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Time Motion Study in Determination of Time Standard in Manpower Process

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Abstract— **Time and Motion Study is rarely used in the industry nowadays. In this study, the company that involve in the rice based company.. This study using this type of study method in order to increase production and identify any improvement that could be made through identifying the process that involving manpower as the main reason and state the time standard in order to achieve the objectives of increasing the production and decreasing the cost. This study is using systematic observation, interview with discussion and stopwatch time study. Statistically Fit and Production Modeler software is used to test the data and make improvements. By stating the time standard for the process involving manpower, production rate increase and the cost will be less. Other than that, proposal for improvement could be made in order to enhance the effort to achieve the main objective of any business organization in the world.**

Keywords: Time and Motion Study, Ergonomics,Productivity, Manpower Factor, Time Standard

I. INTRODUCTION

The important thing in order to determine the success and performance of a company. This happen because, time is the measurement tools the level of company's performance. The measurement of the product or service successful would be known through the time study and time standard by work sampling and workers complaint [1]. It shows that time is the most important thing in determining company's performance and develop the operation level of the company. Time is defined as a component that used in measurement system to arrange events, compare duration time of an event and measure the motion of work element. Time is the huge thing in religion, philosophy and science, but it is define in a situation without controversy, that could be avoid consistently because it suits all kind of field [2].

Research Background

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Total cycle time is means of the combine effect of cycle time in all business processes from the time needed until reach satisfaction. In short, the total cycle time is defined comprehensively. It include all business process cycle time, and it focus on a single process. This study is execute in a rice based company in Sabah which is it is one of the rice processing factory. This factory involved variety main process that involved motion that influence operation time. Time and motion study impact the whole production rate of the company. Time and motion study is a method in order to determine the actual time needed to complete task.

Problem Statement

Time and motion study is the important aspect in business to determine the production rate. Another factor's that effect the production rate is raw material, operation cost, work force and others. All this factors will effect differently to each other. Even though, time is the most influence element this rate. Whether the motion time or the production rate, this element is taken care in any transaction in a company. In this study, the rice company is settling down the grading and packaging process. It involved both the machine and manpower. In the process of manpower has no time standard stated because as we know, manpower process will be influence by many factors. Not as the machine that had been set and produced as what we wish to. When there is no time standard, any task could be finished out of planned. In this study, the process that involved manpower in packaging process is determined and studied. While, a time standard is determined to know the time needed the process could be finished. In business, both of these elements are important to execute the maximum profitable production rate. Hence, with the application of Time and Motion Study the changes and improvement could be seen especially in cost and production matter.

Research Objective

The objectives in this study was to identify work, time standard to work which involves manpower in rice packaging process and see changes which occurred on cost and company production after Time and Motion Study takes place.

II LITERATURE REVIEW

The term Time and Motion Study refers to a broad branch of knowledge dealing with the systematic determination of preferable work methods, with the determination of the time required for the use of human or machine to perform the work by the stipulated method, and with the development of materials required to make practical use of these data [3].

Motion Study

The motion study aspect consists of a wide variety of procedures for the description, systematic analysis, and improvement of work methods considering the raw materials, the design of the outputs, the process or order work, the tolls, workplace and equipment for each step in the process and the human activity used to perform each step. Simplification is most effective method to reduce cost, that saving would be smaller compare to elimination or combining but still can be simplified.

Time Study

When aspects of time study contains a wide diversity of procedures to determine the amount of time required, under an excellent measurement of the state, for work associated with the human, machine, or a combination of both. It is has been introduced by Frederick W. Taylor since the year 1881, but is still widely used as a method of time study. Generally, time study is used to measure work. The decision results than the time study is the period in which a person in accordance with a job or task and fully trained to use specific method, will perform this task if the worker in the normal or expert. This is called the time standard for operation. Align the expert for a work may be made through several methods, where each Method is used only in accordance with some specific circumstances. Time study is include using stopwatch, 'Predetermined Motion Time System or Synthetic Time System', and 'Work or Activity Sampling". However, in this study, only the time study using Stopwatch Time Study will be used in the time measurement. The time study was also allowed to deduct all boarders. Standardization is the objective to be achieved. In organizations that operate without expert time, 60% than the normal organization of achievement. These statistics may be proved by the work sampling operation. If standard set, performance improved to average 85%. This is a 42% increase in performance.

