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KCT BUSINESS SCHOOL

IMPLEMENTATION OF AUTOMATION SYSTEM IN ROOTS INDUSTRIES INDIA LIMITED COIMBATORE

A Project Report

Submitted

By

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KCT
BUSINESS SCHOOL

BONAFIDE CERTIFICATE

Certified that this project report titled **"Implementation of Automation system in Roots Industries India Limited Coimbatore"** is the bonafide work of **Mr.B.Prithiviraj, 10MBA41** who carried out the project under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other project report or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other candidate.

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ROOTS INDUSTRIES INDIA LIMITED

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PROJECT COMPLETION CERTIFICATE

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This is to certify that **Mr. B.Prithiviraj**, Roll No **10MBA41**, a student of KCT Business School, Kumaraguru College of Technology, Coimbatore had undergone a Project entitled **"Implementation of Automation In Roots Industries India Limited"** between **04.07.2011** and **30.07.2011**.

During the tenure, his performance was **good.**

Yours faithfully,
For **ROOTS INDUSTRIES INDIA LIMITED**

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SYNOPSIS

Due to intense competition in the business environment, companies need to compete with their rivalries on all aspects. One such aspect is the productivity which could be improved continuously. So, to improve productivity, various methods are used. But, for ensuring the effectiveness of the work processes, measurements are to be carried out. Time Study is one of the work measurement techniques that help to determine the standard time required for a worker to perform the assigned job.

In Roots Industries India Limited (Thoppampatty unit), most of the processing works are done through sub-contracting. There are substantial amount of workers in assembling of horns, which involves more manual work. Hence, this area needs to be concentrated to find out the existence of delays in work and the reasons for such delays. This project involves time study using stop watch to record the time taken to accomplish a task. Performance rating and allowances calculations are made to find out the standard time required to perform the task. This helps the company to identify the gap in production and better define their capacity.

The study is carried out by dividing each task in work elements and the time taken for each element is measured. The performance rating for each worker is calculated based on factors such as skill, effort, conditions and consistency using Westinghouse rating system. Allowances required for work is calculated based on personal, fatigue and other factors. An in-depth study is made to find out the factors that are to be considered to find the allowances separately for different activities. This study is a direct observation technique and hence it gives a clear idea of the reasons for the delay in work. Finally by implementing an automation system all the time consuming factors can be avoided.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO THE STUDY:

In this fast moving business environment the industries and companies find it really difficult to cope up with changing business environment, increasing competitors, technological improvement and etc. Therefore, any company will face direct or indirect problems throught their progress. In order to overcome all these issues, the company / organization must quickly adopt to the changing scenario. The company which does adopt survives and the company which doesn't adopt finds it really difficult to sustain in the industry or completely comes to an end.

In this study, we are going to go through such a company, which was able to put aside the obstacles put in front of it. The Roots Industries India Limited was able to make it possible by quickly adopting to changing scenario.

1.2 INDUSTRY ANALYSIS:

The first car ran on India's road in 1897. Automotive industry emerged in India in the year 1940s. Mahindra & Mahindra was established by two brothers as a trading company in 1945 and began assembly of Jeep CJ-3A utility vehicles under the license from Willys. The Company soon branched out into manufacturer of light commercial vehicles (LCVs) and agricultural tractors. After economic liberalization in 1991, the Indian automotive industry has shown sustained growth as a result of competition and relaxed restrictions. Several Indian automobile manufacturers such as, Tata Motors, Maruti Suzuki and Mahindra & Mahindra, expanded their domestic and international operations.

The Automotive industry in India now is one of the largest in the world and one of the fastest growing in the world. Around 17.5 million Vehicles including 2 wheelers and 4 wheelers are being manufactured in India and 2.33 million exports every year. India is the second largest motorcycle manufacturers with an annual sales increasing 8.5 million in 2009. A chunk of India's car manufacturing industry is

India operations of Ford, Hyundai, Renault and Nissan headquartered in the city and BMW having an assembly plant on the outskirts. Chennai accounts for 60% of automotive exports. The Chakan corridor near Pune, Maharashtra is another vehicular hub with companies like General Motors, Volkswagen, Skoda, Mahindra & Mahindra, Tata Motors, Mercedes Benz, Land Rover, Fiat and Force Motors having assembly plants in the area.

With automobile industry growing in such a rate, the auto parts industry gains its advantage from this scenario. One such Industry is the Roots Industries Limited. They are the leading Horn manufacturing company in India and 11th Horn manufacturing company in the world.

1.3 COMPANY PROFILE:

1.3.1 Company Name: Roots Industries Limited

1.3.2 Company Logo: ROOTS

1.3.3 Company Website: http://www.rootsindia.com

1.3.4 History:

Roots Industries was established in the year 1970 with a vision and commitment to produce and deliver quality products adhering to International standards. The headquarters is located in Coimbatore, Tamilnadu, India. Roots Industries has been a dominant player in the manufacturer of Horns and other products like Castings and Industrial Cleaning Machines.

