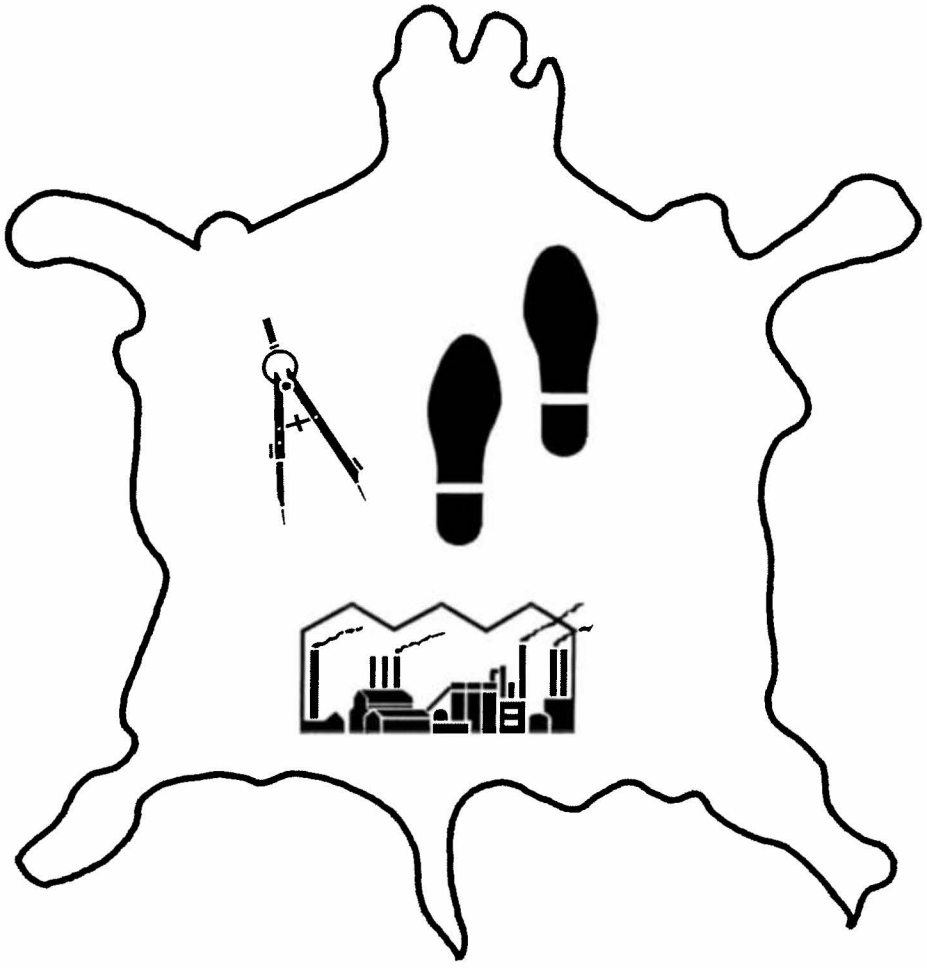
SHOE INDUSTRY

DIPLOMA COURSE

WORK STUDY*



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This learning element was developed by the UNIDO Leather Unit's staff, its experts and the consultants of the Clothing and Footwear Institute (UK) for the project US/PHI/85/109 and is a part of a complete Footwear Industry Certificate/Diploma Course. The material is made available to other UNIDO projects and may be used by UNIDO experts as training aid and given, fully or partly, as hand-out for students and trainees.

The complete Certificate/Diploma Course includes the following learning elements:

Certificate course

-Feet and last
-Basic design
-Pattern cutting
-Upper clicking
-Closing
-Making
-Textiles and synthetic materials
-Elastomers and plastomers
-Purchasing and storing
-Quality determination and control
-Elements of physics
-General management
-Production management
-Industrial Law
-Industrial accountancy
-Electricity and applied mechanics
-Economics
-SI metric system of measurement
-Marketing
-Mathematics
-Elements of chemistry

Certificate/Diploma course

-Closing
-Collection building
-Advanced technology
-Work study
-The role of the production manager
-Production planning
-Material purchasing & control
-Quality control
-Material and related science
-Adhesives
-Pattern making and engineering
-Shoe costing
-Grading

WHAT IS PRODUCTION?

WHAT IS PRODUCTIVITY?

Production is generally thought of as the output of a plant or the flow of product through the plant.

Productivity is the ration of input and output.

It is nothing more than the arithmetical ratio between the amount produced and the amount of any resources used in production.

These resources may be (1) Materials (2) Plants Machines & Tools (3) The Services of Men.

It is possible to have a combination of all three.

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Productivity of Materials

If a skillful cutter is able to cut 21 shoes from a skin of leather, from which an unskilled cutter can only cut 20, then in the hands of the skillful cutter, the material was used with 5% greater productivity.

Unskilled cutter	=	20 pairs
Skilled cutter	=	21 pairs
Different	=	1 pair
Difference	=	1/20
	=	5%

PRODUCTIVITY OF MACHINES

If a machine tool has been producing 100 pieces per working day, and through the introduction of better cutting tools, the output is increased to 120 pieces, the productivity has increased by 20%.

Old system = 100 pieces

New system = 120 pieces

Difference = 20 = $\frac{20}{100}$

= 20%

Productivity of Men

If an operative has been attaching 30 pairs of soles per hour and improved conditions enable him to produce 40 pairs per hour, the productivity has increased by 33-1/3%.

Normal = 30 pairs

Improved = 40 pairs

Difference = 10 = $\frac{10}{30}$ = $\frac{1}{3}$

= 33-1/3%

Increase in production does not signify an increase in productivity.