Time and Motion Study and Produktivity

There are a set of information which has been expanded several years ago that was designed to increase productivity and the organization of certain individuals who develop an organization. Time and Motion Study have the objective to eliminate work that is not required, the design method and the most effective procedure, which requires little effort, and in accordance with the individuals who use them. Moreover, it provides a method to measure job performance or to determine the index production index for the individual or group work, each section, or entire factory [4].

III RESEARCH METHODOLOGY

This chapter will discuss methods used in research studies to obtain results. The data obtained will be collected and analyzed according to the proper specifications and appropriate. Among the important aspects to be considered here is the framework of research, study design, data collection methods, research instruments and measurement tools for analyzing research data.

Research Framework

This study is divided into three parts or stages of the first stage are data collection, data analysis, the second stage and third stage of the study results. There are several methods used to achieve the objectives of this study. After Highlighting literature, observation and data collection needed to review the data used in the analysis. Based on data collection and analysis, any problems and things that are not productive can be identified. Then, results from the test data to determine whether these results can be used or not and if there is data that has not been completed, the data collection carried out until it meets the objectives of the claim. After completion of data analyzed it is recommendations and opinions to the company.

Data Collection

Data and information collected is shaped primary data and secondary data. Primary data refers to data taken from the results of the observations made in the study done.

While secondary data were obtained through reading printed materials such as research journals, reference books related to research this subject, all previous research findings and articles needed to ensure the accuracy of the information, to enhance interpretation and understanding, and to produce high quality research. Information from Internet sources are also utilized in the best possible in the conduct of this study.

Research Instrument

In this study, three types of survey instruments will be used to obtain data and information from the respondents through observation with recording. External observation means systematic observation steps researchers need to plan before implement the study outside. Observations and recording made based on the work involved from the start until producing output. Meanwhile, researchers should concentrate on recording and recording any events associated with non-oral studies in special form. If necessary, discussions and meetings conducted to ensure that all managers involved in operations to ensure understanding of the structure of each system, work organization and operating characteristics of the company is in the details. While recording data through observation

is compatible with the theoretical study time and used movement.

Observation

In this study, conducted systematic observations of researchers required to observe overall work process in the factory, then the selection was made and carried out research work and the only process that only want to review. Based on observation, it is necessary to record everything that happens in every process from start until end of work processes.

Interview and Discussion: Interviews will be conducted via two methods of face and telephone conversations. In this method, information about the work or movement involving humans will be identified. This list is based on the work involved in the process that has registered the company.

Stopwatch Time Study: Study time using the stopwatch is measuring work to determine the policy guidance for future improvements. This method requires direct observation using a stopwatch. It is also to analyze the more specific process through which qualified workers in an effort to identify the most efficient in terms of time. Moreover, this method measures the time required to process the work is completed using the best way. Time measured using the stopwatch. There are various types stopwatches that can be used include, snapback, continuous, digital and computer. However, the stopwatch snapback used in this study because it more easily and have a quick response in the record. In taking the time to use the stopwatch snapback type, hours of work initiated at the beginning of the cycle on the first element of work, and read simultaneously and will again be empty after a full cycle. This allows time for each element inserted directly into the form without counting study time.

Data Analyze: After data collection is carried out, the next step are analyze the data carefully for each work process. Analyzing data is based on observations and interviews, and all the data involves work has been recorded. Experiments carried out on all the facts and the data were recorded using charts and graphs which are produced using software Stat Fit and Pro Model.

Stat Fit Software: Stat Fit statistics are matched with data obtained for the most appropriate analytical distribution. Operating software is kept intuition, which will assist in the extensive files. Features 'Auto Fit' is automatically match a continuous distribution, resulting in comparisons between distribution types, and to measure the absolute acceptance of each distribution. Function 'Export' is the distribution that has been translated to match a more specific form for the selected software simulation. In this study, the software used is Pro Model. Characteristic result of using this software includes a descriptive statistic, budget parameters, good test match, graphical analysis, conversion to product simulations and more.