1.3.5 Roots Group of Companies:

1. Roots Industries India Limited
2. Roots Auto Products Private Limited
3. Roots Multiclean Limited
4. Roots Cast Private Limited
5. Roots Precision Limited
6. Roots Metrology Limited

1.3.5.1 Roots Industries India Limited:

It all started with just a honk. Encouraged by the response, they (ROOTS) kept on moving ahead. In the beginning, they did not realize that they would make such an impact. Slowly but surely, the reverberations were felt far and wide. Indian automobile market responded to our call. Soon the global market too followed suit. Roots horns, in a very short span of time, got a place of pride in millions of vehicles across the globe.

What more could they ask for? But they did ask more. They indeed made a sound beginning but they could not rest on our laurels. The journey has to go on. There are more miles to go and more challenging territories to explore.

1.3.5.2 Roots Auto Products Private Limited:

Commercial transportation plays a crucial role in the economic development of nations. Roots Air Horns ensures safe and smooth passage of thousands of heavy vehicles on the move.

Roots Auto Products Private Limited (RAPPL), the largest supplier of Air Horns in India caters to the needs of several OEMs: Ashok Leyland, Caterpillar India and JCB Escorts. Roots Air Horns also find a place of pride in Passenger vehicles, Trucks, Earth Moving equipment, Material Handling equipment, etc. Roots Air Horns are exported to countries in North America, Europe, Middle East, Africa and SAARC region.

1.3.5.3 Roots Multiclean Limited:

The genesis of Roots Multiclean Ltd., (RMCL) is due to the vision of the promoter of Roots group of company about the requirement of sophisticated cleaning equipment in the country following globalization of business and entry of Multi Nationals who have very high standard of housekeeping. RMCL, situated in the suburbs of Coimbatore, is a Joint Venture with Hako Werke Gmbh & Co., Germany. It commenced manufacture of cleaning equipment in early 90s at its modern factory located amidst natural greenery. RMCL is the sole representative of Hako Werke Gmbh & Company's entire range of cleaning equipment for India and SAARC countries. To improvise and facilitate a better service to its customers, RMCL has established

Regional offices in all Metros and a huge dealer network in bigger Cities and States. The superior quality products and the added advantage of good after sales service has established the company as the country's largest manufacturer of floor cleaning equipment.

1.3.5.4 Roots Cast Private Limited:

Roots Cast Pvt. Ltd., (RCPL) (formerly known as Aruna Auto Castings Private Limited) was established in 1984 to meet the captive requirements of the Roots group. With its ever probing eye on the needs of the market, the company in the late 80s expanded its operations to manufacture High Pressure Die Cast Aluminium and Zinc components to the exacting needs of various customers in Automobile and Textile Industries with a high degree of Quality and Perfection.

RCPL now has established itself as a major player in the die cast component manufacturing thanks to the expertise built in the core activities like tool design, tool making and pressure die cast component manufacturing. RCPL supplies machined castings and sub-assemblies as per customer requisitions.

1.3.5.5 Roots Precision Products:

Roots Precision Products was established in 1987 to address the in-house tooling needs of the diverse industries in Roots group. Owing to continuous improvement and investment into better resources, the company has become self-sufficient. It is catering to the needs of various industries. RPP acts as a one-stop solution for tooling and precision machining.

1.3.5.6 Roots Metrology Laboratory:

Roots' state-of-the-art Metrology Laboratory is a comprehensive calibration centre in South India that offers mechanical, electrical, torque, pressure and vacuum calibration instruments - all under one roof. The laboratory is equipped with advanced facilities traceable to national / international standards. RMTL is accredited by National accreditation Board for Testing and Calibration laboratory as per ISO/IEC 17025: 2005 standards in the field of Mechanical – Dimensions, Pressure/Vacuum, & Force. The laboratory offers on-site

machine, profile projector, Toolmakers Microscope, Pressure switches, Pressure gauges, Temperature indicators, RTDs, Temperature sensors/scanners, Electronic transmitters, Pressure reducing valves, Ovens, etc. The expertise of the laboratory has attracted many renowned Public and Private Sector undertakings.

1.3.5.7 Roots Polycraft:

Roots Polycraft (PC) was established in 1988 to manufacture precision plastic components. It is equipped with latest microprocessor injection molding machines to maintain consistent process parameters. Over the years, Polycraft has gained skills and unique techniques to manufacture small and medium size components for Automotive, Pump, Textile, and Medical Industries besides meeting the captive requirements of Roots Group. Being fully equipped to provide the best service, Polycraft has satisfied customers who have helped augment its technological advances. The Company's commitment towards the customer is demonstrated with quality products and service. This has resulted in continuous growth and product diversification. The process is closely monitored with proven techniques to obtain consistently good quality parts.

1.3.5.8 Roots Vision:

We will stand technologically ahead of others to deliver world-class innovative products useful to our customers. We will rather lose our business than our customers' satisfaction. It is our aim that the customer should get the best value for their money. Every member of our company will have decent living standards. We care deeply for our families, for our environment and our society. We promise to pay back in full measure to the society by way of selfless and unstinted service.

1.3.6 Global Alliances for Competitive Advantage:

Roots is a leading Original Equipment supplier to major vehicle manufacturers like Mercedes Benz, Mitsubishi, Mahindra & Mahindra, Toyota, Fiat, TELCO, Harley Davidson, Navistar etc. The ever demanding requirements of Customer Satisfaction has strengthened the R & D activities and increased Roots technical competence to international standards.

