UNIT 5 ORGANISING

Objectives

After completion of this unit, you will be able to understand:

- the concept of organising
- the meaning of work;
- different approaches to organizing and analyzing work;
- methods to improve and measure the work process;
- the time and Motion study;
- the concept of Ergonomics; and
- impact of Information Technology on Work Design.

Structure

5.1 INTRODUCTION

Organising refers to the formal *grouping of* people and activities to facilitate achievement of the firm's objectives. Issues for discussion here are the types of organisation structure, degree of centralisation, levels of management, span of control, delegation of authority, unity of command, line and staff relationship, and staffing.

Structure refers to the specific manner in which people are grouped. An organisation can group its people on the basis of the various functions (such as production, personnel, finance, marketing), geographical territories or around specific products or product lines (such as detergents, toiletries, basic chemicals, agro-products, as in case of Hindustan Lever Limited). The concept of matrix organisation is a recent evolution and combines the functional and product organisation. This type of organisation is especially

useful in case of projects which require both specialists as well as functional experts to execute a project within a specified time frame. Another type of organisation is by the type of customers served. A company manufacturing and marketing computers has organised its sales department in two groups. One group sells to institutions such as offices, banks, schools, colleges, etc., while the other group sells to individuals. Many companies selling office equipment have organised separate marketing teams to cater to the private sector and the public sector because of the different cultures prevailing in them.

Centralisation refers to the point or level where all decision-making authority is concentrated. One-man enterprises; such as a small bread and butter stores, vegetable vendor, a self-employed car mechanic, are examples of complete centralisation. As the enterprise grows, it becomes increasingly difficult for one person to manage alone and he has to necessarily line up other. people and give them authority to make some decisions. These decisions may be routine, programmable decisions but complete centralisation is no longer possible. The decision-making authority is now vested in more than one individual. This is decentralisation.

You require information to make a decision. It is possible that information may be generated at one place but the decision is taken at another. A Bombay based multinational involved in making and selling ball bearings has its manufacturing facility at Pune. Every evening all information regarding the day's production, machine down time, inventory position is sent to the head office via the linked computer facility and all decisions regarding change in production scheduling are made at the head office. The introduction of real time information with the help of computers enables information generated at one place to be instantaneously transmitted thousands of miles away for making a decision. However, the real criterion for an organisation having a centralised or decentralised structure is a reflection of the top Management's thinking and philosophy.

Closely related to the concept of centralisation are the concepts of levels of management and span of control. Levels of management refers to the number of hierarchical levels under the control of a particular manager. Machine operator, foreman, floor manager and production manager represent the levels of management in a typical production department under the director. The machine operators report to the foreman, the foreman reports to the floor manager who in turn reports to the production manager who is accountable to the director. The number of machine operators who directly report to the foreman represents his span of control. There is a great deal of controversy regarding the ideal number of people that a manager can effectively control or the ideal span of control. Many management thinkers are of the view that three to seven is the ideal range. In practice, this may actually vary from one individual manager to another.

At each level of management, there is a reporting relationship between the manager and the workers. The fewer the number of people that a worker has to report to, the less will be the problem of conflict in instructions, and greater the feeling of responsibility for results. Similarly, the clearer the line

of authority from the manager to the workers, the better the decision-making and communication.

The staff functionary reports directly to the top management and is not a part of the chain of command.

A company may draw up any number of ambitious plans, but if it does not have the right kind of people, it can never succeed in implementing these plans. One of the biggest challenges which a manager faces is matching the right people with the right jobs. The process of staffing starts with defining the job to be done and the necessary qualifications, skills and experience required to do it. The next step is to search for the persons with the desired background. The search may involve a number of complex steps such as advertising the job through newspapers and specialised magazines, screening the applications received in response to the advertisement, conducting a selection process which may include a variety of techniques such as written test, group discussion, personal interview, etc. Before making the final selection, it is important to be sure that the candidate fits in well with the other people and the culture of the organisation.

Having found the right candidate, it is equally important that you are able to retain him. Among other things, motivation and leadership provided by the top management of organisation also plays an important role.

As you have seen, planning specifies the future course of direction of an organisation. The organising process follows the planning process. 'While planning specifies *what* will be achieved *when,* organising specifies *who* will achieve *what* and *how it* will be achieved.

To understand the organising process involving the people and jobs in an organisation, let us discuss a situation in a bank. Suppose you happen to be a teller (person who sits behind the service window) in a bank. Your job requires transacting deposits, withdrawals, cashing the cheques. Also, you may have to secure the approval of bank manager before you could cash a cheque for a person who is not a regular customer of your bank. Here, the bank manager's orders or directives will define how much authority you have to do things on your own. Besides, your work may also be supervised by your immediate superior officer. Hence, organising involves identification of specific jobs, grouping of jobs of similar nature, number of jobs to be included in a specific group and deciding how many people a manager can effectively oversee. An integrated network of people, their jobs and their working relationships ultimately constitutes the structure of the organisation.

