Chapter 2

The Work Study Method

2.0 Introduction

Work Study emerged in the early part of last century as a technique aimed at rationalising and measuring work with the emphasis on economy of motion and movement. Because of that, it was well known as the time and motion study. As it begun to encompass other aspects of observing and analysing work, the earlier term was replaced with "Work Study". Simultaneously, in the late 1940s and later on in the 1960s, other disciplines were developed namely industrial engineering and production management respectively. These disciplines differed from Work Study in the sense that they were devoted to increasing the efficiency of a production operation as a whole, not just the methods of work.

Modern production management looks at various aspects of production such as product design, quality control, layout and materials handling, production planning and control, maintenance management and invariably Work Study. These techniques may be applied singly or in combination, in the company. With time many of them began to rely more on sophisticated quantitative methods such as operations research to solve complicated operational problems. Advances in the fields of computers and information systems helped to boost production management techniques dramatically.

While Work Study has continued to be a relatively simple and cheap method of rationalising methods of work, it has also continued to develop. Several of the existing production management techniques can also be used to help develop improved methods of work.

2.1 Work Content

The time taken by a worker or a machine to carry out an operation or to produce a given quantity of a certain product can be broken down into four categories as illustrated in Figure 2.1.

The first category is the basic work content of the product or operation. Work content is the amount of work contained in a given product or a process and is measured in work-hours or machine-hours. A work-hour is the labour of one person for one hour and a machine-hour is the running of a machine or a piece of plant for one hour.

The basic work content is the time taken to manufacture the product or to perform the operation in a perfect manner i.e. no errors and 100% meeting specifications. The basic work content is the irreducible minimum time theoretically required to produce one unit of output. This of course is just an ideal or perfect condition, which would never occur in practice, although it can sometimes be approached, especially in line manufacturing or process industries. In general, the actual operation times are far more than the basic work content.