Roots Multiclean Ltd. (RMCL) is a joint venture with Hako Werke GmbH & Co., Germany, one of the largest cleaning machine manufacturers with global operations. RMCL is the sole representative in India and SAARC countries for Hako Werke's entire range of cleaning equipment. The quality of RMCL products is so well established that Hako buys back a major portion for their global market. RMCL also represents several global manufacturers of cleaning products and is gearing itself up to provide customized, total cleaning solutions.

1.3.7 Product Variants:

1. Electric Horns
2. Air Horns
3. Cleaning Machines
4. Castings
5. Precision Products
6. Metrology
7. Poly Products
8. Nature Cure Home

1.3.8 Milestones:

1970 Promotes American Auto Service for manufacture of Electric Horns.

1972 First to manufacture Servo Brakes for light motor Vehicles.

1984 Roots Auto Products Private Limited was estimated to manufacturer Air horns.

Die Casting Unit commences commercial operations.

1988 Polycraft, a unit for Plastic Injection Moulding was established.

1990 Roots Industries India Ltd takes over Electronic Horn business.

1992 RMCL enters into Techno-Financial collaboration with M/s.Hako Werke GmbH, Germany.

1994 Production of floor cleaning equipment commences.

Roots Industries India Ltd wins American International Quality Award.

1999 Becomes the first horn manufacturer in Asia to obtain QS 9000.

2000 Becomes the first horn manufacturer in Asia to obtain VDA 6.1 and the first in the world to win ISO / TS 16949.

2000 The first to introduce digitally controlled air horns and low frequency. Low decibel irritation free Jumbo Air horns.

2003 Roots Industries India Ltd., Horn Division is accredited with ISO 14001: 1996.

2003 Roots Industries India Ltd., upgraded its ISO / TS 16949 from version to 2002 version.

2004 Roots Industries India Ltd (RIL) opens its 100% exclusive Export Oriented Unit at their Horn Division Thoppampatti, Coimbatore to cater the needs of Ford North America.

2004 RIL's EOU commences its supplies to Ford, North America.

2004 Roots Multi-clean Limited (RMCL) inaugurates its 100% EOU Plant at Kovilpalayam, Coimbatore.

2004 Roots Cast Private Limited (RCPL) inaugurates its Unit II at Arugampalayam, Coimbatore.

2004 Roots Auto Products Pvt Ltd (RAPPL) expands with its Machining Division at Arugampalayam, Coimbatore.

2004 RIL successfully launches its Malaysian Plant

2004 The group company American Auto Service is accredited with ISO 9001: 2000

2005 Roots Industries India Ltd., is credited with MS 9000, a pre-requisite for Q1 award for Ford automotive operations suppliers. Focus on system and processes.

2005 Roots Metrology & Testing Laboratory has been accredited by National Accreditation board for testing & calibration in the field of Mechanical - Linear & Angular.

2005 Roots Industries India Ltd., is awarded Q1 by Ford Motor Company.

2005 Roots Industries India Ltd., Horn Division upgraded its ISO: 14001 from 1996 version.

1.4 STATEMENT OF PROBLEM:

Low utilization of equipment in Windtone 75 horn diaphragm forming process in the 30 ton hydraulic press, which involves process parameters (forming pressure, dwell time) and man power for handling parts.

Due to the following reasons,

1. Negligence of the machine operator.
2. Idle time of the equipment increases due to co-worker disturbances, allowance time taken and monotonous work leading to fatigue.
3. Management loss like waiting for raw material and waiting for instruction.
4. Motion loss like movement of hand and limbs to perform assigned tasks.
5. Speed loss (Variation in process time)
   - Inconsistency in every process cycle.

1.5 OBJECTIVES :

1.5.1 Primary Objective:

To propose an automation system as a replacement for man power to increase the productivity.

1.5.2 Secondary Objective:

To study the existing process involved in the diaphragm forming in hydraulic press and also understanding the concepts of work measurement.

1.6 SCOPE OF THE STUDY:

By converting the manual process being carried out at present in that particular section into an automated process (i.e., using robots), we can reduce the use of man power to a greater extent, reduce time consumption and increase the productivity.

CHAPTER 2

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

As per the report given by **Mr.Henry De Vos**, Manager, Management Services, American Institute of CPAs, measurement techniques are employed to determine how much time should be taken to complete an operation. Trained analysts observe the employees performing operations and record the elapsed times. The elapsed times are adjusted by the analyst rating the pace at which the work was done in comparison to the normal pace. This adjustment is made to obtain the "should take" time for a trained operator working at a normal pace. Before the standards are used in performance measurement, they must be approved by the supervisor as being reasonable and attainable.

According to **Vincent G. Reuter**, Stop-watch time study remains the dominant technique, although elemental standard data, motion-time systems, and work sampling systems have made inroads on many applications for work measurement. Although work measurement is most extensively used in the production work areas, substantial inroads have been made toward nonproduction applications and limited use in the clerical and administrative work areas.