Therefore, the organising skills can be broadly spelled out as

- ability to analyse and describe various organisational jobs;
- ability to select, train and induct people in jobs;
- ability to draw working links i.e. define authority and span of control amongst people; and
- ability to change these working links whenever there are major changes in the environment or technology or strategy of the organisation etc.

Another example may make it clear to you as to how the manager utilises his organising skill when major changes take place in the environment or technology or strategy. Suppose, you happen to be a doctor in a village, where you are in charge of organising a hospital for catering to routine and non- routine or emergency facilities. You know that more facilities are available in city hospitals such as provision of regular ambulance service, wide range of medicines and services of doctors and nurses, etc. At the time of dealing with an emergency case, you should rush to the city hospital. You have to organise yourself and your co-workers to assess how crucial this responsibility becomes when you have limited resources available with you, yet you want to achieve the best you can.

5.2 THE CONCEPT OF ORGANIZING AND ANALYZING WORK

The goal accomplishment of an organization requires work to be done in many different areas, and highly specialized knowledge and experience. Hence the work is divided among people, work units such as divisions, departments and groups. Organizing work refers *how to arrange matters so that people can work in concert to get the work done, division of work between people and groups, the work done by managers at different levels, and co-coordinating the work of people and groups to make possible to realize the goal of the organization.*

It includes issues like:

- Organization Charts : Organization chart is a form of line diagram . It indicates the arrangement of work units, the delegation of work (that is the delegation of responsibility) and work units in relation to each other.
- Division of Work : The work is divided among people and work units such as divisions, departments or groups. The Head of each work unit is in charge for the work done by the unit as well as for the work by him/her.
- Organising the work done (responsibility carried) at different levels
- Maintaining relationships between people at different levels .
- Coordinating work between people etc.

5.3 DIFFERENT APPROACHES TO ORGANIZING AND ANALYZING WORK

I. The Ancient Approach

The concept of organizing work was there even in ancient times. For instance, the ancient Egyptians built their pyramids, the ancient Chinese built the Great Wall of Chine, the Mesopotamians used to irrigate their land and wall their cities, and the Romans built their roads, aqueducts and Hadrian's Wall. All these man-made construction

required large amounts of human effort and therefore organizing i.e. planning, control and coordination.

The Chinese philosopher Mencius (372-289BC) wrote about the concept and the advantages of the division of labor. Records reveal that the ancient Greeks understood the advantages of, and practiced uniform work methods. They also employed work songs to develop a rhythm in order to achieve a smooth, less fatiguing tempo and to improve productivity.

The division of labor was also recognized by Plato (427-347BC). He wrote in The Republic, 'A man whose work is confined to such limited task must necessarily excel at it'. However, work itself was viewed by the ancient Greeks and the Romans, as demeaning / humiliating. Those who could afford todo so were treated as employed slaves.

With the fall of the Roman Empire, development was reduced; slavery being replaced by feudalism. In pre-Reformation Christian Europe work was also seen as a burden. In this period, the mechanical clock was invented by Heinrich Von Wych in Paris in 1370, and Guttenberg's printing press was set up. The former permitted accurate work measurement and the latter the ability to communicate by the printed word. Indeed Guttenberg's inspired creative thinking can be viewed as an early example of method study. However, with the Reformation the Protestant 'work ethic' emerged based on Luther's glorification of work theory. Calvinism brought further consolidation to this principle and with it the virtues of frugality and the honorable acquisition of wealth. Work was viewed in society as respectable and idleness as awful.

II. The Approach during the Industrial Revolution Period

The momentum for industrial revolution was initiated in the seventeenth century. Agricultural methods had improved in Europe. Technical advances were also being made, most notably in textile manufacturing, in the eighteenth century with the invention of Hargreaves's spinning jenny, Arkwright's water frame and Compton's mule. The steam engine first developed in 1698 by Thomas savory, was harnessed by James Watt. These factors, technological developments, expanding trade/markets, growing populations created opportunities for merchants and entrepreneurs to invest in new factories. This was the beginning of the Industrial Revolution. All these necessitated the improvement in work methods, quality, and productivity of workers.

With the emergence of the factory system**,** Adam Smith, the Father of Economics advocated making work efficient by means of specialization in the eighteenth century. He advocated dividing the work down into simple tasks. He provided three advantages of the division of labour:

- the development of skills;
- the saving of time; and
- the possibility of using specialized tools

After the War of Independence there was a shortage of musket parts in the United States. Eli Whitney proposed the manufacturing of muskets by means of using interchangeable parts. Records form the Soho Bell Foundry in Chelsea, around the same time as Whitney, evince the use of production standards, cost control, work study and incentives during the period..

In 1832, Charles Babbage, an engineer, philosopher and researcher, examined the division of labor in his book On the Economy of Machinery and Manufacturers. Babbage proposed, as an advantage of the division of labor, that the amount of skill needed to take on a specialized task was only the skill necessary to complete that task. He illustrated this concept by breaking down the manufacture of a pin, into seven elements. The important inference for employers was that they need to pay for the amount of skill necessary to complete each individual task. He advocated breaking down jobs into elements and costing each element.

