

## A REVIEW OF INDUSTRIAL ENGINEERING TECHNIQUE: AN APPLICATION AND FUTURE SCOPE OF WORK

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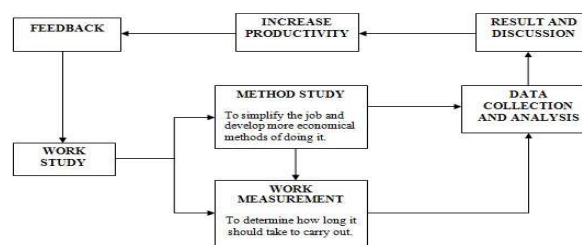
### ABSTRACT

The advancement of industrial engineering was begun with the birth of work study. Work study is simple but effective tool for organization to determine the standard time and increase the productivity. This is a review paper which presents practical implementation of work study technique in real world and the future scope of work. The core objective of work study is to identify and eliminate unnecessary activities. Work study technique is not limited only to the manufacturing industries but it can also be implemented in various sectors like textile industry, medical sector, bank, service organization and many more. Introduction of IT further enhance the work study capability to give better result to the management.

**KEYWORDS:** Industrial Engineering, Work Study, Productivity, Standard Time

### INTRODUCTION

In the beginning of 20<sup>th</sup> 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 one of the most penetrating tools for research. A well conduct work study investigation is systematically followed, where efforts and time are being wasted is laid uncovered one by one. Work study mainly consists of two techniques. (1) Method study (2) Work measurement. Both method study and work measurement are closely link together [1]. The figure 1 is amalgamation of relationship among method study and work measurement [1] and work study application cycle [15].



**Figure 1: Endless Cycle of Work Study Application**

Method study is concerned with the reduction of the work content of a job or operation, while work measurement is mainly concerned with the investigation and reduction of any ineffective time associated with job [1 & 20].

### OBJECTIVES OF WORK STUDY

- To identify problem in the process of production work [6].

- To identify and eliminate ineffective time [1].
- To set up the standard time of a product that company manufactured.
- To improve work process in terms of production time, number of process [6].
- To identify bottleneck operation and improve it [2].
- To simplify the operation sequences by combining two or more activities [6].
- To reduce the fatigue [11].
- To illustrate better work place layout with minimum movement of workers and machines [11].
- To enhance the productivity of industries while reducing operation cost, labors cost and raise profit [2].

## BRIEF HISTORY ABOUT WORK STUDY

### 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 [4 & 6].

### MOTION STUDY

Motion study has the greatest prospective for saving. Frank and Lillian Gilbreth are known as the parents of motion study. Gilbreth begin investigation to find the “best way” of performing a given task by analyzing the motion in which his workmen were involved. He attempted to make improvement by eliminating all unnecessary motion. The elimination of those motions is known as work simplification [7].

### METHOD STUDY TECHNIQUE

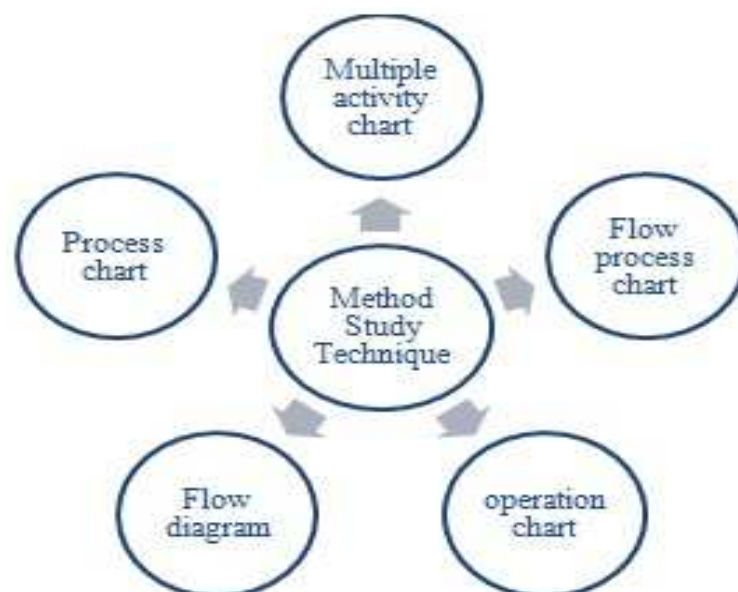


Figure 2: Method Study Technique [1] & [6]