Why?

Example I

Three men produce 300 pairs of shoes daily.

The team is increased by one man.

Four men produce 400 pairs per day.

$$\frac{300 \text{ pairs}}{3 \text{ men}} = 100 \text{ pairs per man}$$

$$\frac{400 \text{ pairs}}{4 \text{ men}} = 100 \text{ pairs per man}$$

Production has increased by 100 pairs.

Productivity remains the same at 100 pairs per man.

Example II

Five men can forepart last 500 pairs daily.

The team is increased by one man.

Six men increase the production to 540 pairs daily.

$$\frac{500 \text{ pairs}}{5 \text{ men}} = 100 \text{ pairs per day}$$

$$\frac{540 \text{ pairs}}{6 \text{ men}} = 90 \text{ pairs per day}$$

Difference = 100 - 90 = 10

$$\frac{10}{100} = 10\% \text{ decrease in productivity}$$

Labour Team = 5 Men
Increased to 6 men = Difference of one man = $\frac{1}{5} = \frac{20}{100}$

= 20% increase

Output of 500
Increased to 540 $= \frac{40}{500} = \frac{8}{100} = 8\%$ increase in production

Labour team increased by 20%

Production increased by 8%

Productivity decreased by 10%

Example 3

Three men can insole attach 300 pairs daily.

The method in use is reorganized.

Three men can now produce 360 pairs daily.

Increase of 60 pairs $= \frac{60}{300} = \frac{1}{5} = 20\%$

Productivity has increased by 20% with the same resources.

Production has increased by 20%.

Example 4

Five females can stitch 100 leather handbags per day.

Each femal collects her work from the previous operation.

Reorganization eliminates the need for collection. Four females can now stitch 100 handbags per day.

100 bags produced by 5 femails = 20 bags per female

100 bags produced by 4 females = 25 bags per female

Difference = 5 = $\frac{5}{20}$ = $\frac{1}{4}$ = 25%

Production in each case is 100 bags.

Productivity has increased by 25%

Production remains the same.

CONCLUSIONS

1) An increase in production does not by itself indicate an increase in productivity.

2) If the input of resources goes up in direct proportion to the increase in output, the productivity will stay the same. (Example 1).

3) If the input of resources goes up by a greater percentage than output, higher production will be achieved at the expense of a reduction in productivity (Example 2).

4) Higher productivity means that more is produced with the same expenditure of resources.
i.e. some cost in terms of materials, machime time or labour (Example 3).

5) Alternatively that the same amount is produced at less cost in terms of materials, machine time or labour. This also is an example of an increase in production (Example 4).

Who is responsible?

Action must be taken by all sections of the community.

Government

Employers

Workers

What is the role of Government?

Creation of conditions favourable to the efforts of employees and workers to raise productivity.

(1) Balanced program of economic development

(2) To take the steps necessary to maintain employment.

(3) Opportunities for those who are unemployed or underemployed.

(4) Opportunities for those who may become redundant as a result of productivity improvements in individual plants.

What are the resources at the disposal of a manufacturing company?

(1) Materials

Materials that can be converted into products to be sold. (Upper materials, insoles, soles, heels, trims can be converted into shoes or leathergoods).