In this manner, these developments foreshadow the machine age, replacing traditional manual labor and improving productivity. Machines were located near sources of power, first water later coal for steam. Large concentration of machines were gathered in one place under one roof in the factories. Huge numbers of people came together to operate these machines and in the delivery of the outputs from the factories. As a result, the management functions of control, planning and coordination were required with greater strength..

At the turn of the century, the problem of layout and method were studied by Robert Owen. Owen through experimentation at the New Lanark Mills was successful in raising the living conditions of his workers whilst reorganizing his mills on commercial principles. Robert Owen is endorsed with being the first to identify fatigue and the work environment as factors affecting the performance of factory workers.

III. The Scientific Management Approach

Frederick W. Taylor known as the father of scientific management and modern industrial engineering. By experimenting with different designs of shovel for use with different material (from 'rice' coal to ore) he was able to design shovels that would permit the worker to shovel for the whole day. In so doing, he reduced the number of people shoveling at the Bethlehem Steel Works from 500 to 140. This work, and his studies on the handling of pig iron, greatly contributed to the analysis of work design and gave rise to method study.

In 1909, he published the book for which he is best known, *Principles of Scientific Management*. Taylor's impact has been so great because he developed a concept of work design, work-measurement, production control and other functions, that completely changed the nature of industry.

Objectives of Scientific Management

The four objectives of management under scientific management are as follows:

- The development of a science for each element of a man's work to replacethe older rule-of-thumb methods.
- The scientific selection, training and development of workers instead of allowing them to choose their own tasks and train themselves as best they could.
- The development of a spirit of hearty cooperation between workers and management to ensure that work would be carried out in accordance with scientifically devised procedures.
- The division of work between workers and the management in almost equal shares, each group taking over the work for which it is best fitted instead of the former condition in which responsibility largely placed with the workers.

His framework for organization was: clear delineation of authority, responsibility, separation of planning from operation, incentive schemes for workers, management by exception, and task specialization.

Assumptions of Scientific Management

Two basic assumptions dominated Taylor's approach to the design of jobs. **First Assumption (Management)**: Management is assumed to be more effective than labor at devising methods for executing the work and then at planning and organizing. By breaking the work down into simple elements:

- the training of workers is clearly simplified
- workers are more easily substituted, one for another
- supervision is made easier as it is apparent when workers are doing something that is not part of the specified task.

Second Assumption (Workers): Human beings are rational economic beings. The prime goal is assumed to be monetary and consequently reward systems which relate pay levels to output are seen as likely to result in maximum output. As such, humans will examine a situation and identify a course of action likely to maximize their self interest and act accordingly. All that is required to maximize output, from the organizations perspective, is to hire the right people, train them properly and construct an appropriate reward system. If the work can be paced, a worker can develop a natural rhythm and momentum.

Principles of Scientific Management

Three primary principles of scientific management directly or indirectly relatingto work design are:

i. Taylor assumed that it is possible to "gather all of the traditional knowledge which in the past the been possessed by the workman and then classifying, tabulating, and reducing this knowledge to rules, laws, and formulae which are immensely helpful to the

workmen in doing their daily work". In this way the industrial engineer (and the manager) learns the best way for a job to be performed.

ii. The work of every individual employee "is fully planned out by the management at least one day in advance… describing in detail the task which he is to accomplish as well as the means to be used in doing the work" (p.39). If management understands the process by which the work is done, it should be possible to plan out the work in the smallest detail before the employee even show up. In this way the manager and engineer know exactly how the work will be accomplished.

iii. "The science which underlies each workman's act is so great and amounts to so much that the workman who is best suited to actually do the work is incapable (either through lack of education or through insufficient mental capacity) of understanding this science" (p.41). If management understands the best, most efficient way for a job to be accomplished, and if this is planned out in advance, no mental contribution is necessary from the worker.

The scientific management approach was exceedingly successful in the firsthalf on the 20th century.

Constraints of Scientific Management

Although scientific management was unquestionably effective for more than 50 years, gradually it is losing ground because of the following reasons.

First, production and/or service jobs are no longer simple. Creating uncomplicated jobs was easy at the beginning of the 20th century because the products and the manufacturing processes were elementary. However this is not the case today. Even unskilled factory jobs today require reading computer screens, working with numerical tools, or using and/or making custom productsand services.

Second, allied with this increase in job complexity, the technology employed in both manufacturing and the service sector has also increased in complexity.

The jobs of today also are changing more rapidly than in the past and so alsothe technology. If the technology is changing daily, so are those rules. By the time management understands the technology and how it should best be used, the technology has changed.

Finally, products and services are changing at an ever more rapid rate. If we want to compete in the global marketplace, speed has become a necessity (Dumaine, 1989).

