

# A Review on Concepts of Work-Study for Productivity Improvement

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**Abstract:** *The globalization of Indian economy has faced a great challenge to the Indian industries in respect of productivity, quality, cost, delivery and so on. Productivity is very important factor for any firm to survive in this increasing competition and also to solve break through's. The objective of this paper is to present an overview on various methodologies which can be used for improvement of productivity in small and medium scale industries. Work-study concepts with Lean manufacturing tools, kaizen problem solving concept and cell manufacturing technique would result more effective for controlling various aspects in an industry with assured profit margins.*

**Keywords:** productivity, work study, lean manufacturing, kaizen methodology, cell manufacturing

## 1. Introduction

Productivity is a measure of how well the production unit uses the resources. We measure productivity as units of qualitative output per unit of input. Where output includes quality goods and services produced and sold. Input includes all of the materials, services, machinery usage and efforts expended in the production of the output.[1] Work-study concept with lean manufacturing tools, kaizen problems solving concept and cell manufacturing concept can be the possible way to solve the problems concerning and governing productivity in small and medium scale industries. With implementing the further stated techniques as suited to the firm would definitely solve interdependent problems governing the productivity. This can be the better way to improve the productivity by eliminating or reducing time consuming actions which generally do not contribute in actual production and also the cost of manufacturing can also be reduced.

## 2. Work Study Concept

Work study is a specific type of operations research used to measure work being performed in order to increase efficiency and productivity. It can also be defined as 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 factors which affect the efficiency and economy of the situation being reviewed, in order to effect improvement. [3]

## 3. Method Study

The study of methods and processes employed to perform work logically leads to improved efficiency. Some methods are more efficient than others in terms of resource usage and time and effort required. The preparation phase of work measurement is an appropriate time to analyze the system as a whole and the methods used to perform the work. [3]The role of method study is to facilitate the job while confirming the respective standards of the job and guaranteed optimization in the use of time, resource and efforts. Application of method study concept can be best resulted

when done in the environment of workers and questioning the work being done, why it is being done?, which method is applied?, is it necessary?, How else it can be done?, Is it being done by appropriate person?, Is it being done at appropriate time?, Is minimal amount of effort required to achieve desired result? And etc.

For efficient results the analysis of work procedure and data collection should be done with standardized industrial charts available like operation process chart, flow process chart, value stream mapping, and etc. thus, method study and work measurement are quite inter related. Method study is concerned with the reduction of the work content of a job or operation, while work measurement is mostly concerned with the investigation and reduction of any ineffective time associated with it; and with the subsequent establishment of time standards for the operation when carried out in the improved fashion, as determined by method study.[4]

## 4. Work Measurement Techniques

Techniques used to measure the work differs in the terms of accuracy, cost and degree of difficulty. The type of work to be measured, the desired degree of accuracy to be achieved and the resources available to conduct work measurement can determine which work measurement techniques should be used. One needs to choose the most appropriate work measurement technique for the work to be measured. Work measurement techniques may be applied to measure any type of work, be it of a repetitive or variable nature, efficient or inefficient in its use of human resources. The measurement technique chosen needs to be appropriate to suit the objectives and the purpose of the study. [3]

Principal work measurement techniques listed by the ILO (1978, p. 192) are;

- 1) Work sampling
- 2) Stop-watch time study
- 3) Predetermined time standards (PTS)
- 4) Standard data.

Currie (1977, p. 138) lists the following;

- 1) Time study,
- 2) Synthesis,

- 3) Predetermined motion time system (PMTS),
- 4) Analytical estimating,
- 5) Comparative estimating,
- 6) Activity sampling and rated activity sampling.

Another method is the „modular arrangement of predetermined time standards“ (MODEPTS) developed in Australia by Heyde (1966) and promoted by the Australian Association for Predetermined Time Standards and Research. Work measurement is either preceded or followed by method study to reveal shortcomings of design, tools, procedures, work organization, flow of production processes, holdups etc., and to find ways of overcoming such inefficiencies.[3]

## 5. Method Study Procedure

Method study application at any work place aims to improve the method of operation and manufacturing. The initial step to carry out the study is to select the work which can be studied with economic advantage and define the scope of the selected work or process, after the selection process work has to be recorded on the work place by means of industrial charts and graphs such as Two handed chart, multiple activity chat, SIMO Chart, PMTS, Cyclographs, Chrono cycle graphs, Film analysis, Motion photography and many more.

After recording activity the charts and graphs made for the activities are to be examined critically and best efforts to be made to simplify the process, sequence, person and means of the process by combining the activities or seeking the best possible alternative by applying the various problem solving techniques.

Mechanical aids, Manual control, visual instruments, equipment re-design, jigs and fixtures, local working conditions and etc. are some of the possible alternatives for designing the new and efficient process and thus, then a regular check for the activity should be carried to achieve better working condition, reduction of fatigue, improve use and condition of resources, equipment's and man power which makes ultimately the productivity to improve.

## 6. Lean Manufacturing Tools for Productivity Improvement

Lean manufacturing is “manufacturing without waste.” Waste has many forms. Material, Time, Idle equipment and inventory are examples. [5]

Lean manufacturing improve handling, inventory, quality, scheduling, personnel and customer satisfaction. Lean tools have not been derived or proposed in one single day. They have been derived from the research of many people throughout the history. As they are very complex & interdependent on each other and one can find similarities in one another.