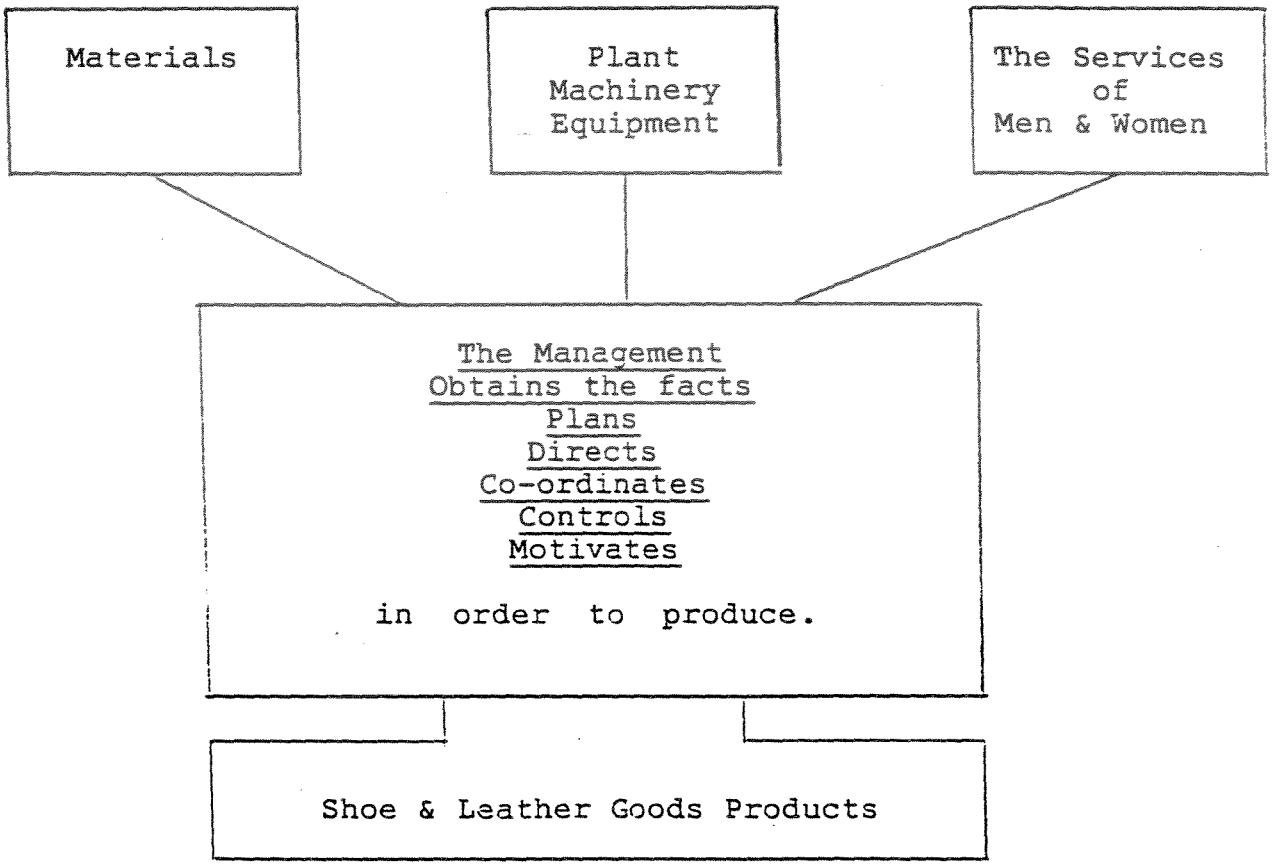
(2) Machines

Plant, equipment and tools necessary to carry out operations of manufacture and the handling and transport of materials and finished leathergoods and shoes. Heating or cooling system: Power Plant:Office equipment and furniture.

(3) Labour

Men and women to perform the manufacturing operations: To plan and control; To do clerical work; To design and to research; To buy and sell.

What is the role of Management?



ROLE OF MANAGEMENT(cont.)

To create a favourable climate for a productivity programme.

To obtain cooperation of workers (this is necessary for real success).

To obtain cooperation of the trade unions.

Important to explain policy to workers so that management and workers can move forward together.

It is important for management to understand that coersion is no substitute for voluntary action.

The most difficult task that management has is to encourage people to cooperate.

Role of the Workers

There are often difficulties in obtaining the active cooperation of the workers.

Fear that raising productivity will lead to unemployment.

Fear of working themselves out of a job.

Fear greatest when unemployment already exists.

Discussions (the need to become more competent and more productive or other companies and countries will obtain all the business).

Time Components of a Job

How's the total time of a job is made-up

Man Hour = Labour of one man for one hour

Machine Hour = Running of machine or part of plant for one hour

The time taken by a man or machine to carry out an operation or to produce a given quantity of product may be considered as made up in the following manner:

(1) Basic work content of the product or operation

(2) Excess work content

(1) Basic Work Content

The basic work content is the minimum time theoretically required to produce one unit of output.

This is a perfect situation which rarely occurs in practice.

(2) Excess Work Content

(a) The work content is increased by work content added by defects in the design or specification of the products.

(b) Work content added by inefficient methods of production or operation.

(c) Ineffective time due to shortcomings on the part of management

(d) Ineffective time within the control of the worker.

Ineffective Time due to shortcomings of Management

Marketing Policy Lack of Standardization

Design changes Planning Lack of materials

Plant breakdowns Plant in bad condition

Bad working conditions Lack of training

Supervision Style of Management Communications

Unfair Labour Practices Working Conditions

Increased Work due to Defects in Design Area

Inadequate Knowledge of market Design & Skills

No. of Patterns Difficult Shapes

Perforated Designs Lack of Standardization

Excessive variety of Products Quality Standards

Material Specifications Construction

Position of Seams & Laps Ill Fitting Patterns

Surplus Material Interlocking of Patterns

Insufficient Allowance Heel & Seat Shape

Ineffective Time within the Control of the Workers

Absence, Lateness & Idleness

Careless Workmanship

Accidents

Attitudes

Work Content added by Inefficient Methods of Production or Operation (Examples)

Material store
Material savings
Cutting boards
Cutting tools
Patterns
Size Marking Incorrectly
Damages at Skiving
Light Skiving
Lining Fit
Guides at Seam Closing
Top stitching without knife attachment
Top stitching without guides
Positions of toe puffs
Components attached prior to stitching (extra operations)
Insole Bevel
Insole Mould
Shank Attach Incorrectly (causing poor top lines)
Incorrect type of stiffeners
Insufficient time dwell (causing week bonds)
Forepart last machine (crooked vamps)
Seat last plates (not correct fit)
Roughing excessively (damages)
Heel attach (broken heels)
Clicking layout (causing extra movement)
Closing layout (causing extra movement)
Lasting & Making layout (causing extra movement)
Warehouse system (lack of organization)

Is it possible to introduce a system to ensure that all designs are examined in detail prior to bulk production?

This can be achieved by the use of the Value Analysis Team System.

The use of the Value Analysis Team System assists in eliminating faulty patterns, faulty manufacturing. It stabilizes the price structure.

The Value Analysis Team System

Who are the members of this team?

Factory Manager

The Designer/Pattern Cutter

Accountant

Quality Controller

Work Study Officer

Production Planner

Material Controller

Supervisors

Aims of the Team

(1) To produce shoes and leathergoods that are within the specified cost.

(2) To produce designs that are saleable.

(3) To produce designs that are problem free in relation to manufacture

(4) To ensure that the materials specified can be obtained readily.

Team examines, discusses and makes suggestions for each design produced during each phase of the collection building and bulk test programme.

Each design is costed during the sample manufacturing stage. Consequently costs are available for all designs at each development meeting of the range collection and bulk test programme.

Designer has List of Restrictions for each Price Bracket

Cost of materials including trims

Number of standard minutes allowed
Bottom unit costs

Capacity Plan produced for each style.