IV. Fordism

In the early 20th Century , Henry Ford dramatically established the concept of relative surplus value by doing what at the time was considered impossible. He paid workers 4 or 5 times the 'going rate' (actually the bare minimum that could be screwed from the bosses), yet still made a huge profit. By vastly increasing the production of relative surplus value through the use of the assembly line, coupled with FW Taylor's 'Scientific Management' of the work process, he was able to vastly improve the productivity of his plants.

Ford brought into existence the concept of 'mass worker'. Whereas before the capitalist had relied largely on skilled workers to manage the production process, the mass worker was a new type.

V. The Human Relations Approach

The human relations approach arose almost as a direct result of the harshness imposed by supervisors who excessively used scientific management principles. An outgrowth of the famous Hawthorne Studies conducted during 1924-33, the human relations approach de-emphasized the technical components of a job and concerned itself with the impact of employee social and psychological needs on productivity.

Originally, the goals of the Hawthorne investigators were to identify elements of the work environment which fostered productivity. Surprisingly, the investigators discovered that the greatest impact on productivity was that of the social interaction patterns of the workers rather than environmental conditions like lighting. The significance of the findings to management are that:

- workers thought and acted not as individuals but as a group;
- workers would sacrifice their self-interest in the fact of group pressure;
- money is not the sole motivator. (This prompted Mayo to comment: "Factorymanagers are going to someday realize that workers are not governed primarily by economic motives.")
- supervisors have significant influence on output.
- Mayo's recommendations reflected these findings and were that:
- managers must not ignore the informal organization but ensure its norms arein harmony with organizational goals;
- man is basically motivated by social needs, not economic ones;
- in order to influence the behavior of individuals managers must focus on thework group rather than individuals; and
- effective supervisors are those who satisfy subordinates' social needs.

These recommendations led to principles advocating the design of jobs which facilitate social need gratification by the workers, including the use of non- authoritarian leadership styles by supervisors and the fostering of effective workgroups.

VI. The Socio Technical Systems Approach

The socio technical systems approach to work redesigns tasks in a manner that jointly optimizes the social and technical efficiency of work. Beginning with studies on the introduction of new coal-mining technologies in 1949, the socio technical systems approach to work design focused on small, self-regulating work groups. Later it was found that such work arrangements could operate effectively only in an environment in which bureaucracy was limited. Today's trends towards lean and flat organizations, work teams, and an empowered workforce are logical extensions of the sociotechnical philosophy of work design.

VII. Modern Approaches

Modern concepts, are not entirely disparate to scientific management and classical organization theory, but are evolved from earlier views and represent modifications based on research and experience.

In order to counter the weaknesses of the earlier approaches discussed above that the *behavioral science approach* was adopted. Industrial psychologists , although at first arrived at similar conclusions to the human relations movement, based on their research concentrated on motivation of individuals .And industrial sociologists looked at the behavior of formal and informal groups at work.

In the period between 1951 and 1971, managers moderated their 'logical' approach to such things as job design and considered such alternatives as participation, job-redesign, job enlargement and job enrichment. By the mid- 1960s and 70s in Britain there was much puzzlement as to which theory to follow and much conflicting evidence from researchers. Goldthorpe (1969), for example, was to find that some employees, although they disliked the work which involved repetitive tasks in their Coventry car assembly plant, would put up with them for the money rather than move to more interesting jobs and lower wages in plants nearby. Experiments at Philips at Eindhoven demonstrated that although output initially mounted after enlarging the jobs in radio assembly, workers were unhappy with their new jobs and responsibilities and many left. White (1973) also found that the motivation of managers to work depended very much on two factors: the type of job that was being performed and the age of the jobholder. These findings show the boundaries of approaches such as those proposed by Herzberg and others that advocate a single 'best way' and draw attention to the danger of viewing behavioral science as a provider of packaged solutions.

In nutshell, advocates of each approach point the finger at the incompetence of the application of other approaches. Accordingly, it becomes clear that no single panacea exists for work organization. As

advocated by the contingency theorists, it depends upon several 'contingent variables' .

5.4 WORK IMPROVEMENT AND MEASUREMENT

Work Improvement

The term 'work improvement' is very wide and includes the study of work and simplification and standardization of methods, equipment and working condition. It is otherwise known as *'method study' or method engineering'*. Work improvement may be defined as *scientific techniques of studying and analyzing the conditions influencing the quantity and quality of work done by the workers* According to W.W. Haynes and J.D. Massie, "All of the physical aspects of operations can be considered as a part of the work improvement study, layout of work-place, materials handling, design of equipment, working conditions including lighting, color, air-conditioning, power and so forth".

Work improvement not only improves work efficiency, but also improves human comfort and satisfaction. This is also known as *'human engineering' or 'ERGONOMICS'*.