Anything in the manufacturing process that does not add values to the product is known as waste. In other words, it is

nothing but the process for which customer does not pay to company. The seven most deadly wastages in common are:

- 1) Transportation - The unnecessary movements of operator, products or components from one place to another result in this waste. Unnecessary transport more commonly occurs together with product damages, lost parts and systems, which are related with movements.[2]
- 2) Inventory – Inventory is the quantity of materials in stores, which are required to manufacture a job. When they are not used they take up storage space, become useless which cannot be used for more important goods.
- 3) Motion - This waste comprises of all unnecessary movements occur when operator is moving around his work area and as a result of this time & efforts are wasted. All kinds of unnecessary motion may be caused by improper working standard practices, un-optimized process design or work space layout.[2]
- 4) Waiting- If operators, machine, system or materials of the production process are delayed by any reason, production time is wasted, the productivity is decreased & the cost of production will be increased.
- 5) Over Processing- It is a manufacturing of products in larger quality than required. This can also be result of not checking what the customer's real requirements are.
- 6) Over Production- It arises when the manufacturer is producing more products than the demand. This is the worst kind of waste, as it generally creates other kinds of wastes. It increases rework factor, material storage, processing, holding & waiting, as well as transportation & unnecessary motion.[2]
- 7) Defects (Rework, Scrap) - Rework is required when products and components are defective or damaged. Defects are caused by bad manufacturing processes (by human or machine errors). In worst case the items are discarded.

## 7. Inter relation with Work Study Principle

The basic definition of lean manufacturing can be stated as, perspective to manufacturing that searches for an opportunity to reduce the operation time of processes, increase maneuverability, and improve the corresponding attributes while reducing the 7 wastes. Similarly, work study examine the processes and the workplace condition with the help of charts and other visual techniques and make the process and workplace improve by efficiently using the resources, equipment's and manpower. Referencing the 7 wastes while performing the method study and time study many direct conclusions can be obtained which can collectively increase the productivity, the final objective of both principles at higher rates. This can help the engineer to solve the critical processes with new techniques keeping in mind the principles of both the methods which are in turn resolved for higher productivity.

## 8. Kaizen Problem Solving Concept

Kaizen is a Japanese word that has become common in many western companies. The word indicates a process of continuous improvement of the standard way of work. It is a compound word involving two concepts: Kai (change) and Zen (for the better). [7] The Kaizen methods and techniques

are valuable instruments that can be used to increase productivity, to obtain the competitive advantage and to rise the overall business performance on a tough competitive market. [6] Around the globe the concept of kaizen techniques have been accepted as the best methods of performance improvement within the companies since its implementing costs were minimal.

The Method provides every worker in the company, a common platform for sharing ideas to solve the problems faced by the company. This, in turn can bring the best alternatives for many bottlenecks and fatigue experiences, this method in all also develops the reliable and user friendly methods, for workers has greater experience as they spend their productive time at respective workplaces. Involving the workers during the problem solving phase of method study can open up the new window of solutions which would be better more practical and resistance free fulfilling the objectives of the method study for higher productivity. These method brings together all the employees of the company ensuring the improvement of the communication process, inter-relations, working objective and our cause the productivity.

### **9. Cell Manufacturing Technique for Productivity Improvement**

Group Technology (GT) is a processing philosophy based on the principle that similar products should be processed similarly (Askin and Standridge, 1993). The basic idea of GT is to decompose a manufacturing system into subsystems. It reduces (Kusiak, 1990) production lead time; work-in process; labor; tooling; rework; scrap material; set-up time; delivery time; and paper work. The idea behind GT is to improve efficiencies by exploiting similarities. The application of GT influences time power of operation, WIP inventory, material handling, job satisfaction, jig and fixture, set up time, required space, quality, finished product and labor cost (Wemmer and Hyer, 1998). This concept has been successfully employed in cellular manufacturing in which, parts with similar processing requirements are identified and grouped into part families, and then machines with different processing capacities are placed within a cell (Kusiak, 1990). [8]

Group Technology (GT), although being used in the manufacturing environment since late 1950s, is still drawing increasing interest from manufacturers and researchers because of its many applications for boosting productivity [9].

Cell manufacturing practice ensures and motivates the use of jigs and fixtures for every similar processes, economic use of material, and greater flexible options in manufacturing, on the other hand ensures the reduction in work in process time, set-up time and process lead time. This results however, reduces the unnecessary movements, inventory level, waiting and complexity of the process which are the defined wastes to be reduced during lean practices.

### **10. Conclusion**

Thus it can be concluded that with increasing competition in modern world of industries, small and medium scale industry should also work in the direction of quality improvement and productivity improvement by using work study concepts with other relative productivity tools.

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### **References**

- [1] Kootenay Boundary Productivity Initiative, Report on Productivity and Productivity Improvement Tools, February 6, 2012
- [2] Prathamesh P. Kulkarni, Sagar S. Kshire, Kailas V. Chandratre., "PRODUCTIVITY IMPROVEMENT THROUGH LEAN DEPLOYMENT & WORK STUDY METHODS" International Journal of Research in Engineering and Technology Volume: 03 Issue: 02, Feb-2014
- [3] Section 2: Operations research, work study and work Measurement
- [4] "INTRODUCTION TO INTERNATIONAL LABOUR OFFICE WORK STUDY" INTERNATIONAL LABOUR OFFICE, GENEVA 1969
- [5] Lean Manufacturing Essentials, www.strategosonic.com
- [6] Gratiela Dana BOCA, "KAIZEN METHOD IN PRODUCTION MANAGEMENT", International Scientific Conference YOUNG SCIENTISTS 2011
- [7] Rajesh Gautam, "Kaizen Implementation in an Industry in India: A Case Study", IJRMET Vol. 2, Issue 1, April 2012 [3]
- [8] ArashShahin, "Group Technology (GT) and Lean Production: A Conceptual Model for Enhancing productivity", International Business Research, Vol. 3, No. 4; October 2010
- [9] Kamal Khanna, "Group Technology in Design of Manufacturing Systems- A Review", AIMTDR 2014, IIT Guwahati, Assam, India.