According to **Herm Gershoni** and **Norman Rudy**, one of the fundamental concerns of work study practice is the accuracy of performance standards. Such standards are influenced by many factors but unfortunately investigations of accuracy usually deal with only one or two of the most obvious elements of the problem. For example, most attempts to control the accuracy of a Time Study deal only with cycle-to-cycle variation of the measured element times. The cycle-to-cycle variation of element times is only one of many factors influencing the total variance of standard time. The specific motions used to perform the task, inaccuracy of stop watch readings, bias of the time study leveler, and the variance of leveling have appreciable effects on the accuracy of standard time. Thus all the relevant factors must be considered if one is to have a meaningful appraisal of the overall accuracy of the standard time established.

CHAPTER 3

RESEARCH METHODOLOGY

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RESEARCH METHOLOGY

This chapter explains the research tools that have been applied by the researcher to collect data analyze and interpret results. In this study, the researcher seeker to understand the current situation and process followed by Roots Industries India Limited. Results obtained were analyzed and used as a measure to decide on the appropriate automated production process to be implemented. Research methods are a program that guides the researcher in collecting, analyzing and interpreting data and facts. The following tools were used in this research:

3.1 TOOLS USED IN THIS RESEARCH:

3.1.1 INTERVIEWS:

There are many possible ways of gathering information directly from participants if such information cannot be observed. One of these direct ways of gathering information directly from participants is by interviews. An interview involves direct personal contact with the participant who is asked to answer questions.

There are two types of interviews, namely, non- scheduled structured interview and scheduled structured interview. Non-scheduled structured interview is structured in that a list of issues which have to be investigated is made prior to the interview. It is non-scheduled in that the interviewer is free to formulate other questions as judged appropriate for the given situation.

The most structured way of getting information directly from the respondents is by means of scheduled structured interview. This method is based on an established questionnaire with fixed wording and sequence of presentation. The researcher used a scheduled structured questionnaire in this research.

Non Structured Interviews were conducted among production foreman and managers at Roots cast by the researcher to establish the attitudes of production foreman and managers towards manufacturing process as well as to evaluate the current manufacturing system.

3.1.2 ADVANTAGES AND DISADVANTTAGES OF INTERVIEWS:

Advantages

- The interviewer is able to assess the extent to which the respondent is prepared to co-operate and the constraints that may affect co-operations. Constraints may be lack of time, fatigue and other priorities the respondent may have.
- In many cases, the researcher is able to assess whether the respondent is answering questions to please the researcher or to distort reality.
- The researcher is also able to assess the extent to which the interview is asking for the information the respondents do not have.
- Interviews ensure that the respondent understands the questions.

Disadvantages

- Interviews are very time-consuming and expensive.
- Research assistants need training.
- May introduce interviewer bias.

3.1.3 TIME STUDY:

The different recording techniques are charts, diagrams, models and photographic aids. The most commonly used recording techniques to cover most of the activities are shown in Table 1.

Recording Techniques	Information Recorded
(a)Charts:	
1. Outline process chart	Principle operations and inspection of the processes.
2. Flow process chart	Activities of men, material or equipment are analyzed into five events namely, operation, transport, inspection, delay and storage.
3. Two-handed process chart	Movement of two hands or limbs of the operator.
4. Multiple activity chart	Simultaneous/interrelated activities of operators and/or machines on a common time scale.
5. Simultaneous motion cycle (SIMO) chart	Movement of body members of the operator, expressed in terms of therbligs on a common time scale.
(b)Diagrams and models:	
1. Flow diagram	Path of men, materials and equipments on a scale model.
2. String diagram	Same as above except for the variation that it uses string to trace the path.

Table 1: Recording Techniques

The different symbols which are used in process charts are explained in Table 2.

Symbol	Activity	Purpose for which it is used
○	Operation	It indicates the main step in a process.
→	Transport	It indicates movement of workers, materials or equipment from place to place.
□	Inspection	It indicates any type of inspection, check, measurement, visual scrutiny for quality and/or quantity.
D	Temporary Storage or Delay	It indicates a delay in the sequence of events.
▽	Storage	It indicates a controlled storage in which material is received into or issued from stores under some form of authorization or an item is retained for references purposes.

Table 2: Symbols used in Process Chart

The above mentioned are some of the common tools used in method study for recording data. The main tool used in this study of time measurement is the "Simple type of short cycle study form". The format of the study form is given below in the Table 3.

SHORT CYCLE STUDY FORM

EL NO	ELEMENT DESCRIPTION	OBSERVED TIME										TOTAL OT	AVG OT	R	BS
		1	2	3	4	5	6	7	8	9	10				

Note:

R – Rating

OT – Observed Time

BT – Basic Time

Table 3: Short Cycle Study Form

Here in this study we also use Man-Machine chart to represent the relationship between the manual work performed by one or more operators and one or more machines involved in a manufacturing process. A Man-Machine Chart looks is given in the Table 4.

MAN MACHINE CHART				
SL NO	**DESCRIPTION**	**TIME CONSUMED (In Sec)**		**REMARKS**
		MAN	**MACHINE**	
SL NO	**DESCRIPTION**	**MAN**	**MACHINE**	
1	Idle Time			
2	Working Time			
3	Total Cycle Time			
4	Utilization in %			

Table 4: Man Machine Chart

Standard Cycle Time:

The standard time for the job will be the sum of standard times for all the elements of which it is made up, due regard being paid to the frequencies with which the elements recur, plus the contingency allowance. In other words:

Standard time is the total time in which a job should be completed at a standard performance.