Work Measurement

Work measurement deals with assessing the time content of a job performed by an operator to determine the proper time to be allowed and the efforts required for the efficient performance of a job. R.M. Curie has defined work measurement as *'application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance'*. Work measurement is popularly known as 'time study' whichis a major constituent of the work study. Its advantages are as follows:

- Work measurement determines the normal time for a job and thereby serves as a basis of a sound wage incentive system.
- The standard time determined by work measurement helps in labor costcontrol.
- Work measurement provides the relevant data for efficient work planningand control.
- Work measurement facilitates effective manning of plant and equipment.
- Work measurement technique can be useful in reducing the time and cost involved in the proposed production orders.

Work Measurement vs. Work Improvement

Work measurement is the study and analysis of time taken in the performance of a specific task. Work improvement denotes the study of methods and techniques of production for increasing efficiency. These two

concepts are interlinked with each other because both of these aim to increasing productivity. Efficient work improvement is a precondition of work measurement. Work improvement uses the techniques of motion study, process analysis, plant layout and materials handling whereas work measurement involves time study, work sampling and synthetic standards. Work improvement is done to suggest the best method of doing the job whereas work measurement helps in fixing fair day's work, laying down wage incentive plans, and production planning and control.

5.5 TIME AND MOTION STUDY

Work study is an important tool in the hands of management for achieving greater productivity in the organization. It is a methodical study of the use of workers, materials and equipment in order to enhance existing methods and work performance by elimination of every type of waste. Taylor recommended the technique of time study for work measurement and determination of time standards. Gilbreths devised the technique of motion study to carry out work study. Thus, work study covers both time study and motion study for work measurement and work improvement.

Objectives of Work Study

The objectives of work study are as follows:

- Effective use of manpower
- Effective use of methods, machines and equipment.
- Effective layout of plant.
- Elimination of unnecessary human motion.
- Simplification and standardization of operations.
- Measurement of time required to perform an operation and establishment of standard level of performance for each worker.

Motion Study

Frank B. Gilbreth, an intrusive Industrial engineer, had pioneered the technique of Motion study in association with his wife Lillian Mollar Gilbreth during

1902-12. Prior to use of Gilbreth's standard method, 120 bricks laid per worker were considered to be normal. Gilbreth's development of standard method using motion study resulted in an average production rate of 350 bricks per worker per hour. This increase was not achieved by making bricklayers work faster but through most effective way of doing it. For example, Gilbreth reduced the number of motions from 18 to 5 in laying the bricks. Traditionally, a bricklayer would bend over and pick up a brick from a pile of bricks on a relatively unadjustable scaffold, rotate the brick to find the best side, and then lay the brick by tapping with mortar of often poor consistency. Gilbreth suggested a different pattern. Gilbreth wanted bricklayers to be able to pick up a brick most efficiently. Therefore, he

had minimum-cost laborers arranging the bricks on a pallet for ease of pick up by the master bricklayer. He then provided adjustable scaffolds, the proper location of bricks and mortar, and mortar of proper consistency. The result was a vast improvement in productivity with less fatigue.

From various studies Gilbreth developed the law of human motion from which evolved the principle of motion economy. The motion study is a process of analyzing a job to find the easiest, most effective, and most economical way of doing it with the help of a close scrutiny of the motions made by a worker or a machine. Motion study can be divided into three components, namely :

(i) analysis of therbligs, (ii) micromotion study; and (iii) principles of motion economy.

Therblig Analysis

Gilbreth classified the basic motions into what he called *therbligs* (which is gilbreths spelled back), such as search, find, transport empty, preposition, grasp,and so forth A therblig is a small part of a job. Gilbreths gave a list of 17 basic motions of a worker. The list is as follows : 1) Search (Sh) 2) Select. (St.) 3) Grasp (G) 4) Transport empty (TE) 5) Transport loaded. (TL) 6) Hold (H) 7) Release load (RL) 8) Position (P) 9) Preposition (PP) 10) Inspect. (I) 11) Assemble (A) 12) Disassemble (DA) 13) Use (U) 14) Unavoidable delay (UD) 15) Avoidable delay (AD) 16) Plan (Pn) 17) Rest for overcoming fatigue (R).

Micromotion Study

Micromotion study is a study of the fundamental elements of an operation with the help of a high speed movie camera in order to eliminate the unnecessary motions involved in the operation and balancing the necessary motions. The speed of the camera should be 1,000 frames per minute. Finding out the numbers of films that elapse in doing a particular element of motion and knowing the speed of the camera, one can know the exact time value that could be assigned to a particular element. This value can be indicated on the frame scale or time scale drawn on the simo chart (simultaneous motion cycle chart). The study is known as memo motion study if it is done with the help of a slow speed camera.

Principles of Motion Economy

The principle of motion economy developed by Gilbreths envisage the correct application of theories behind motion elements to achieve harmonization of human body movements, best layout of work places and the optimal design of equipment and tools. There are five basic principles of motion economy whichare listed below

- Principles of minimum movement.
- Principles of simultaneous and symmetrical movement.
- Principles of rhythmic movement.

- Principles of natural movement.
- Principles of habitual movement.