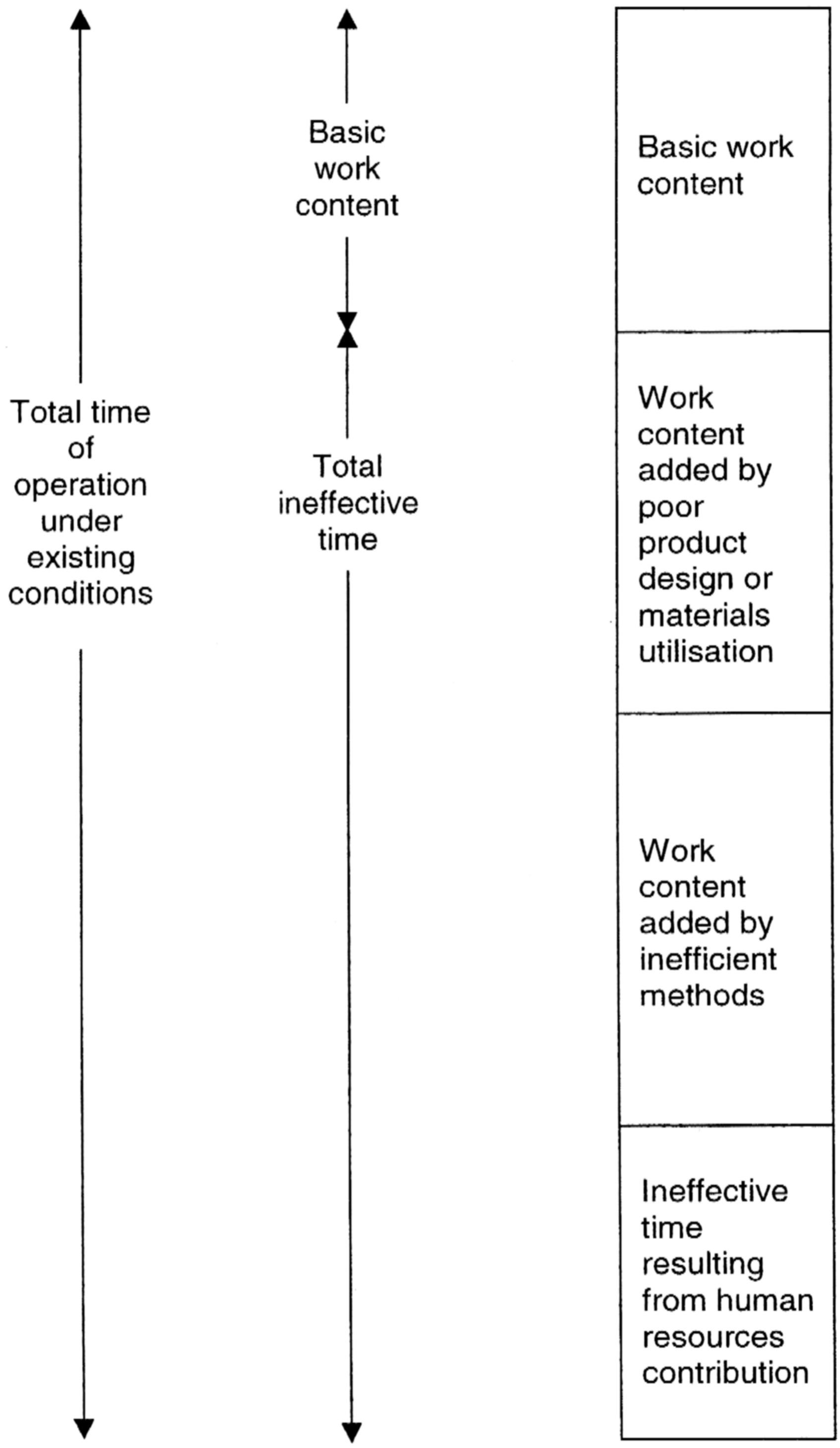


Figure 2.1: Breakdown of Total Operational Time

The work content is increased by the following 3 factors:

2.1.1 Design or specification of product

Additional work content can be contributed by poor design or specification of the product or its parts, or improper utilisation of materials. There are several ways in which unnecessary time and waste can be attributed to poor design of the product or its parts, or to incorrect quality control.

1. Poor design and frequent design changes

   The product may be designed in such a way that it may require a large number of non-standard parts causing a lengthy time to assemble. Excessive variety of products and lack of standardisation of products or their parts may mean that work has to be produced in small batches, with set up time lost as the operator adjusts and shifts from one batch to the next.

2. Waste of materials

   The components of a product may be designed in such a way that an excessive amount of material has to be removed to bring them to their final shape. This increases the work content of the job and wastes material as well. Operations requiring cutting in particular need careful examination to see if the resulting waste can be reduced to a minimum or reused.

3. Incorrect quality standards

   Quality standards that are too high or too low can increase work content. In engineering industries, insisting on sometimes unnecessarily tight tolerances requires extra machining and a corresponding waste of material. On the other hand, setting tolerances too loose may result in a large number of rejects. Deciding on the appropriate quality standard and the method of quality control is an important efficiency consideration.

2.1.2 Methods of manufacture or operation

Ineffective time and higher cost can result from a poor method of carrying out the operations, resulting in unnecessary movements of persons or materials. Similarly such ineffective time can be due to inappropriate handling methods, poor maintenance of machinery or equipment resulting in frequent breakdowns, or poor inventory control causing delays because of an absence of products or parts or higher costs as a result of overstocking.

1. Poor layout and utilisation of space

   The space used for any operation represents an investment. Proper utilisation of space is an important source of cost reduction, particularly when a company is expanding and needs an increased work area. Furthermore, a proper layout reduces wasted movement, time and effort.

2. Inadequate materials handling

   Raw materials, parts and finished goods are invariably being moved from one place to another throughout a production operation. The use of the most appropriate handling equipment for the purpose can save time and effort.

3. Frequent stoppages as production changes from one product to another

The proper planning and control of production operations can ensure that one production batch or order follows immediately on another so that idle time of machinery, equipment or labour is eliminated or minimised.

4. Ineffective method of work

   A sequence of operations may be well planned but each or some of them done in a cumbersome manner. By examining the way a certain operation is carried out and devising a better method, ineffective time can be reduced.

5. Poor planning of inventory

   In every operation, raw material is usually ordered and stocked ahead of time and at every stage of the operation an inventory of so-called "materials-in-progress" or semi-finished products and various parts are temporary stocked waiting to be processed. These various inventories represent tied-up investment. A proper inventory control system installed can minimise such an idle investment while ensuring that the operators do not run out of the material needed.