Examination by supervisors of the design in relation to availability of skills and equipment.

Quality Standards specified by Quality Control

And Production Supervisors

Team involved in cost reduction programme.

Series of questions which are related to method study.

Investigations in each area.

Materials - type and cost

Bottom costs

Labour costs

Reducing Ineffective Time due to Management

Marketing Policy Essential

Should the company attempt to specialize in a small number of products with styles made in large quantities or special requirements of every customer.

Rate of productivity will depend on decision.

Some form of specialization is necessary.

Standardization

Lasts

Components

Dies

Patterns

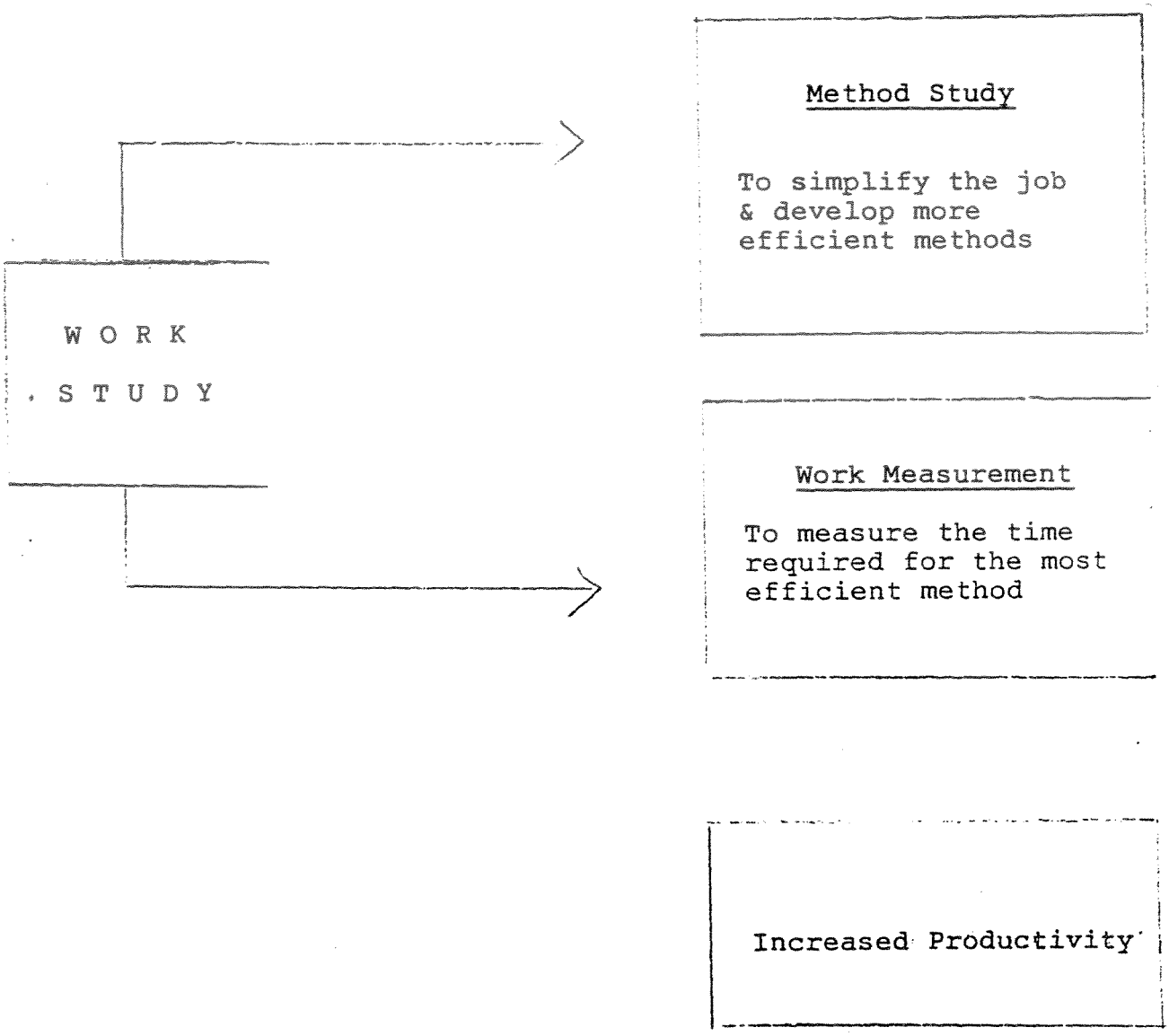
What is Work Study

Work Study is a system of increasing productivity. It is a term used for the techniques of Method Study & Work Measurement.

It aims at the problem of increasing productivity through the systematic analysis of existing operations.

Work Study usually contributestowards increasing productivity with little or no extra capital involved.

Method Study & Work Measurement



Method Study

Method study is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods of cost reduction.

Work Measurement

Work measurement is the application of techniques designed to establish the time required for a qualified worker to carry out a specified job at a defined level of performance

Why is Work Study Valuable?

It is systematic in the approach to the examination of the problems and the development of the solution.

Work Study needs to be the responsibility of a full time agent.

Managers and Supervisors are too busy.