Availability:

Availability of time can be calculated using the formula given below.

Availability = (Time utilized for produced / Time available for production) * 100

Production Efficiency:

Efficient production is achieved when a product is created at its lowest average total cost. Production efficiency is defined as the ratio between the Actual Output to the Standard Output and it is given as shown below.

Production Efficiency = (Actual Output / Standard Output) * 100

Quality Factor:

Quality Factor is defined as the ratio between numbers of good parts produced to the total number of parts produced. It is given as follows.

Quality Factor = (No. of good parts produced / Total no. of parts produced)

Overall Equipment Effectiveness (OEE):

Overall equipment effectiveness (OEE) is a hierarchy of metrics which evaluates and indicates how effectively a manufacturing operation is utilized. The results are stated in a

generic form which allows comparison between manufacturing units in differing industries. It is not however an absolute measure and is best used to identify scope for process performance improvement, and how to get the improvement. OEE measurement is also commonly used as a key performance indicator (KPI) in conjunction with lean manufacturing efforts to provide an indicator of success.

OEE = (Availability * Production Efficiency * Quality)

Introduction to Work Study:

Work Study deals with the technique of method study and work measurement, which are employed to ensure the best possible use of human, machine and material resources in carrying out a specified activity.

Objective of Work Study:

Work Study is concerned with finding better ways of doing work and avoiding waste in all forms. As such the objective of work study is to assist management to obtain the optimum use of human, material and machine resources available to the organization for the accomplishment of the work upon which it is engaged.

The objective has three aspects:

- The effective use of plant and equipment.
- The most effective use of human effort.
- The evaluation of human work.

Work study has two broad areas namely, **method study** and **time study.**

Method Study is concerned with finding the facts about a situation and after a critical examination of these facts, developing a new and better method of doing that work. It is defined as the existing and proposed ways of doing work and the development and application of easier and more productive methods.

Time Study is concerned is with the establishment of time standards for a qualified worker to perform a specified job at a defined level of performance.

Method study must precede time study before any attempt is made to measure and set standards for various jobs concerned.

Method Study:

It is the systematic recording, analysis and critical examination of existing and proposed ways of doing work and the development of easier and new production methods.

Areas of application of method study:

It can be applied to any field of work, but the most important areas where it plays a major role in improving productivity are as follows.

- Improved layout of office, working areas of factories.
- Improved design of plant and equipment.
- Improved use of materials, plant, equipment and manpower.
- Most effective handling of materials.
- Improved flow of work.
- Standardization of methods and procedures.
- Improved safety standards.
- Better working conditions.

Steps in Method Study:

Methods improvement involves systematic, orderly and scientific approach to problems. One should have an open mind, maintain a questioning attitude, collect all relevant facts, consult others including workers, list reasons/causes for various effects.

Decisions must be taken after listing out all alternatives and evaluating them critically.

Based on these guidelines, the steps in method study are explained below.

1. Select: Select the work to be studied.
2. Record: Record all the relevant facts of the present (or proposed) method by direct observation.
3. Examine: Examine the facts critically in sequence, using special critical examination sheet.
4. Develop: Develop the best method i.e. the most practical, economic and effective method, under prevailing circumstances.
5. Evaluate: Evaluate different alternatives to developing a new improved methods comparing the cost-effectiveness of the selected new method with the current method of performance.
6. Define: Define the new method, as a result, in clear manner and present it to those concerned, i.e. management, supervisors and workers.
7. Install: Install that method as standard practice.
8. Maintain: Maintain that standard practice by regular routine check.

Time Study:

Time study is a work measurement technique for recording the times of performing a certain specific job or its elements carried out under specified conditions, and for analyzing the data so as to obtain the time necessary for an operator to carry it out at a defined rate of performance.

Time Study Equipments:

If time studies are to be made, certain items of equipments are essential. Basic time study equipment consists of:

- a stop watch;
- a study board;
- time study forms;

although any or all of these may be replaced with electronic equivalents as will be indicated later on.

The Stop-Watch:

There are two main types of watch in general use for time study, the mechanical and the electronic.

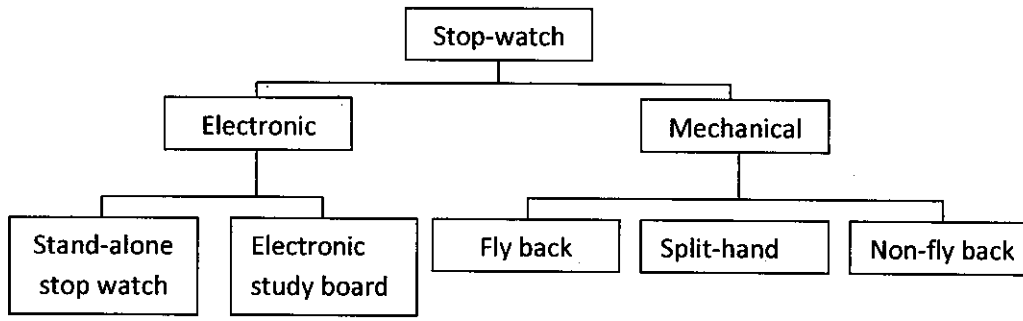

Figure 1: Types of Stop- watches

The Study Board:

The study board is simply a flat board, usually of plywood or of suitable plastic sheet, needed for placing the time study forms. It should be rigid and larger than the largest form likely to be used. The types of study boards are as follows study board for general purpose form, study board for cycle form and an electronic study board.