6. Frequent breakdown of machines and equipment

   Poor maintenance results in machinery and equipment that are often out of action, and idle time ensues while waiting for repairs. Installing a preventive maintenance system and mounting maintenance campaigns would ensure the smooth functioning of machinery and equipment.

2.1.3 Contribution of human resources

Workers in a company can influence the time of operations voluntarily or involuntarily as follows:

1. Absenteeism and lateness

   If the management fails to provide a safe and satisfying work climate, workers could respond by absenteeism, lateness or deliberately working slowly.

2. Poor workmanship

   If workers are improperly trained, the resulting poor workmanship can mean that the job has to be done again. Loses may also occur because of wasted material.

3. Accidents and occupational hazards

   If the management fails to provide a safe and healthy place to work, accidents or occupational illness can occur with resulting effects on morale and increased absenteeism.

If these factors can be eliminated, the minimum time and cost for the production of a given output can be achieved and thus gaining maximum productivity. In conducting a Work Study to examine an operation and trying to develop an improved method, all these factors have to be kept in mind.

2.2 What is Work Study

Work Study is one of the many methods used in production management to improve the efficiency of a process or operation. It can be categorised into 2 i.e. method study and work measurement. Method study is the systematic recording and critical examination of ways of doing things in order to make improvements. Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a task at a defined rate of working.

Figure 2.2 illustrate the relationship between method study and work measurement. Method study is concerned with the reduction of the work content of a job or operation, while work measurement is mostly concerned with the investigation of any ineffective time associated with it. This paper will concentrate on the method study technique.