The study of the above principles is a lengthy one, usually coming under workphysiology. However, a few rules of effective motions are mentioned below:

1. Successive movement should be so related that one movement passes easily into that which follows.
2. The order of movements should be so arranged that the mind can attend to the final aim.
3. The sequence of movements is to be so framed that an easy rhythm can be established.
4. The continuous movements are preferable to angular movements involving sudden changes in the direction of movements.
5. The number of movements should be reduced as far as possible.
6. Simultaneous use of both hands should be encouraged.
7. Fixed positions should be provided for tools, materials, etc.

Time Study

Time study is an essential way of work measurement. It is the art of recording and analyzing methodically the time required to perform a motion or a series of motions. This divulges that time study is to be conducted after a motion study has been undertaken.

Probably the first attempt at formally timing work was done in 1760 when Jean Radolphe Perronet studied the manufacturing of pins and attempts to establish standard times for various operations. Documents have been found relating to the Old Derby China Works for the year 1792 in which Mr. Thomas Mason pledged himself to undertake time studies in the factory. But the term Time Study was coined by F.W. Taylor. Unlike the early activities of Perronet and others, Taylor started to break the timing down into elements.

Objectives

The need for time study arises whenever a better method of doing a work is introduced in a plant. Time study endeavors to:

- Determine a standard day's work by finding the amount of time needed byworkers to perform the various operations and
- Provide production data.

Procedure of Time Study

The procedure to time study involved the following steps:

- Selection of work to be studied.
- Establishing standardized methods, equipments and working conditions.

- Selecting the average worker who is to be studied while performing the work. Necessary confidence in the worker should be created so as to obtain his cooperation.
- Division of work into elements suitable for time study.
- Studying the operator doing the job. For the validity of the time study results, it is necessary that the analyst should take readings not once but anumber of times. The number of times for which time study should be repeated, (i.e., number of cycles) will depend upon the level of confidence needed.
- Recording time with the help of stop watch on the time study board of the required number of work cycles.
- After the time values for each element for a sufficient number of cycles have been recorded, the mode value is selected. The mode value represents the most frequently appearing time value for an element of the job. Mode values of different elements will be added to get the normal time for doing a job. Normal time is the time required by an average worker working under normal conditions to perform a job.
- Adding allowance to normal time to get the standard time. Relaxation allowances include personal allowance, fatigue allowance, delay allowance,etc.

In the above mentioned procedure, it is recommended that an average worker should be preferred for the purpose of time study. If an average worker is not chosen, performance rating factor will have to be assessed to determine the normal time for each category of worker. For instance, workers are divided into three categories : (i) Poor workers (75 points); (ii) Normal or average workers (100 points); and (iii) Good Workers (125 points). If a good worker is studied, the time taken by him to perform the job will be multiplied by 125/100 to get the normal time taken by an average worker

Benefits of Time Study

The advantages of time study are as follows:

- Time study helps in determining the ideal workload of different categories ofworkers.
- The standards of performance evolved as a result of time study may beused for evaluating the performance of employees.
- Time study helps in designing a suitable incentive wage plan to motivate the workers to increase their productivity.
- Cost standards are very accurate if they are based on the results of time study.

Limitations of Time study

Time study is not limitless. Some of the perceptible limitations of time studyare like so:

- There are variations of the standard time determined by different observers. Even the same observer sets different standard time each time he is asked to conduct the time study.
- Time study involves an element of subjectivity of the observer. Sufficient judgment has to be used by the observer in the choice of a measure of central tendency, deciding the degree of personal allowance and so on.
- The standard time determined by time study may not be accurate becauseof incorrect performance rating of the operator under study.
- Time study usually has an adverse effect on the workers. They may not show the normal behavior pattern when they are being observed. Even the trade unions may resist stop watch time studies.

Difference between Time Study and Motion Study

The difference between the Time and Motion study is specified in Table 1.

Table 1: Difference between Time Study and Motion Study

Basis	Time Study	Motion Study
1. Purpose	Concerned with the determination of time taken by the workers in performing each operation on the job.	Concerned with the motions or movements ofworkers.
2. Scope	Covers both workers and machines.	Covers only workers.
3. Procedure	Conducted with the help of a stop watch.	Conducted by photographic procedures.

5.6 ERGONOMICS

Ergonomics is the scientific, interdisciplinary study of individuals and their physical relationship to the work environment It is closely associated with industrial and experimental psychology. Beginning in 1940, the term 'human engineering' was associated with equipment design. By mid 1950s, several aircraft companies began to utilize human engineering in machine design andtraining programmes.

Ergonomics is also called the science of human engineering. Human engineering may be described as an approach by which an engineer set about the problem of designing machine and equipment to be used by human beings. The human engineer applies scientific knowledge and research methodology to study human areas as they pertain to the operation of the machine systems and concepts.

Human engineering groups generally include engineers, psychologists, physiologists, mathematicians, anthropologists, physicians and specialists fromother fields.

The human and machine systems possess different characteristics as shown in Table 2. Ergonomics advocates using these characteristics in complimentary manner while designing and implementing any production and mechanical operations.