Pro Model Software: Pro Model software (Production Modeler) is a medium for simulation modeling various systems and engineering services. It is very useful to run testing of various design alternatives, ideas and processes before the actual implementation. Improvements in the system design process of new or existing can be modeled and tested before engaging in cost and time. Various process operations and alternatives can be compared and analyzed to ensure selection of the most appropriate and cost savings in time.

IV DATA ANALYSIS AND OUTCOME

In completing this research and to achieve each objective, it is important to analyze the data. The main thing that is focused in this chapter is to identify the result of research findings researchers to achieve the objectives of the study conducted. There are several ways to analyze data using software such as SPSS, Microsoft Excel or Minitab software. However, in this research cases, Stat Fit and software Pro Model used to achieve the objectives of analyzing the data.

Data Collection

Data collection is intended to determine the data needed to develop process design. The data collected describe how the operations process, when, where and how each job is executed. Data collected as much as possible in between 32 times within a month based on systematic observation, study time using the stopwatch and process flow charts, data is included:

(i) Flow chart for each process
(ii) Information operations in detail for each process
(iii) Production time
(iv) Movement from one process to another process

Work Process

Based on observations made systematic studies of the area, we can know that there are seven key processes in the production of rice ready in the package containing 5kg and 10kg.The description of each work process and sub process specified in Table 1. The process begin with workers loading the raw materials in the sacks of rice in the lift and then go into a processing tank and ended with a pack of rice ready for delivery to customers.

Production Time

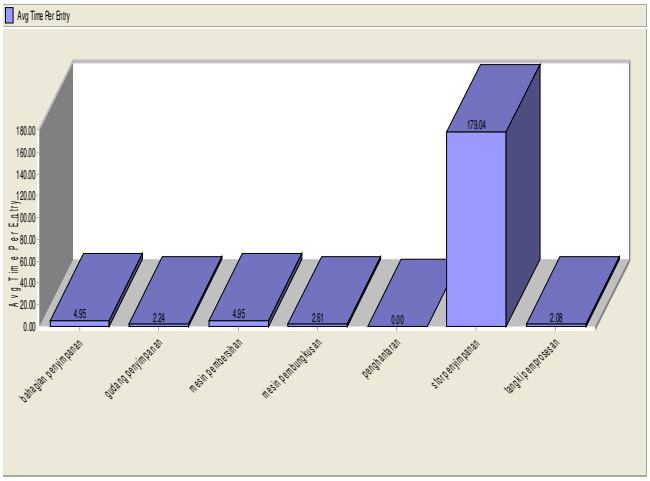

Figure 1: Average Time per Entry

Based on the histogram in Figure 1 above, we can know that the time required to complete each process, in which storage takes the longest compared to other processes. Storage takes the longest because it includes the process of raising rice packs weighing 10kg and 5kg manually using the manpower to keeping the store is located quite far from where the packaging, which took 179.04 minutes. This distance has resulted in wastage of time and delay the process happens. Meanwhile, the processing tank takes the least of 2:08 minutes to separate and mix of rice destroyed together. It takes a very short because of the use of fully automated machines are used. Delivery take the time of 0 min in the histogram because there is no shipping information recorded in this research, only involves the packaging of rice only.

Scientific Data Analyzing

In the simulation, the data has been collected must be analyzed and interpreted first, to ensure that the operating system is described accurately in this model. To generate data presentation, data analysis should be to determine the suitability of the data in this simulation because not all data can be used indiscriminately irrelevant data and not important to be ignored. In this research, analyzed the data is using software such as Stat Fit.

Stat Fit Software: Pro Model and comes equipped with Fit Stat. By using the Stat Fit, set of data can be automatically analyzed, tested for use in process simulation, and matched with the distribution in Pro Model. Analyzed the data calculated using this method is that all work processes involving humans, the filling, packing and organization. Data for the three processes is analyzed using Stat Fit for distribution as the information required in the process model in Pro Model.

