

Time Study of Nigerian Engineering Works Ceiling Fan Production Line

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Abstract : *It is seen as a colossal waste if there have been great improvements in the machinery, systems and tools, but they still do not function at optimal capacity. This have been attributed to non-optimal interaction of these systems with labour or other factors. Again, if there is poor work measurement to understand the productivity level in the operation. Productivity improvement is a continuous activity in manufacturing systems. This is as a result of the need for industries to have capability of coping up with customer demands to deliver quality products and on time. Hence, work measurement is an approach in which production system undergoes time study analysis to increase productivity in the industry. This paper is aimed at improving productivity of a production system through work measurement approach. Time study technique of work measurement was used to establish labour standards for the ceiling fan production line of the Nigerian Engineering Works Limited. The estimated sizes calculated in this research work offered 95% confidence that the sample average cycle time would be within 5% of true average.*

Keywords: Productivity, Work measurement, Production line, Time Studies, Labour performance,

Introduction

The way an industry or business can grow and have sustainability is by increasing its productivity. This have led to the increasing of effort to improve the utilization of resources. Appropriate measures of performance for systems have become an important requirement. The concept of productivity provides us with one such measure [1]. Industrial Engineering plays many key roles in an organization which includes business process improvement, building effective measurement systems, integrating organizational systems performance measurements, determining resource plan, and estimating costs [2]. In this research, the building of effective measurement systems is considered. Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a task at a defined rate of working. It is responsible for investigating, reducing and eliminating ineffective time, in the work space. This is done on the performance of an operation or series of operations. This approach is very necessary for both the planning and control of operations. Without measurement data, it will be difficult to determine the capacity of facilities, determine the rate of production and also labour utilization and efficiency. In general, work measurement provides a sound basis for: comparing alternative methods, assessing the correct initial manning (manpower requirement planning), planning and

control, realistic costing, financial incentive schemes, cost reduction and cost control, identifying substandard workers. A work has to be measured to discover and eliminate lost or ineffective time, establish standard times for performance measurement, measure performance against realistic expectations and set operating goals and objectives.

Furthermore, productivity stands as a yardstick to measure the progress of an industry. Generally productivity is said to be the ratio of output to some or all of the resources utilized to produce the output. The productivity measures help to identifying the effectiveness of resources utilization in a system in producing the desired output [3]. Therefore, measurement of work is a basic technique that results in increased productivity. Thus, work measurement technique is mainly used to quantify the work content related with a job, in terms of the standard time. Setting of the time standard is done using four techniques which are mainly: time study (stop watch technique), synthesis, work sampling, predetermined motion and analytical estimating. Time study and work sampling involve direct observation and the remaining are data based and analytical in nature.

Time study is the most widely utilized method to determine standard time. It is the fundamental approach of work measurement as some of the other techniques either derive from it or are variants of it.

It is a technique of establishing an allowed time standard to perform a given task, based upon measurement of work content of the prescribed method, with due allowance for fatigue and personal and unavoidable delays [4]. In addition, this technique is used to determine the time required by a qualified and well trained person working at a normal pace to do specific task and exerting average effort. The result of time study is called the standard time (the total time in which a job should be completed at standard performance i.e. work content, contingency allowance for delay, unoccupied time and interference allowance, where applicable). In this technique the job to be studied is timed with a stopwatch, rated, and the Basic Time calculated. Time study and the other method of measuring work are used for many purposes including: determining schedules and planning work, determining standard cost and as an aid in preparing budgets, estimating cost of product, determining machine effectiveness, basis for a payment, basis for labor cost control [5,3]. Furthermore, these necessary factors are required for effective time study: co-operation and goodwill; defined job; defined method; equipment of proper working condition; quality standard and checks; experienced, qualified and motivated worker; method of timing; method of assessing relative performance; work schedule breakdown; definition of break points and recording media [6].

In this study, work measurement is conducted at Nigerian Engineering Works Limited Port Harcourt. The Newclime ceiling fan production line of the manufacturing firm was utilized for the study. The objective of this study is to determine

standard time of assembly process for a ceiling fan. This is to establish adequate workloads of production line in order to increase productivity.