## WORK MEASUREMENT TECHNIQUE

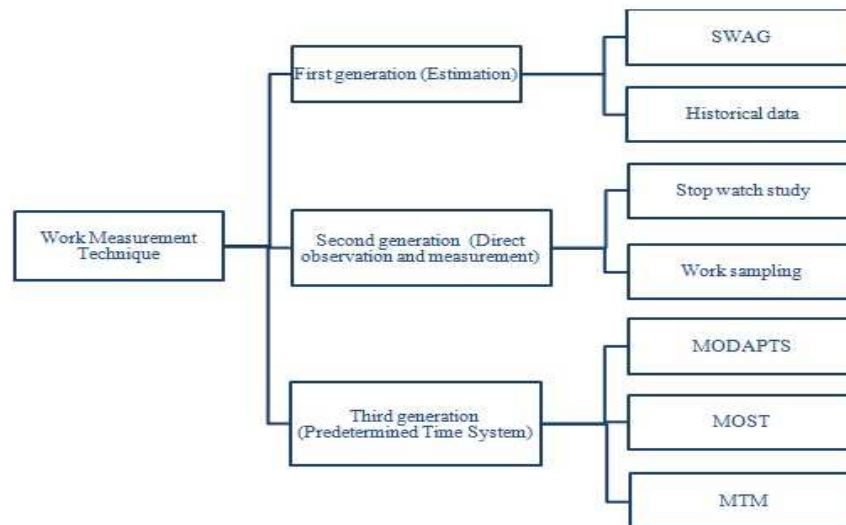


Figure 3: Work Measurement Techniques [17] & [18]

### Scientific Wild Ass Guess (SWAG)

In early days standard time was estimated by the person who is believed to have knowledge about the task. Sometimes task completed early or some time it took a longer than estimated time. It is believed that U.S army has started to use SWAG. The SWAG is an educated guess but is not regarded as the most accurate estimate. It is used to describe an estimation derived from a combination of factors including past experience, general impressions, approximate calculations rather than proof or rigorous calculation [18& 19].

### Modular Arrangement of Predetermined Time Standards (MODAPTS)

Chris Heyde an Australian was the first person who introduced MODPATS. It is based on the premise that the time taken for any body movement can be articulated in terms of a multiple of the time taken for a finger move. MODAPTS mainly classified as low task and high task standards for physical activities. The high task standard is equal to 129% of the low task standard [17].

## AUTHORS AND RESEARCHERS VIEWS ON WORK STUDY AND ITS TECHNIQUE

Though work study is one of the oldest techniques to enhance the productivity for organization but still it is widely used technique by managers. A time and motion study is an organization enhancement technique which consisting the time study work of F.W. Taylor in the company of the motion study work of Frank and Lillian Gilbreth known as Taylorism. Time study emerged as setting the standard time, while motion study evolved as a basic technique for improving work method [14]. Work study techniques generally provide the better output result and facilitates to the user to augment their performance during the manufacturing operation [11]. There is a link between work study and TQM. The relation between these two are important in terms of approach as well as in method for assessing the effective use of human and other resources [16]. The systematic application of work study is also useful for improving workers satisfaction and productivity particularly in repetitive production tasks as they are major concern for management. As these tasks are monotonous, boring, fatiguing, and demotivating and consequently affect satisfaction and productivity of workers [17]. Some body of knowledge has been design over the past few years to enhance the productivity of an organization and of the individual who make up the organization.

The exclusion of unnecessary work, the design of method and procedures (which are the most effective, and require the least effort, and are suited to most the person who uses them) are most key objectives of motion and time study [7]. Time study technique gives an effective solution in measuring the actual working time [18]. Time is one of the important parameter to determine the performance and success of a company [3]. Time and motion study is the important aspect in business to determine the production rate [9]. Time study records the actual process time and levels of a predetermine work using specific condition. The collected data is analyzed and used to identify the time required to finish the work with a defined process speed [5]. Time and motion study are applied to find out productivity [8]. In recent scenario, time and motion study is also applied to health care sector; like in hospital for determine the time spent by nurses in various activities in hospital [10]. Work measurement technique and method is a very adaptable research tool that can be applied in measuring task or process either from service sector or manufacturing industries [20]. Work measurement is commonly used method for work organisation [1].

### INFORMATION TECHNOLOGY (IT) IN WORK STUDY

Nowadays computer and its application find place everywhere, whether they are manufacturing industries or a service sector or any other. Numbers of softwares have been developed for data analysis, proposed alternative solution, simulation etc. Name of some software are ARENA, ANN (Artificial Neural Network) model, Production Modeler (Pro Model), Statistical Fit Model (Stat Fit). ANN model is simple and inexpensive. It has been recognized as a fast and flexible tool for modelling, analysis and design purpose [5]. A simulation tool for modelling i.e. Production Modeler is a powerful tool to assessment various alternative design, ideas, and process before actual working. [6] & [9]. Various collected data have been tested, analyzed and interpreted with the help of Statically Fit model. Irrelevant data discarded so the model will represent the most correctly and suitable operation processes [6] & [9]. ARENA is powerful modelling and simulation software which brings business process improvement. Typically it can be simulated with any processes that described with the help of flow process chart. ARENA software is useful to estimate the output per day [2]. These software and many more software plays an important role to implement work study and its technique successfully in manufacturing or service sectors and give the better result to managers.