Table 2: Man Vs Machines

	Man excels in		Machines excels in
1.	Detection of certain forms of very low energy levels.	1.	Monitoring (both men & machines)
2.	Sensitivity to an extremely wide variety of stimuli	2.	Performing routine, repetitive, or very precise operations.
3.	Perceiving patterns and making generalizations about them.	3.	Responding very quickly to control signals
4.	Detecting signals in high noise levels	4.	Exerting great force, smoothly and with precision
5.	Ability to store large amounts of of information for long periods and recalling relevant facts of appropriate	5.	Storing and recalling large amounts information in short time period moments.
6.	Ability to exercise judgment where events cannot be completely defined	6.	Performing complex and rapid computation with high accuracy
8.	Improvising and adopting flexible procedures	9.	Doing many different things at one time
9.	Ability to react to unexpected low-probability events	9.	Deductive processes
10	Applying originality in solving problems: i.e. alternate solutions	10	Insensitivity to extraneous factors
11.	Ability to profit from experience and later course of action.	11.	Ability to repeat operations very rapidly, continuously, and precisely the same way over a long period
12.	Ability to perform fine manipulation, especially where misalignment appears unexpectedly	12.	Operating in environments, which are hostile to man or beyond human tolerance
13.	Ability to continue to perform even when over loaded.		
14.	Ability to reason inductively		

Source: Woodson, Wesley E. and Donald W. Conover (1964), *Human EngineeringGuide for Equipment Designers,* University of California Press, Berkeley.

Needs of Human Engineering

Human engineering is the study of people at work and of work methods. Its purposes are to:

- Design human-machine system involving the best combination of human and machine elements.
- Study equipments design, hours of work and physical conditions of work.
- Design the machine for its users fitting it to their physiological requirements to minimize fatigue and maximize output.
- Reduce the types of injuries caused by poor design. Ergonomically designed spaces, systems and environment that take into account both the psychological and physical aspects of the people increases efficiency, health and prevent injuries and musculoskeletal disorders
- Assist in design and operation of man-machine environmental system which will ensure physical and mental ease to the human beings.
- Design the machines and equipments in such a manner that not only the users but also those in the vicinity should be protected against dangers of accidents.
- Design the machinery, equipment and tools to suit the human operator and not *vice versa*. It includes the following :
- Tools and materials should be arranged at the work-place in such a way that the operator can reach them easily.
- Machine control should be installed in the working area so that it is within the reach of the machine operator.
- There should be mechanization of materials handling on and between processing points, particularly, for heavy and bulky items.
- The machine operator should be permitted to sit while on the job unless the nature of job requires him to stand. If he is required to stand for long hours, he should be given rest pauses so as to relax himself. There should be proper arrangement to eliminate job safety hazards.
- Good working conditions should be provided to the operators so as to maintain their physical and mental health. There should be satisfactory lighting and sanitary facilities. The operator should have easy access to service facilities.

5.7 WORKSPACE AND ARCHITECTURAL ERGONOMICS

The design of the workspace or **Architectural Ergonomics** has a direct impact on the efficiency and productivity of the workers. Workspace is the space within which one perform the tasks that add up to his job. Physical design of a workspace includes working out how much space needed, and positioning of furniture, tools, equipment and any other items needed to perform the tasks, in respect of posture, access, clearance, reach and vision of the user.

A poorly designed workspace, or a bad arrangement of furniture or equipment, may result in injuries and strains due to adoption of uncomfortable working postures, less 'spare' capacity to deal with unexpected events or emergencies, the increased possibility of errors or accidents, and inefficiency.

A 'workspace envelope' is a 3-dimensional space within which one carry out physical work activities when he is at a fixed location. The limits of the envelope are determined by ones functional arm reach which, in turn, is influenced by the direction of reach and the nature of the task being performed.

Table 3: Guidelines for the Design of Workspaces

- Encourage a frequent change in posture
- Avoid forward bending of head and trunk
- Avoid causing the arms to be held in a raised position
- Avoid twisted and asymmetrical positions
- Avoid postures that require a joint to be used for long periods of time at thelimit of its range of motion
- Provide adequate back support for all seats
- Where muscular force must be exerted the limbs should be in a position ofgreatest strength
- Test your workspace layouts

Proper work place design **helps to** reduce or eliminate the risk of injury to a worker, minimizes the required number of movements or steps, and optimizes the flow of process or materials through the space. By designing for efficient use of space, technology and architectural features, architectural ergonomics enhances function and usability by promoting: work flow, process flow, traffic flow, wayfinding, integration of technology, facility maintenance, and accessibility. Guidelines for the design of workspaces is provided is Table 3.