METHODOLOGY

The data were collected and analyzed according to the requirements. Data analysis was done after data collection. The following steps were followed in getting standard time: conduct stopwatch time study, record the details, measure the time of each task, determine standard rating, calculate the normal time, determine the allowance, and determine the standard time.

Time Study is based on a record of observed times for doing a job together with an assessment by the observer of the speed and effectiveness of the worker in relation to the observer's concept of Standard Rating. Standard rating is also defined (in British Standard BS3138) as: "The rating corresponding to the average rate at which qualified workers will naturally work, provided that they adhere to the specified method and that they are motivated to apply themselves to their work". If the standard rating is consistently maintained and the appropriate relaxation is taken, a qualified worker will achieve standard performance over the working day or shift. The British Standards Rating Scale which is a scale where 0 corresponds to no activity and 100 corresponds to standard rating was adopted. Considered also was the basic time for a task, which is the time for carrying out a task or an operation at standard rating.

Results and Discussions

Following the data collected and the corresponding analysis carried out, the obtained results are as tabulated in the tables displayed in this section.

Table 1: Standard time summary for ceiling fan components

Components	Trimming	Shearing	Blanking	Hole forming	Radiusing	1 st forming	Final forming	Total time (man-min)
Blade	$\frac{1/1}{0.35}$	$\frac{355}{0.18}$	$\frac{4/3}{0.22}$	-	$\frac{355}{0.18}$	-	$\frac{400}{0.15}$	1.08
Shank	-	$\frac{5000}{0.012}$	$\frac{1500}{0.04}$	$\frac{188}{0.32}$	-	-	$\frac{400}{0.15}$	0.52
Bracket	-	$\frac{6000}{0.01}$	$\frac{1200}{0.05}$	-	-	-	$\frac{3/5}{0.16}$	0.22

In table 1, the numerators are the expected (standard) production per hour in units at each workcenter. The denominators are the standard time for the operations in minutes. Therefore, the numerators were obtained using the equation:

$$\text{Hourly standard production} = \frac{60 \text{ minutes}}{\text{Standard time (in minutes)}} \quad (1)$$

Furthermore, table 1 shows the standard time and the hourly standard production for each workcenter. Each operative is

expected to produce the standard quantity within one hour. These are the standard target for the operatives in order for the system to achieve high/optimal productivity.

Table 2: Time study summary for ceiling fan component production

Component s	Operation s	Standar d time per piece (man-min)	Numbe r per set	Total time (man-min)	Expected productio n per set per Hour	Expected productio n per set per Shift (x8)
Blade	Trimming	0.35	3	1.05	57	456
	Shearing	0.18	3	0.54	111	888
	Blanking	0.22	3	0.66	91	728
	Radiusing	0.18	3	0.54	111	888
	Forming	0.15	3	0.45	133	1064
Shank	Shearing	0.012	3	0.036	1667	13336
	Blanking	0.04	3	0.12	500	4000
	Hole forming	0.32	3	0.96	63	504
	Final forming	0.15	3	0.45	133	1064
Bracket	Shearing	0.01	3	0.02	3000	24000
	Blanking	0.05	3	0.1	600	4800
	Forming	0.16	3	0.32	188	1504
				5.126		

From table 2, the total standard time per unit (per set) of components of ceiling fan is 5.13 man-min. In addition, the total standard time to manufacture a set of ceiling fan components (blade, shank and bracket) on the production line takes 5.13 minutes. This time excludes the time for material movement and change of machine tools. However, the cycle time was used to calculate the standard output or production for each component.

Conclusion

The research is aimed at finding the fundamental work measurement facts as it is critical and important in determining productivity in the industries. Therefore, the preferred and frequently used method of time study with the aid of stopwatch based on the practitioners' technical training, on job experience and existing company practice have been employed in this work. Time study technique of work measurement was used to establish labour standards for the ceiling fan production line of the Nigerian Engineering Works Limited. The labour standards formed the basis for analyzing the line idle time, balance delay, production efficiency and also productivity. The estimated sizes calculated in this research work offered 95% confidence that the sample average cycle time would be within 5% of true average.

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