Time study forms:

Taking a time study requires the recording of substantial amounts of data. These data are in a regular form consisting of element codes or descriptions, ratings and element durations (perhaps with additional explanatory notes).

Forms used on the study board:

1. Time study top sheet.
2. Continuation sheet

3. Short cycle study form.

Allowances:

Even when the most practical, economic and effective method has been developed, however, many jobs will still require the expenditure of human effort, and some allowances (e.g. contingency allowances) may also have to be added to the basic time in order to give the work content. The difficulty in preparing a universally accepted set of precise allowances that can be applied to every working situation anywhere in the world is due to various reasons. The most important among them are:

1. Factors related to the individual.
2. Factors related to the nature of the work itself.
3. Factors related to the environment.

The types of allowance are given in a pictorial form below;

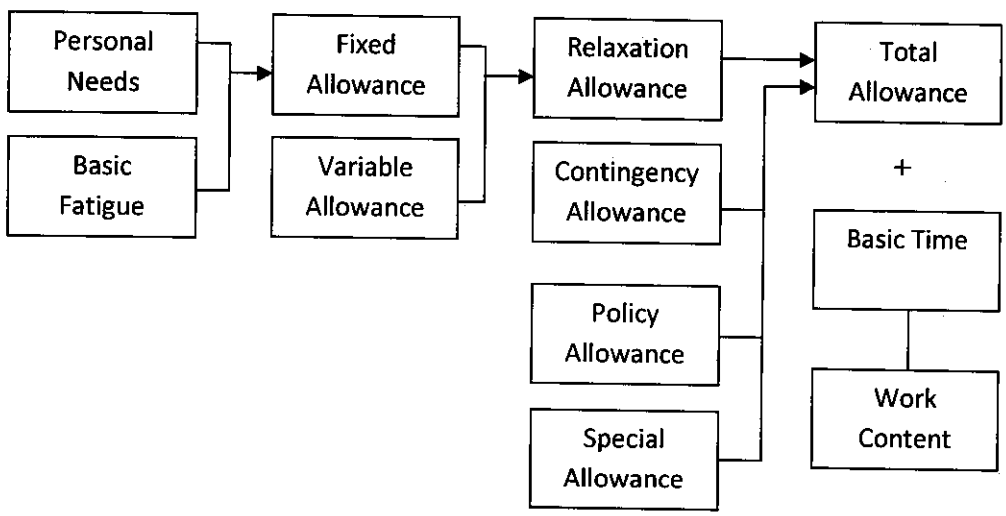

Figure 2: Allowances

Calculation of allowances:

The basic model for the calculation of allowances is shown in the above figure 2. It will be seen from this model that relaxation allowances (which are intended to aid recovery from fatigue) are the only essential part of the time added to the basic time. Other allowance, such as contingency, policy and special allowances are applied under certain conditions only.

Relaxation allowances:

Relaxation allowance is an addition to the basic time intended to provide the worker with the opportunity to recover from the physiological and psychological effects of carrying out specified work under specified conditions and to allow attention to personal needs. The amount of allowance will depend on the nature of the job.

Relaxation allowances have two major components: **fixed allowances** and **variable allowances.**

Fixed allowances are composed of allowances for **personal needs** and allowances for **basic fatigue.**

Variable allowances are added to fixed allowances when working conditions differ markedly from those stated above, for instance because of poor environmental conditions that cannot be improved, added stress and strain in performing the job in question, and so on.

Contingency allowances:

A contingency allowance is a small allowance of time which may be included in a standard time to meet legitimate and expected items of work or delays, the precise measurement of which is uneconomical because of their infrequent or irregular occurrence.

Policy allowances:

A policy allowance is an increment, other than bonus increment, applied to standard time (or to some constituent part of it, e.g. work content) to provide a satisfactory level of earnings for a specified level of performance under exceptional circumstances.

3.2 DATA COLLECTION:

The data was collected from the station (work area) where the study is being conducted. The data was collected using the **Short Cycle Study Form** with the help of a stop watch and the entries were made in the form. The entered data is given in the Table 5.

Time Study															
No	**Element Description**	**Observed Time**										**Total OT**	**Avg. OT**	**R**	**BT**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
1	Picking and placing the blank in the tool	1.8	1.5	2.1	1.6	1.5	1.7	2	2	1.6	1.34	16.96	1.696	90	1.5264
2	Pressing the green button	0.5	0.6	0.4	0.5	0.6	0.6	0.5	0.5	0.5	0.61	5.15	0.515	100	0.515
3	Ram comes to Bottom Dead Center	0.7	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.8	0.78	7.5	0.75	100	0.75
4	Holding (Dwell) Time	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	25	2.5	100	2.5
5	Ram going to Top Dead Center	0.8	0.8	0.8	0.7	0.8	0.7	0.8	0.8	0.7	0.76	7.5	0.75	100	0.75
6	Picking up the diaphragm from the tool and stacking	0.7	0.7	0.7	0.6	0.7	0.6	0.7	0.6	0.6	0.59	6.36	0.636	95	0.6042
												Total Basic Time			6.6456
							Basic Time			6.6456					
							Allowance for this process			9%					
							Standard CT			7.2437					
	Details Of Allowance														
	Fatigue Allowance	4%													
	Personal Allowance	5%													