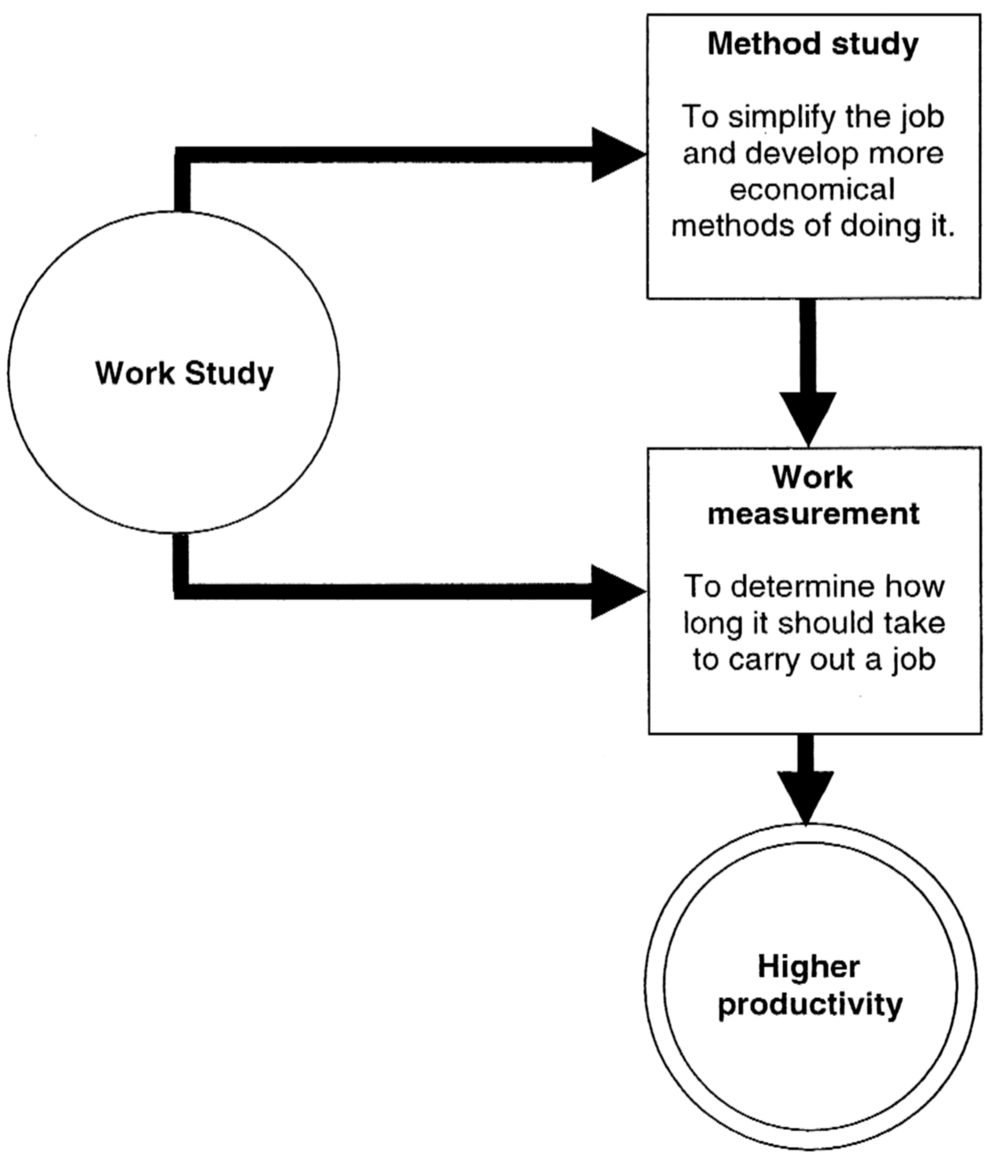


Figure 2.2: Work Study

2.3 Method Study

Method study is the systematic recording and critical examination of ways of doing things in order to make improvements. There are 8 steps in this method study i.e.

1. Select the work to be studied and define its boundaries
2. Record the relevant facts about the job through direct observation and collect any additional data as needed from appropriate sources.
3. Examine the way the job is being performed and challenge its purpose, place, sequence and method of performance.
4. Develop the most practical, economic and effective method
5. Evaluate different alternatives to developing a new improved method comparing the cost-effectiveness of the selected new method with the current method of performance.
6. Define the new method, as a result, in a clear manner and present it to those concerned i.e. management, supervisors and workers.
7. Install the new method as a standard practice and train the persons involved in applying it.
8. Maintain the new method and introduce control procedures to prevent a drifting back to the previous method of work.

2.3.1 Step 1: Selecting the work to be studied

Almost any operation in a work setting can be a candidate to be investigated and improved on. It is important to carefully select the process that would have the highest impact to the organisation using the limited resources and time. There are three factors that should be kept in mind when selecting a job to be studied.

1. Economic or cost-effective considerations: It will be a waste of time to start or continue a long investigation if the economic importance of a job is small, or it is one that is not expected to run long. Questions to ask are: "Will it pay to begin a method study of this job?" or "Will it pay to continue this study?" Some obvious choices for study includes:
   a) Key profit-generating or costly operation, or ones with the largest scrap/waste rates.
   b) Bottlenecks which are holding up other production operations, or lengthy operations that consume a great deal of time.
   c) Operations involving repetitive work using a great deal of labour and ones that are likely to run for a long time.
   d) Movements of material over long distances between workstations, those involving the use of relatively large proportion of labour or which require repeated handling of material.

   One of the easiest techniques that can be used to identify key operations is the Pareto analysis i.e. often a small number of items among a range of products account for the highest value.
2. Technical or technological considerations: One of the important considerations is the desire by the management to acquire more advanced technology, whether in equipment or in processes. Before such steps are taken, a method study can help point out the most important needs of the company in this respect. Method study acts as a scouting operation prior to the introduction of more advanced technology.
3. Human considerations: Certain operations are often a cause of dissatisfaction by workers. They may induce fatigue or monotony or

may be unsafe or clumsy to operate. The level of satisfaction should point to a need for method study.

It is important to limit the scope of the work to be studied i.e. determining the type of work to be studied, set-up boundaries around it and decide what exactly it will encompass. This is to ensure we have something that is achievable and not too ambitious, which may take too long of a time and resource to complete it.

2.3.2 Step 2: Recording the facts

After selecting the work to be studied, the next step is to record all the facts relating to the existing method. The success of the whole procedure depends on the accuracy of the facts recorded, because they will provide the basis of both the critical examination and the development of the improved method. It is essential that the record be clear and concise.

Recording may be carried out in 2 phases: first, a rough sketch or charting of the job being studied to establish whether the recorded information is of use; and second, a more formal and accurate chart or diagram to include in a report or presentation.