Reasons for introduction of Work Study

(1) Increases Productivity
(2) Accuracy in establishing standards of performance
(3) Savings occur immediately
(4) Can be introduced in all areas of factory life
(5) One of the most efficient systems of investigation available to management
(6) Constant application for best results
(7) Systematic - Everything is checked
(8) It is ruthless in relation to waste of any form, in relation to material, time or human ability

Basic Procedures of Work Study

There are eight activities in the process

(1) Identify the job
(2) Record each activity
(3) Question each element
    (a) reason for activity
    (b) location of process
    (c) sequence
    (d) operator
    (e) method used
(4) Construct the most economic method
(5) Time the operation
(6) Record the information for future identification
(7) Introduce the new method as agreed standard practice
(8) Introduce system to ensure maintenance of new process

The Human Factor

(1) Good relationships

(2) Leadership from Management

(3) Supervision

(4) Workers

(5) Work Study Consultants

Introduction to Method Study and the Selection of Jobs

Method Study is the systematic recording and critical examination of existing and proposed ways of doing work as a means of developing and applying easier and more effective methods & reducing costs.

Basic Procedures

(1) Define the problem

(2) Obtain all the facts

(3) Examine the facts critically

(4) Consider the possibilities

(5) Act on the decision

(6) Follow up the development

Basic Procedures for Method Study

(1) Select work to be studied

(2) Record all the relevant facts about the present method by direct observation

(3) Examine these facts critically and in ordered sequence using the techniques best suited to the purpose

(4) Develop the most practical, economic and effective method

(5) Define the new method so that it can always be identified

(6) Install the method as standard practice

(7) Maintain the standard practice by regular routine checks.

Selecting the Work to be Studied

Economic Considerations

(1) Profitability of this job

(2) Production Holdups

(3) Important that adequate technical knowledge is available to the Method Study Officer.

(4) Human reactions

Standardized list of points to be covered

(1) Product Design & operation

(2) Person who proposes investigation

(3) Reason for proposal

(4) Suggested limits of investigation

(5) Particulars of the job

(6) (a) How many are produced per week

(b) How long will the job continue

(c) Will it be increased in the future

(d) How many operatives are employed on the job

(i) directly (ii) indirectly

(e) How many does each member of the team produce per day

(f) What is the daily output compared with the hourly output

(g) What is the form of payment

(i) team work (ii) piecework (iii) bonus (iv) time rate

(h) What is the daily output

(i) best operative (ii) worst operative

(i) Are the machines used all the time

(j) Is the layout efficient

(k) Are the designs easy to make

(l) Is the quality standard correct

(m) What savings or increase in productivity may be expected from a method improvement

(i) through reduction in work content

(ii) through better machine utilization

(iii) through better use of labour

(n) Is the existing space allowed for the job enough (layout)

(o) Is extra space available

(p) does the space already occupied need reducing

(q) Are frequent design changes causing problems

(r) Can the design be altered for easier manufacture

(s) What quality is demanded

(t) When & how is the product examined.

Record, Examine & Develop

(1) Record the facts

(a) Record all the facts relating to the existing method

(b) Success depends on accuracy.
It provides opportunity for critical examination & development of improved method.

(c) One way of recording is to write them down.
This is not suited to complicated processes.

Some other techniques have been developed.

Charts & Diagrams

Charts are usually related to two groups.

(1) Those which are used to record a process sequence, i.e. a series of events in the order in which they occur, but do not show them to scale.

(2) Those which record events also in sequence, but on a time scale so that the interaction of related events can be more easily studied.

Diagrams are used to indicate movement more clearly than charts can do. They usually do not show all the information recorded on charts which they supplement rather than replace.

PROCESS CHART SYMBOLS

(1) The recording of the facts about a job or operation on a process chart is simplified by the use of a set of given standard symbols.

(2) The symbols represent the different types of activity likely to be experienced.

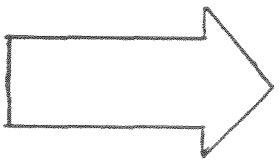
 = Operation

(1) It specifies the mainsteps in a process, method or procedure

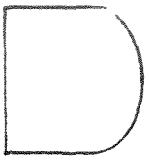
 = Inspection

It specifies an inspection for quality.

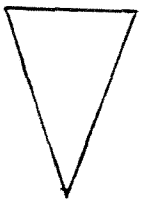
A more detailed picture can be obtained by adding three other symbols.

 = Transport

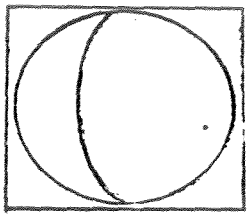
Indicates the movement of workers, materials or equipment from place to place.

 = Temporary storage or delay.

Indicates a delay in the sequence of events (Work waiting between operations).

 = Permanent storage

This is a permanent stores area.



= Combined Operations

When it is necessary to demonstrate activities performed at the same time by the same operative at the same work station, the symbols for these activities are combined.

Outline Process Chart

General view (records only the main operations & inspections)

Flow process charts are used more often in the shoe industry.

Flow process charts can be used in terms of materials, workers, equipment.

A flow process chart demonstrates the sequence flow of any product, or procedure by recording all the events.

The Flow Process Chart presents a complete picture of what is being done and assists the consultant in understanding the facts and their relationships to one another.

The facts are obtained by direct observation.

Charts must not be based on memory but must be prepared as the work is observed.

Charts should be neatly recorded

A chart that is not clearly defined creates a poor impression and may lead to errors.

Charts will always be referred to at some future date and special information should be available:

(1) The name of the product or material.
(2) Operations or processes with starting and finishing references.
(3) Location
(4) Chart reference no. and sheet no.
(5) the observer
(6) Date of study
(7) A description of the symbols used
(8) A summary of distance and time
This is required when old and new methods are being compared.

Before completing the chart, the following points should be checked.

(1) Have all the facts been correctly recorded.
(2) Has the investigation been complete.
(3) Have all the facts involved been recorded.