Table 1: Type of Distribution

Process	**Distribution**	**Rank**	**Acceptance**
Filling	Lognormal	80.8	Do Not Reject
Packaging	Lognormal	100	Do Not Reject
Arrange	Lognormal	100	Do Not Reject

Motion of Work Process

After using the application software Pro Model, we can note that the layout used in the company is not very efficient in terms of any order, it is not proper. Figure 2, shows the movement involved in the work flow processes involved. Movement in the work process is analyzed to decide the best process flow operations in producing a number of products. From Figure 3, we can note that the restructuring process and storage process can be combined into one process. This can reduce the amount of the primary process and certainly can reduce production time as well.

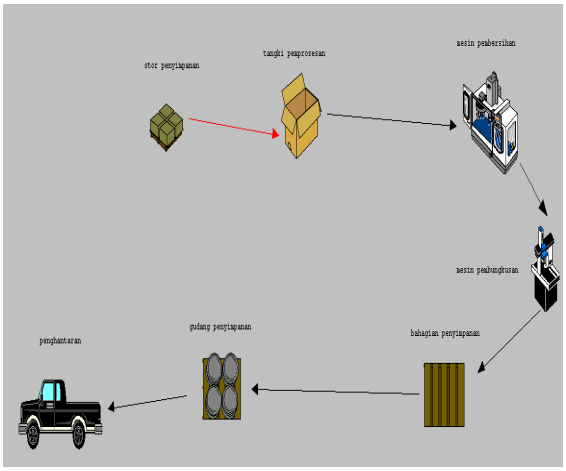

Figure 2: Current Layout

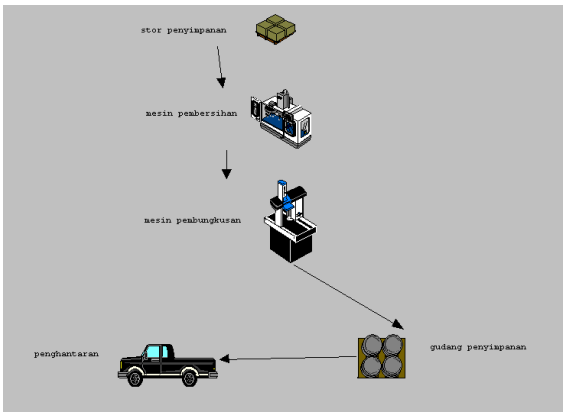

Figure 3: Propose Layout

Based on the analysis and discussion about the parameters, we can conclude that there are seven all processes, including filling, mixture, packaging, storage, cleaning, organization and delivery. Source data are important in determining the improvement in the problem.

Overall, the work process took 3:39 hours. In this research, the process involved to be identified and is only analyze involving human consumption only. Process is in the process of filling, packing and organization. As we know, a lot of human energy consumption is influenced by external factors such as level of motivation, emotion and environment. If there is no time standard set by the company, employees will work with arbitrary and will thus affect the quality of the product. Based on data collection and model simulations, we can know that the average time to complete production process of each entry of raw materials is 3:39 hours without setting time standards for

each process involving humans. If the standard is set, employees will strive to complete work in time.

Table 2: Comparison of the Average Time Per Entry

Process	Current Time	Standard Time
Filling (min)	3.71	3.25
Packaging(min)	2.56	2.0
Setting (min)	4.98	4.5
Total Time Cycle Complete (hr)	3.39	3.21

Table 2 above shows the comparison between the current process and the process by setting time standards for each process involving the human raw material for each entry into the system. Reduction of production time of 5:31% gives a change of production time and total number of production companies. This can reduce production time and thus reduce costs.

V DISCUSSION AND CONCLUSION

Introduction

This chapter will explain the continuation of chapter four, where it is further discussion about the problems that arise when there is no standard time for a process involving humans. For this chapter, researchers should propose some improvements to the company. Proposal must contain the parameters used in this research, namely, the number of work processes, production time, and the layout of the production plan. In addition, researchers also submit several proposals appropriate to benefit certain parties. In fact, this study provides several recommendations to the parties who are interested to conduct research about research and innovation that is increasingly regarded seriously.

