform, ladder	Manual	1200	142	22
19	Front cone fitting nozzle	Manual	525	35	0
20	Polishing Whole tank	GM	243	20	0
			3833.93	501.79	124.84