The Data Recorded must now be examined critically.

Plant Layout

In conducting a method study, it becomes desirable at some stage to look critically at the movement of men and materials, through the plant and to examine the plant layout.

Reasons

(1) The initial layout was not well thought of.

(2) Expansion from time to time

Notes on Plant Layout

(1) Layout by fixed position

(a) The material does not travel around the plant but stays in one place. All the necessary equipment & machinery is brought to it instead.

(b) Bulky products are usually involved in this type of layout.

Layout by process or Function

(Sometimes called operation based layout)

All of the operations of the same type are grouped together.

Examples

Clicking & Closing in the Shoe Industry

Product Based Layout

(Sometimes called mass production type)

All of the necessary machinery & equipment needed to make a given product is situated in the same order and in the sequence of the manufacturing process.

The Lasting and Making areas are examples in this area.

Layout which makes possible group production methods or group layout.

Example

Closing room group responsible for all operations. Each operative performs three or four operations.

The following steps are taken when a layout for a plant or a work area is designed.

(1) The equipment and machinery required is determined by the product. The stuck on process, sandal and slip last type will have different machinery in some areas.
(2) Number of machines will be determined by the production required.
(3) Space for machinery is determined by calculating the area for the machines and multiplying by the number of machines.
(4) Space for materials, work in progress, material handling equipment and finished shoes or leather goods at the warehouse is also necessary
(5) Canteen, washroom, offices will also require space
(6) Total space will be assessed by adding the areas together for 3rd, 4th, 5th items together
(7) The various departments are planned to give the most economical flow such as closing beside clicking and the lasting department following on from Closing
(8) The plan is determined by the positioning of working areas, storage areas and auxiliary services
(9) Additional space is required for parking and transport storage for incoming and outgoing goods.

The work study consultant is usually involved in modifying an already existent plant layout. In this case it is a question of deciding what is best and most economical.

Developing the flow for one product or process.

Normally the flow process chart is used, supplementing it with a flow diagram.

The flow process chart is useful in recording travel distance and the time taken for the various operations.

Its value lies in its use, as an analytical tool to question the existing method.

The flow diagram on the other hand is a plan drawn substantially to scale of the plant, specifying the positions of machines and working positions.

The Flow Diagram can also be used for the study of movement on several floors of a multi-storey building.

Flow diagrams of each floor can be made as well.

The Layout

When the dimensions and the relative position of machinery, storage arrangements and auxiliary services have been decided, it is necessary to make a visual presentation of the proposed layout.

When positioning the templates ensure that gangways are wide enough to allow the free movement of material, handling equipment and work in process.

Flow Diagrams

The String Diagram

The string diagram is a scale plan or model on which a thread is used to trace and measure the path of workers, material or equipment during a series of events. It is a special form of flow diagram in which a string or thread is used to measure distance.

Examine critically

The questioning Techniques.

Each activity is subjected in turn to a systematic series of questions.

The five sets of symbols or activities recorded in the Flow Chart fall into two main categories:

(1) Where something is actually happening to the material or product or it is being examined

(2) Those in which it is not being touched, being either in storage or at a standstill

Activities in section (1) may be subdivided into three groups:

(1) Make ready

Activities required to prepare the material and set it in position ready to be worked on.

(2) Do Operations

Change in shape of product.

(3) Put away activities

Where the work is moved aside from the machine or work place. Put away activities may be the make ready activities for the next operation.

It can be seen that while "make ready and put away activities may be represented by "Transport" & "Inspection" symbols, "Do" operations can only be represented by "operation" symbols.

Aim is to have as many operations of "Do" as is possible since these are the only ones which carry the product forward in its progress from raw material to completion. The first activities to be challenged will be the "non productive" including storage and delays, which represent tied up capital.

The Primary Questions

In method study the questions are always the same.

Purpose	What is actually done Why is the activity necessary at all	Eliminate unnecessary parts of the job
Place	Where is it being done Why is it done at that particular place	Combine whenever possible or re-arrange the seque
Sequence	When is it done	for more effective results
Person	Who is doing it why is it done by that particular person	
Means	How is it being done Why is it being done in that particular way	Simplify the operation

The Secondary Question

During the second stage of questioning, the following questions are introduced.

(1) What else might be done

(2) What should be done

In the same way, the answers already obtained on (1) place (2) sequence (3) person (4) means are subjected to further enquiry.

Purpose	What is done Why is it done What else might be done Who should be done
Place	Where is it done Why is it done there Where else might it be done Where should it be done
Sequence	When is it done Why is it done there When might it be done When should it be done
Person	Who does it Why does that person do it Who else might do it Who should do it.
Means	How is it done Why is it done that way How else might it be done How should it be done

Those questions are the basis of successful method study.

Methods and Movements at the work place.

We will now examine the situation in relation to one man working at a machine or bench.
It is important to make certain that the job is in fact necessary and is being produced in the most efficient manner.

The Questioning Technique must be applied as regards

(1) Purpose

To ensure that the job is necessary.

(2) To ensure that it is being done where it should be done.

(3) Sequence

To ensure that it is in its right place in the sequence of operations

(4) To ensure that it is being done by the right person.

(5) Means

To simplify the job as much as is economically possible.

The Principles of Motion Economy

(1) Use of the human body.

(2) Arrangement of the work place

(3) Design of equipment.

Use of the Human Body

(1) Where possible the two hands should begin and complete their movements at the same time.

(2) The two hands should not be idle at the same time except during periods of rest

(3) When movements are performed symmetrically and simultaneously, they achieve not only a time balance but also a balanced equilibrium of the whole body, which makes them easier to perform.