	9%														
	Note:														
	R-Rating			**Basic Time =**			**(Observer Time*Rating)/(Standard Rating)**								
	OT-Observed Time														
	BT-Basic Time														
	CT-Cycle Time														
	Standard Rating	100%													

Table 5: Time Study Form

With the collected data the total basic time is calculated and by adding the allowance percentage to it we can get the Standard cycle time. The percentage of allowance is 9% and it constitutes fatigue allowance of 4% and personal allowance of 5%. The standard rating factor is considered as 100%.

CHAPTER 4

ANALYSIS AND INTERPRETATION

CHAPTER 4

ANALYSIS AND INTERPRETATION

With the data collected the Man-Machine chart, overall Equipment Efficiency has to be found out. This process is being done to check whether the Equipments and machineries are used to their full potential. If it is found to be low, it can be reported to the management.

4.1 MAN - MACHINE CHART:

To identify the utilization of man power and machine work to complete a single item is identified using the **Man-Machine Chart** and it is given in the Table 6.

No	Activity	Time Consumed (In Sec)				Remarks
		Man		Machine	Net Time	
		Left	Right			
1	Placing the blank in the tool	1.5264	-	-	1.5264	Machine Idle
2	Pressing the Double end hand switch by using both hands.	0.515	0.515	-	0.515	Machine Idle
3	Ram comes to Bottom Dead Center	-	-	0.75	0.75	Man Idle
4	Holding (Dwell) Time.	-	-	2.5	2.5	Man Idle Right hand Idle
5	Ram returning to Top Dead Center	-	-	0.75	0.75	Man Idle
6	Picking up the diaphragm from the tool and stacking	-	0.6042	-	0.6042	Machine Idle Left Hand Idle
		0.515	1.1192	4.00	**6.6456**	
No	**Description**	**Man**		**Machine**		
1	Idle Time	4.00		2.6456		
2	Working Time	2.6456		4		
3	Total cycle time	6.65		6.6456		
4	Utilization in %	39.8098		60.1902		

Table 6: Man-Machine Chart

4.2 OVERALL EQUIPMENT EFFICIENCY:

By calculating the Overall Equipment Efficiency (OEE), we can determine whether the current process which is being executed is performing to its full potential or not. If the Overall Equipment Efficiency is low then the management should consider an alternate option for replacing the current process. The formula for calculating OEE is given in previous chapter and the calculation part is shown below.

The data used for calculating OEE is given below table 7. This table contains on which date and day how many quantity of items produced per shift and also the production time in hours per shift.

Day	Date	Quantity Produced			Production Time (In Hrs)		
		Shift 1	Shift 2	Shift 3	Shift 1	Shift 2	Shift 3
Wed	1/6/2011	2700	2550	1600	6.42	6	5.33
Thu	2/6/2011	2100	1700	1600	7.33	5.92	5.42
Fri	3/6/2011	2750	2070	2100	7.33	6.8	5.92
Sat	4/6/2011	2350	2900	1800	6.83	6.25	5.17
Sun	5/6/2011						
Mon	6/6/2011	3200	2800	1300	7.33	7.33	4.5
Tue	7/6/2011	2145	500	0	5.08	1	0
Wed	8/6/2011	0	900	1000	0	4.17	5.08
Thu	9/6/2011	2000	2250	0	4.58	6.33	0
Fri	10/6/2011	2600	3100	2250	6.67	7.33	5.08
Sat	11/6/2011	1800	3050	0	4.75	7.33	0
Sun	12/6/2011						
Mon	13/6/2011	2000	2100	1100	5.83	7.33	5.17
Tue	14/6/2011	1500	2100	1800	7.33	6.83	5.6
Wed	15/6/2011	2600	2400	795	6.83	6.8	3.17
Thu	16/6/2011	2600	3000	1300	7.33	6.75	4.17
Fri	17/6/2011	1800	2930	1550	4.58	6.83	5.08

Sat	18/6/2011	1300	2100	1210	4.83	6.83	4.17
Sun	19/6/2011						
Mon	20/6/2011	2050	1730	1400	6	5.33	5.58
Tue	21/6/2011	1700	2485	1850	7.33	6.5	5.58
Wed	22/6/2011	2200	1850	1525	6.08	4.33	5.08
Thu	23/6/2011	3100	2750	1750	7.08	7.08	5.25
Fri	24/6/2011	1900	2550	1300	6.5	7.33	5.42
Sat	25/6/2011	1950	1525	1700	6.33	4.42	5.08
Sun	26/6/2011						
Mon	27/6/2011	2160	3050	2225	5.08	7.33	5.42
Tue	28/6/2011	3200	2450	2050	7.33	7	5.58
Wed	29/6/2011	3000	1300	1200	7.33	3	5.08
Thu	30/6/2011	1750	3000	1550	5.25	7.33	5.42

Table 7:

4.3 CALCULATION OF TIME UTILIZATION:

Time utilization is one of the important factors considered for determining Overall Equipment Efficiency. It is shown in the following Table 8.