To describe exactly everything that is done in even a very simple job which may takes perhaps only a few minutes to perform would probably result in several pages of closely written script. To overcome this difficulty other techniques or tools of recording have been developed, so that detailed information may be recorded precisely and at the same time in standard form, in order for it to be readily understood by everyone, in whatever factory or country they may be working.

The most commonly used of these recording techniques are charts and diagrams. There are several types of standard chart available, each with its own special purposes. The charts available fall into two groups:

- Those used to record process sequence, i.e. a series of events or happenings in the order in which they occur, but which do not depict the events to scale; and
- Those used to record events, also in sequence, but on a time scale, so that the interaction of related events may be more easily studied.

The names of the various charts are shown in Table 2.1, which lists them in the 2 groups given above and also lists the types of diagram commonly used. Diagrams are used to indicate movement and/or interrelationships of movements more clearly that charts can do. They usually do not show all the information recorded in charts, which they supplement rather than replace.

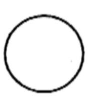
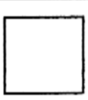
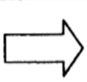
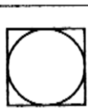
Table 2.1: Commonly used method study charts and diagrams

A. Charts	Indicating process SEQUENCE Outline process chart Flow process type - Worker type Flow process type – Material type Flow process type – Equipment type Two-handed process chart Procedure flowcharts
B. Charts	Using a TIME SCALE Multiple activity chart Simo chart
C. Diagrams	Indicating MOVEMENT Flow diagram String diagram Cyclegraph Chronocyclegraph Travel chart

2.3.2.1 *Process chart symbols*

A set of five standard symbols can be used to represent all the different types of activity or event likely to be encountered in a factory or office environment. They serve as a very convenient, widely understood type of shorthand, saving a lot of writing and helping to show clearly just what is happening in the sequence being recorded. The two principal activities in a process are operation and inspection. These and the other three activities are represented by the following symbols in Table 2.2.

Table 2.2: Method Study Symbols

Symbol	Activity	Description
	Operation	Indicates the main step in a process, method or procedure. Usually the part, material or product is modified or changed during the operation
	Inspection	Indicates an inspection for quality and/or check for quantity
	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: e.g. work waiting between consecutive operations, or any object laid aside temporarily without record until required
	Permanent Storage	Indicates a controlled storage in which material is received into or issued from a store under some form of authorisation, or an item is retained for reference purposes
	Combined activities	Shows activities performed at the same time or by the same operative at the same workstation e.g. circle within a square represents a combined operation and inspection.

An operation is said to take place when information is given or received, or when planning or calculating takes place. An operation always takes the material, component or service a step further towards completion, whether by changing its shape or its chemical composition or by adding or subtracting material. An operation may equally well be a preparation for any activity that brings the completion of the product nearer.

An inspection does not take the material any nearer to becoming a completed product. It merely verifies that an operation has been carried out correctly as to quality and/or quantity. Were it not for human shortcomings, most inspections could be done away with.

A transport occurs when an object is moved from one place to another, except when such movements are part of an operation or are caused by the operative at the workstation during an operation or an inspection. This symbol is used whenever material is handled on or off trucks, benches, storage bins and so on.

Examples of temporary storage or delay are work stacked on the floor of a shop between operations, cases awaiting unpacking, parts waiting to be put into storage bins or a letter waiting to be signed.

A permanent storage occurs when an object is kept and protected against unauthorised removal. A requisition or other form of authorisation is generally required to get an article out of permanent storage.

When it is desired to show activities performed at the same time or by the same operative at the same workstation, the symbols of those activities are combined.

2.3.2.2 *The outline process chart*

An outline process chart provides a "bird's-eye" view of a whole process or activity which can be very valuable as an initial assessment before embarking into a detailed study. An outline process chart is a process chart giving an overall picture by recording in sequence only the main operations and inspections. Brief notes of each of the operation or inspection and the time allowed for it is made beside the symbol. The operations and inspections are numbered uniquely and both start from 1.

2.3.2.3 *Flow process chart*

Once the general picture of a process has been established, flow process chart can be used to go into more detail. A flow process chart is a process chart setting out the sequence of the flow of a product or a procedure by recording all events under review using the appropriate process symbols. There are 3 types of flow process chart i.e.:

- Worker type: records what the operator does.
- Material type: records how material is handled or treated.
- Equipment type: records how the equipment is used.