Research Contributions

Based on the discussion in chapter four, we can conclude that there are various problems that will occur in connection with the production, which takes more time than we expect because of the attitude of workers themselves. So, matters pertaining to this study are:

(i) Production Time
(ii Production Layout
(iii) Number of process

Based on observation, data collection and analysis, researchers perform simulations of far closer to identifying the real problem. Then, based on the current models, researchers propose a new process model that contains the new work process that combines some of the production process to reduce total production time. The new model work processes simulate to illustrate the process flow of work involved. Researchers produced a new work processes to make the comparison process produces the best work in the production. This new work processes that will reduce the number of production processes and the amount of time required. Comparison between the current and the new work is shown in Table 3.

Table 3: Comparison of Total Time

Process	Current Time	Time Standard
Total Time Completed Cycle (hr)	3.39	3.21

Production Time : Before the improvements made, the current production should be measured first. Then, measurements will be used as a basis for determining the level of improvement of work processes. According to the study time using the stopwatch, wasted time, inaccuracies and inconsistency that arise can be avoided. It also facilitates the work and produce products with a shorter time. Table 3 shows that, during the work process take longer, more than 10.8 minutes when setting a standard time. Therefore, this improvement indicates that no time can be effectively avoided, where improvements will enable the company to achieve goals and objectives to reduce costs and increase production.

Number of Process: Consolidation process can be done to reduce operation time. This can also simplify the existing work to ensure that companies operate effectively or not. Studies have also said that the movement to make improvements to work processes is through changes, elimination and consolidation process.
Production Layout : The layout is effective layouts that can minimize production time, using the space provided the complete proceedings of the process and facilitates the work done. It is a key that determines the company is efficient or not in production. Proposed a new layout is shown in Figure 3. Changes have been made and the results showed little change occurred. Table 4 shows the changes that occur. Each location shows the reduction of processing tanks, except for merger process has occurred in this location. Storage showed 68% reduction, machine cleaning of 76.22% increase in packaging machine and an increase of 87.55%.

Table 4: Space Utilization Comparison

Location	Current Layout (%)	Propose Layout (%)
Storage Store	41.96	13.44
Cleaning Machine	23.52	98.94
Packaging Machine	12.27	98.52

Recommendation for Future Research

After carrying out this research, there is some connection and relationship that must be done during data collection. Data collection and analysis is important in getting accurate results. If there is data that is inaccurate, necessarily occur between inaccurate data. This result can make the findings do not meet the objectives to be achieved. Among the recommendations are the following:

(i) the distance between the machine and the processing must be measured first and recorded prior to produce more accurate comparison.
(ii) Collection of data that is made should include the appropriate times such as during the busy, time and time regular audits (temporarily stop production).
(iii) The level of health workers was taken for each data collected to identify the reasons why problems arise in their work.
(iv) During the data collection is done; make sure there is no problem in the production such as machinery and damaged social problems that can disrupt the production process indirectly.

Pro Model Software

Pro Model simulation study is a tool that is often used by many researchers that involves movement and engineering. It is generally used to produce a system design. Through this software, we can use existing information to reflect the actual system. In addition, the software is very easy to use and applied and it is very suitable for use by planning officers and managers in determining solutions and improvements that are complex to be resolved manually. Based on [5], producing a simulation model is a process of designing a real system and conduct studies, research on which this model can reduce time, cost and disruption of the actual system. On behalf of the company, if the simulations can be applied in total in the production and development operations, it is possible to maximize the true achievement of the company. This is because the nature of this simulation is simple and provides many benefits to users. While, for industry, simulation is much help in determining the reliability of a proposal and plan done. In addition, the industry can also determine the most appropriate alternative use without involving the use of any costs and waste time if it is determined through trial session first. Although software simulation takes a fairly high cost but it is very beneficial for the long term used. The high cost to produce higher returns in the long term is very worthwhile and productive.

Conclusion

Based on the discussion about all the features and criteria which show the organization can maximize production and optimize costs. When this can be applied, organizations can leverage the cost and time in efforts to develop and promote them. Researchers are note that can be optimized through the use of cost comparison results for the location of the Pro Model software. Meanwhile, to maximize production observed through comparison of results for the entities of this software. The objective of this study can also be achieved by the application of Study Time and movement, a process that is human can be identified and the standard can be determined. In addition, positive changes that occur can also be observed and concluded that the reduction of cost and time can be reduced in line with efforts to increase production organization.

VII REFFERENCES

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