Arm movements are classified into five groups.

(1) Movements of the fingers
(2) Movement of the fingers and wrist
(3) Movement of figners, writst and forearm
(4) Movement of fingers, wrist, forearm and upper arm
(5) Movements of figners, wrist, forearm, upper arm and shoulder.

Hand movements should be confined to the lowest category that is consistent with doing the job properly.

(6) Rhythm is essential to the smooth and automatic performance of a repetitive operation.
(7) Work should be organized so that eye movements are confined to a comparable area without the need for frequent changes of focus.

Arrangement of the work place

(1) Definite and fixed stations should be provided for all tools and materials to permit habit formation.

(2) Materials should be prepositioned to reduce searching.

(3) Materials and tools should be arranged to permit the best sequence of motions

(4) There should be adequate lighting

(5) Chairs should be arranged to permit good posture.

Defining the new method

(1) The written standard practice outlines in simple terms the methods to be used by the operative

(2) The equipment to be used

(3) A description of the method

(4) A diagram of the work place if necessary

Installing the new method

Installation occurs in 5 stages:

(1) Gaining acceptance by departmental supervision

(2) Gaining approval by the management

(3) Gaining acceptance by the workers involved and their representatives

(4) Retraining the workers

(5) Maintaining close contact with the progress of the job until it is functioning successfully.

Problems Involved

Displacement of labour must be carefully worked out

a. Worker is part of group
b. Adjusts his personality to group
c. If moved suddenly, social circle will be broken up
d. Importance of group behaviour
e. Failure to take this into account may lead the workers to resist changes which they would otherwise accept
f. If redundancy or transfer are not likely to be involved, the workers are much more likely to accept new methods if they are allowed to share in the development.

Define, Install and Maintain

(1) Obtaining approval for the improved method

(2) Work study consultant prepares a report

(3) Costs in materials, labour and overheads of the two methods and savings expected

(4) Cost of installing the new method
(new equipment or change in layout)

(5) Executive actions required to implement the new method.

Work measurement

Work study consists of two complementary techniques.

They are Method Study & Work Measurement

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specified job at a defined level of performance.

The aims of work measurement

Work measurement provides the management with a means of measuring the time taken in the performance of an operations or series of operations in such a way that ineffective time is showing up and can be separated from effective time.

Work Measurement has another role to play.

It can be used to set standard times for carrying out the work. If ineffective time occurs at a later stage, it will be immediately highlighted.

Uses of Work Measurement

(a) Possible to compare efficiency of alternative methods

(b) It assists in balancing the work of members of teams

(c) It provides information on which the planning and scheduling of production can be based including the plant and labour requirements.

(d) It provides information for labour cost control

The Basic Procedures

(a) Select the work to be studied,

(b) Record all the relevant data relating to the circumstances in which the work is being done, the methods and the elements of activity in them.

(c) Examine the recorded data and the detailed breakdown critically.

(d) Measure the quantity of work involved in each element in terms of time.

(e) Compile the standard time for the operation which in the case of stop watch study will include time allowances to cover relaxation, personal needs,

(f) Define, precisely the series of activites and methods of operation for which the time has been specified.

Conducting the work sampling study

It is important to decide on the objective of the work sampling.

The problem of all idle machines can be extended by investigation the reason for the stoppage.

(1) Machine problems

(2) No work

(3) Personal needs of workers

Random Sampling

The persons to be observed must be notified in advance. The reasons for the studies should be discussed with them. It is a low cost method and less controversial than stop watch time study.

Information Obtained from Work Sampling

(1) Comparisons of efficiency
(2) More equitable distribution of work
(3) Provides management with the information in relation to the percentage of ineffective time
(4) Reasons for ineffective time
(5) Assistance in decisions regarding
    (a) where method study needs to be applied
    (b) system of material handling
    (c) production planning techniques
    (d) lack of supplies

What is Time Study

Time study is a work measurement technique for recording the times and rates of working for the elements of a specified job carried out under specified conditons and for analysing the data so as to obtain the time necessary for carrying our the job at a defined level of performance.

Basic Time Study Equipment

(a) Stop watch
(b) Study Board
(c) Time study forms
(d) Calculator
(e) Reliable clock with a second hand
(f) measuring instrument

Stop Watch

Two types of watch are in general use for time study, namely the flyback and the non-flyback types a third type (the split-hand stop watch is sometimes used).

A fly-back decimal-minute stop watch is the type in most general use to day.

The Need for Work Sampling

In order to obtain a complete and accurate picture of the productive and idle time, it would be necessary to observe continuously all the machines in that area. A number of people would be required to complete this operation. This is not usually possible.

It is possible to visit the production units at random intervals. It will be necessary to record the machines that are idle and the reasons for each stoppage.

This is the basis of the work sampling techniques.

If the sample size is large enough and the observations made are at random, there is a high probability that these observations will reflect the real situation, plus or minus a certain margin of error.

The hand of the small dial makes 1/30th of a revolution of the main hand and thus makes a complete turn every 30-minutes.

In this type the movement is started and stopped by a slide at the side of the winding knob. Pressure on the top of the winding knob causes both the hands to flyback to zero without stopping the mechanism, from which point they immediately move forward again. If the slide is used, the hands can be stopped at any point on the dial and restarted without returning to zero as soon as the slide is released. This type of watch can be used for either "flyback" or "cumulative" timing.

The non-flyback type is controlled by pressure on the top of the winding knob. The first pressure starts the watch. The second pressure stops it. The third pressure returns the hands to zero. This watch is only suitable for cumulative timing.