### APPLICATION OF WORK STUDY AND ITS TECHNIQUE IN REAL WORLD

**Table 1: Application of Work Study, Result and Future Scope of Work**

No	Author's Name	Tools (and/or) Technique	Other	Use of IT Software	Field of Application	Result	Future Scope
1	R. Hedman et al.	Work study			Modelling of human manufacturing resources	If this model implemented it will improve the planning, control capacity.	This model is initiative for improving the production.
2	Khalid S. Al-Saleh	Motion and Time study		ARENA	Service sector (motor vehicle inspection station)	Two alternative solutions were proposed First improvement of 97.3% in inspection lane at point 1. Second with little investment, 174.8% improvement can be achieved at Inspection point1.	After successfully implementation of time and motion study technique, it might apply to remaining four service points for further improvement in motor vehicle inspection.
3	V.H. Tatawadi et al.	Time study, Motion study	Ergonomics		Electronic motor company	165 motors of 1 H.P can be produced in a month instead of 104. It is found that the dimensions for working table was not as per the anthropometry data of workers and the average energy expenditure of workers during	There is a great imbalance between two handed process chart. It can be balance for motor assembly. Further consider the ergonomics and anthropometry data for convince of the workers work. Establish the separate production line for

						operation were more than the required.	manufacturing 1H.P motor and rework of motor.
4	Mayank Dev Singh et al.	Work study	Fixture design	Pro-E	Manufacturing of a stay vane of francis turbine	Production increased from 19 to 21 per month. Manufacturing time reduce from 28:15:57 (hr: min: sec) to 26:00:57 (hr: min: sec). Profit per year increase to 1, 34,400Rs.	Space utilization can be reduced by redesign the layout. Currently most of activities are done manually. FPC and OPC can be developed for further eliminate unnecessary activities or combining the activities.
5	Abdul Talib Bon et al.	Time Motion study		Stat Fit and Pro Model	Rice manufacturing industry	New standard time was set from 3.39 hours to 3.21 hours. Propose alternative layout for space utilization was also suggested.	Distance between each machine station measure accurately and record data more accurately, take all the activities time to conclude more relevant result.
6	Hussain Bux Marri et al.	Motion and Time study			Textile sector	Only suggestions were given.	Implement all suggestion for better result.
7	Metin Dağ Gdeviren et al.	Alternative work measurement technique		ANN model	Heavy duty truck and bus manufacturing company	Most suitable network configuration has found to be 5×5×2×1. Product can be manufactured in 92 minutes but it estimated 126 minutes so in real instead of 3 the actual production is 4.	The model shows that the proper planning is required to get the better result.
8	Abdul Talib Bon et al.	Time Motion study		Stat Fit and Pro Model	Chili sauce company	Two alternative solutions were proposed. First cycle time was reduced to 3.41 hours from 4.1hours with reduction in number of processes were 5 from 7. Also space utilization was reducing. Second cycle time was reduced to 3.45 hours from 4.1hours with reduction in number of processes were 5 from 7 and space utilization was reduce.	Measure all the dimension of machines to developed the most accurate layout and gathered the data most systematically to prevent error to determine more accurate standard time for producing chili sauce.
9	Ann Hendrich et al.	Time Motion study			Health sector	Most time spent by nurses was found successfully. They are documentation, care coordination, Patient care and nursing practice time.	Study shows that the areas for improvement for nurses are documentation, administration and care coordination.
10	Noriah Yusoffa et al.	Work measurement			Automobile sector (Car seat manufacturing line)	Benchmark time was successfully established. For 100% efficiency (with no rejection) 13.42minute from 15 minutes. For 95% efficiency (with 5% rejection) 14.09 minutes from 15.75 minutes.	Presently car seat production is done manually. It is an immense possibly to make the production line semi automatic or automatically to increase productivity with investment. Since all activities done manually it is better to draw OPC and FPC for further elimination of unnecessary activities.

## CONCLUSIONS

This review paper present the fact that work study and its application is a very versatile research tool. The application of work study is not limited up to the manufacturing industries but also in service organizations, health care centre, bank and etc. As the main objective of work study is to simplify the method for performing the task with cost reduction and increase productivity. IT software further increases the capability of work study to solve the real life problem

and make it more valuable tool for management. Lean management technique like continuous improvement (KAIZEN) and other techniques must be imposed for achieving better result.

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