Time Utilized for Production (In Hrs)	Non Production Time	Total Available Time For Production (In Hrs)	Time Utilization (%)
17.75	4.75	22.5	79%
18.67	3.83	22.5	83%
20.05	2.45	22.5	89%
18.25	4.25	22.5	81%
19.16	3.34	22.5	85%
6.08	16.42	22.5	27%
9.25	13.25	22.5	41%
10.91	11.59	22.5	48%
19.58	2.92	22.5	87%
12.08	10.42	22.5	54%
18.33	4.17	22.5	81%
19.76	2.74	22.5	88%
16.8	5.7	22.5	75%
18.25	4.25	22.5	81%
16.49	6.01	22.5	73%
15.83	6.67	22.5	70%
16.91	5.59	22.5	75%
19.41	3.09	22.5	86%
15.49	7.01	22.5	69%
19.41	3.09	22.5	86%

19.25	3.25	22.5	86%
15.83	6.67	22.5	70%
17.83	4.67	22.5	79%
19.91	2.59	22.5	88%
15.41	7.09	22.5	68%
18	4.5	22.5	80%
		Average:	**74.31%**

Table 8:

4.4 CALCULATION OF PRODUCTION EFFICIENCY:

The production efficiency is obtained by dividing actual quantity produced to the standard production quantity. Calculation is shown in the Table 9.

Actual Quantity Produced	Standard Production Quantity	Production Efficiency (%)
6850	8821.5	78%
5400	9278.7	58%
6920	9964.5	69%
7050	9070.0	78%
7300	9522.2	77%
2645	3021.7	88%
1900	4597.1	41%
4250	5422.1	78%
7950	9730.9	82%
4850	6003.6	81%
5200	9109.7	57%
5400	9820.4	55%
5795	8349.3	69%
6900	9070.0	76%
6280	8195.3	77%
4610	7867.3	59%
5180	8404.0	62%
6035	9646.5	63%
5575	7698.3	72%
7600	9646.5	79%

5750	9566.9	60%
5175	7867.3	66%
7435	8861.2	84%
7700	9894.9	78%
5500	7658.5	72%
6300	8945.7	70%
	Average:	**70.29%**

Table 9:

4.5 CALCULATION OF QUALITY FACTOR:

The quality factor is derived by reducing the NC parts from the actual quantity produced and then dividing it by the actual quantity itself again. The results are shown in the Table 10.

Actual Quantity Produced	No. of NC Parts produced	Quality Factor (%)
6850	0	100%
5400	1	99.98%
6920	0	100%
7050	3	99.96%
7300	1	99.99%
2645	0	100%
1900	0	100%
4250	6	99.86%
7950	0	100%
4850	1	99.98%
5200	0	100%
5400	0	100%
5795	0	100%
6900	0	100%
6280	0	100%
4610	0	100%
5180	13	99.75%
6035	2	99.97%
5575	0	100%
7600	0	100%
5750	0	100%

5175	0	100%
7435	0	100%
7700	0	100%
5500	0	100%
6300	0	100%
	Average:	**99.98%**

Table 10:

CHAPTER 5

FINDINGS, SUGGESTIONS AND CONCLUSION

CHAPTER 5

FINDINGS, SUGGESTION AND CONCLUSIONS

5.1 FINDINGS:

The finding from the analyzed data is given here.

- The total time utilized.
- The production efficiency.
- The quality factor.

Total Time Utilized	**74.31%**
Production Efficiency	**70.29%**
Quality Factor	**99.98%**

- The overall equipment efficiency is calculated as given below,

OEE = (Total time utilization * Production efficiency * Quality factor)/100

OEE = 52.1 %

5.2 SUGGESTIONS:

The following suggestions are made to improve the overall efficiency of the production line.

- The main objective of the project is to eliminate the utilization of man-power.
- As the utilization of man-power increases more complexities removing them would solve the issue.
- To replace man-power automated system can be brought in.

- To run the automated system the least man-power would be required i.e., to perform tasks like cleaning the machine, initializing the machine, testing the machine and also operations like loading raw materials.
- The automated system can run for a long time only if it is maintained in a proper manner.
- In order to do the above mentioned task, an individual person should be assigned the job of cleaning the machine at regular intervals, loading of raw materials and etc.
- The Time utilization can be improved from 74.31% to 90%, this can be achieved easily because when a automated system is implemented it need not wait or stop for any reason other than waiting for raw materials, initial machine setup, cleaning and maintenance.
- This process requires very less time when considered with the previous system.
- The Production Efficiency can be improved from 70.29% to 100%, because once the automated system is set to run, it can produce and deliver constantly and consistency.
- Simultaneously the Quality factor will be at the maximum and as a result the Overall Equipment Efficiency will increase.

5.3 CONCLUSION:

Thus by finding that involvement of human effort i.e. man-power creates the possibilities of occurrence of error and faults we could implement an Automation system were the human effort is reduced to a greater extent. So the implementation of automation system will be beneficial to the company in various dimensions.

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