The study board is simply a flat board usually of plywood or plastic to place the forms on when recording time studies.

Time Study Forms

There are many variations of this type of form.

The types used are generally.

(1) Time study top sheet - The top and introductory sheet of a study on which is recorded all the essential information about the study. the elements into which the operation being studied have been broken down and the break points used.

Continuation sheet for further cycles of the study

Study summary sheet is a form for the general summary of all the information which has been obtained furing the course of the study.

Analysis of studies sheet

This form records the results obtained in all the studies made on an operation.

Before leaving the office to make a study, the work study officer starts his stop watch and notes on his study sheet the time by the office clock when he did so.

Selecting & Timing the Job

Some of the reasons why a job requires attention are:

(a) Introduction of new operation
(b) Change in material or method (examination)
(c) Workers are not satisfied with value
(d) Production problems
(e) Introduction of new incentive scheme
(f) Required output is not achieved
(g) Machine stoppages for abnormal period
(h) Operational costs high

Communication with workers

Time Study Procedures

Collecting the facts

(a) Information on job
(b) Information on operative
(c) Conditions

Recod complete description of the elements

The Challenge

(a) Is the most effective method being used?
(b) Are all of the motions necessary?

Programme of Events

Decision on sample size
Measuring of elements
Rating
Adjustment of observed time to "basic times"
Decisions on allowances
Procedure for obtaining standard time
Organizational procedures in relation to obtaining information

Information required to ensure that the recorded study can be found and identified quickly when needed

(a) Study number
(b) Sheet number
(c) Name or initials of study man
(d) Date of study
(e) Name of person approving the study

Information to enable the operations to be identified accurately

(a) Name of operation
(b) Drawing
(c) Material
(d) Quality requirements

Information to enable the operation to be accurately identified

(a) Department
(b) Description
(c) Machine
(d) Sketch

Information to enable the operative to be identified

(a) Operatives name
(b) Block number

Stop Watch Procedure in Relation to Elements

When elements are selected and recorded, the timing of the operation beings.

At the end of the element, the hands of the stop watch are returned to zero, and another timing begins. The mechanism does not stop, and the immediate timing of the next element begins.

The normal procedure is to obtain an independent check of the overall time of study using a wrist watch or clock in the work study office.

It is important to note the time and date of study. This may be important in relation to retiming.

Procedures in relation to study

Work study walks to the clock. He sets his stop watch running. He records time on clock in "**start**" position on form.

He return to area of work study timing, and allows the hands of the stopwatch to continue moving until timing of operation begins.

At the beginning of the first element timing, he returns the hands to zero by applying pressure to winding knob.

He records the time that has elapsed before starting in "**T.E.B.S.**" column.

At the completion of the study, the hands are returned to zero, but the hands continue to resolve.

The work study officer walks to the clock and notes time of finishing when the watch is finally stopped. this is recorded in section T.E.A.S.

The "**Final Clock**" time is entered in the "**Finish**" section.

The two times recorded before and after the study in the "TEBS" column and "TEAF" column are known as ineffective time.

The different in time between the clock times of "start" and "finish" is recorded in the "elapsed" column.

The total of element times and other activities plus ineffective time is known as the "recorded" time.

It should in theory agree with the elapsed time.

Elements

Repetitive element is an element which occurs in every work cycle of the job.

An occasional element occurs at irregular intervals.

A variable element is an element for which the basic time varies.

A machine element is an element automatically performed by a power driven machine.

A foreign element is an element observed in a study which after analysis, is not found to be a necessary part of the job.

Rating

Rating is one of the most controversial aspects of Time Study.

(a) Time studies should be made on qualified workers extremely fast and slow workers should be avoided a qualified worker has the necessary skills to perform the job or operation at a normal speed.

(b) Standard rating - standard performance

The time standard must be such that their achievement must be within the capacity of the workers.

(c) Rating is the assessment of the workers rate of working This rate of working corresponds to what is termed the standard rating and is 133 on the rating scale that we will use.

What is rated?

The purpose of rating is to determine from the time actually taken by the operative being observed the standard time which can be maintained by the average qualified worker.

What the study man is concerned with is therefore the speed with which the workers carry out the work in relation to the study man's concept of a normal speed.

Speed of working is the only thing that can be measured by a stop watch.

An unskilled operative may move extremely fast and yet take longer to perform an operation than a skilled operative who appears to be working quite slowly.

The unskilled operative puts in a lot of unnecessary movement, which the experienced operative has long since eliminated.

The only thing that counts is the effective speed of the operations.

Judgement of effective speed can only be acquired through experience and knowledge of the operations being observed.

An inexperienced study man can be fooled

(a) Large number of rapid movements

(b) Underestimation of rate of working of skilled operative

Contingency allowances 2-5%

Instructions from supervisors

Waiting for work for very short period

Minor stoppages not related to machines

Rest allowances 4-13%

Monotomy

Degree of concentration

Strain on eyes-ears

Personal needs

Fatigue

Machine allowances 3-7%

Thread breaks
Needle breaks
The machine oil process
Bobbin change
Threading up

From Study to Standard Time

(a) Completing the study

(b) Preparing the study summary sheet

(c) Extension: The calculation of basic time

(d) Allowances

(e) The standard time

The Use of Time Standards

(1) Define the work covered by the time standards
(2) work specification
(3) Standard unit of work
(4) Production Planning and Utilization of Plant and Labour
(5) Estimating Production Costs
(6) Standard costing and budgetary control
(7) Incentive Schemes
(8) Organization of the recording system associated with work measurement and labour control