Architectural Ergonomics can be incorporated into an organization by:

- Facilitating employees in Participative Design Processes
- Design audits
- Ergonomics training

Digital Human Simulation and Ergonomics

A new method for determining the workspace of human motion has been established in recent years at the University of Iowa Center for Computer Aided Design (CCAD) . This method addresses the problems of interest in human motion analysis in terms of ergonomic design, workspace visualization, posture prediction, layout design, and placement. It brings in the exact boundary of the workspace in closed-form which makes it possible to :

- Demarcate the exact reach envelope (boundary of the workspace) of humanlimbs while taking into consideration the ranges of motion.
- Visualize the exact workspace of human limbs.
- Define and plan trajectories in the workspace.
- Design ergonomic workplaces subject to specified cost functions.
- Facilitate the design of layouts and packaging.
- Verify measured data and validate human models.
- Predict realistic postures, and
- Optimize designs based on specified cost functions. Cost functions representing dexterity, reach ability, energy, force, and others have been developed and integrated with optimization code to address ergonomics design problems.

Activity 1

Suppose you are designing an internet café. How can you use ergonomics.

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Activity 2

Your neighbour has started a new school for kids. He is interested in applying ergonomics in the school. He has bought some colored and mobile furniture for classrooms, so the kids can move and organize it in several ways. Could you please help him with some ideas regarding this problem? He would also like to use ergonomics to stimulate kids imagination and to facilitate the process oflearning.

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5.8 IMPACT OF INFORMATION TECHNOLOGY ON ORGANISING WORK

Over the past ten to fifteen years the emergence of Information Technology (IT) as a strategic resource has evolved new types of working and working relationships. It has not only affected the structure of organizations but has made it possible to invent new ways of working. IT has been used as a facilitator as well as an enabler of new work. As a consequence it has enabled many companies to reduce their fixed asset costs, mainly office space and buildings.

A few example of new forms of IT enabled work design are:

Satellite Location is an attempt to reduce the office space. Satellite Locations are networked together to form a cohesive structure. Expensive large corporate centers have been reduced in size and only a token 'image' presence is kept in prestige locations.

Hot Desking And Hoteling is another attempt to reduce office space and hence the cost of fixed assets. Employees simply plug in to office space with docking facilities for laptop computers and other support.

Telecentres and Telecottages: Telecentres are specific regional centres that support many organisations' employees providing all the electronic communications infrastructure needed for effective working. Telecottages are a variation on these theme to support workers in rural or thinly populated locations.

Teleworking and Telecommuting: Teleworking could be described as home working with electronic communication support whereas telecommuting could be described as the mobile office in a car, hotel or anywhere, supported by the mobile phone and the laptop computer. (According to a new AT&T survey conducted by the Economist Intelligence Unit, business will see a major growth in teleworking over the next two years.17% of AT&T managers now work full time from home in Virtual Offices, while the operational benefit of telework to AT&T exceeds $150 million annually).

Telematics (Field Systems): A closely related concept to telecommuting but the equipment is more specialized usually fixed in vehicles. Used to communicate information between control centres and mobile workers. It is used by the utilities, service companies and the Police etc.

Computer Supported Co-Operative Working (CSCW): It is gaining appreciation as a technology that can support and enhance a truly enterprisewide working environment.

The Virtual Organisation: Many sole traders use agencies that provide a virtual presence for their clients using CIT (computer integrated telephony) and by providing office space and electronic facilities when needed.

Teleworkers can be networked together to form their own organisations, although their clients may never see them or need to visit them. Their virtual offices may be contained in a website.

Online business and E-commerce: The success and growth of the Internet has made on-line business a cost effective and available technology for many small and medium sized businesses to market their products. Amazon is a virtual bookstore, now the largest bookstore in the world.

Activity 3

On the basis of your experience, explain how IT can enabled new ways of working at the work place.

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Activity 4

Carefully go through the narrative on impact of IT on organizing work and construct definitions and examples of the following terms.

Hotdesking and Hotelling:

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Telecottages and Telecentres:

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CSCW:

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Virtual Organizations:

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Teleworking and Telecommuting:

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E-commerce:

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Telematics:

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5.9 SUMMARY

Work is any productive activity undertaken to generate a given product or a service. Organizing work refers to arrangement of matters so that people can work in concert to get the work done. There are different ways of organizing and analyzing work as recommended by different management thinkers.

Work measurement is the study and analysis of time taken in the performance of a specific task. Work improvement denotes the study of methods and techniques of production for increasing efficiency. Work study covers both time study and motion study for work measurement and

work improvement. While Time study is concerned with the determination of time taken by the workers in performing each operation on the job, Motion study is concerned with the motions or movements of workers.

Ergonomics is the scientific study of individuals and their physical relationship to the work environment. Computer Aided Design method addresses the problems of interest in human motion analysis in terms of ergonomic design, workspace visualization, posture prediction, layout design, and placement. The use of IT has evolved many new forms of work design in recent years.

5.10 SELF ASSESSMENT QUESTIONS

1. What are the different approaches to organising and analysing work?
2. Explain the concept of "ergonomics."
3. Write down the impact of IT in organising work with suitable examples.

5.11 REFERENCES/ FURTHER READINGS

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