Whichever type of flow process chart is being constructed, the same symbols are always used and charting procedure is very similar. Active voice verb is usually used for worker-type entries while passive voice is used for material-type and equipment-type charts. The same format can be used for all 3 types of charts. Because of its greater detail, the flow process chart does not usually cover as many operations per sheet as may appear on a single outline process chart. It is usual to use a separate chart for each major component of an assembly, so that the amount of handling, delays and storages of each may be independently studied.

A typical format is shown in Figure 2.3. Some important points, which must be considered in the preparation of process charts, are listed below:

1. Charting is used for recording because it gives a complete picture of what is being done and helps the mind to understand the facts and their relationship to one another.
2. Charts are an important means of illustrating clearly to everyone concerned the way the job is being carried out. Although supervisors and workers may not be trained in the use of a particular recording technique, they can understand a chart or diagram sufficiently to confirm that it represents the "time" situation and can often see inefficiencies such as unnecessary delays from the chart.
3. The details appearing on a chart must be obtained from direct observation. Once they have been recorded on the chart, the mind is freed from the task of carrying them, but they remain available for reference and for explaining the situation to others. Charts must not be based on memory but must be prepared as the work is observed (except when a chart is prepared to illustrate a proposed new method). Details recorded should be reviewed and confirmed with the supervisor. This confirmation has two aims. First, it ensures that the facts are correct. Second, it strengthens the bond between the Work Study person and the supervisor, who appreciates that his or her opinion is valuable to the investigation.

4. A high standard of neatness and accuracy should be maintained in preparing fair copies of charts constructed from direct observation. The charts will be used in explaining proposals for standardising work or improving methods. An untidy chart will always make a bad impression and may lead to errors.

5. To maintain their value for future reference and to provide as complete information as possible, all charts should carry a heading giving the following information:

   a) the name of the product, material or equipment charted, with drawing numbers or code numbers;

   b) the job or process being carried out, clearly stating the starting-point and the end-point, and whether the method is the present or proposed one;

   c) the location in which the operation is taking place (department, factory, site, etc.);

   d) the chart reference number, sheet number and the total number of sheets;

   e) the observer's name and, if desired, that of the person approving the chart;

   f) the date of the study

   g) a key to the symbols used. This is necessary for the benefit of anyone who may study the chart later and who may have been accustomed to using different symbols. It is convenient to show these as parts of a table summarising the activities in the present and proposed methods;

h) a summary of distance, time and, if desired, cost of labour and material, for comparison of old and new methods.

6. Before leaving the chart, check the following points:

   a) Have the facts been correctly recorded?

   b) Have any over-simplifying assumptions been made (e.g. is the investigation so incomplete as to be inaccurate?)

   c) Have all the factors contributing to the process been recorded?

<table>
<tr><td colspan="10">Flow process chart</td></tr>
<tr><td colspan="2">Chart No. 1 Sheet No. 1 of 1</td><td></td><td colspan="7">Summary</td></tr>
<tr><td colspan="2">Subject charted:</td><td>Activity</td><td>Present</td><td colspan="5">Proposed</td><td>Saving</td></tr>
<tr><td colspan="2"></td><td>Operation
Transport</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Activity:</td><td>Delay
Inspection
Storage</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Method: Present/Proposed</td><td>Distance (m)</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td colspan="2">Location:</td><td>Time (work-h)</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>Operative(s):</td><td>Clock No.</td><td>Cost
Labour</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>Charted by:</td><td>Date:</td><td>Material</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>Approved by:</td><td>Date:</td><td>Total</td><td></td><td colspan="5"></td><td></td></tr>
</table>

Description	Quantity	Dist-ance (steps)	Time (min)	Process Symbol					Remarks

Figure 2.3: Flow Process Chart

2.3.3 Step 3: Examine Critically: The questioning technique

The questioning technique is the means by which the critical examination is conducted, each activity being subjected in turn to a systematic and progressive series of questions. The five sets of activities recorded on the flow process chart fall naturally into 2 main categories:

- Those in which something is actually happening to the material or work-piece under consideration, i.e. it is being worked upon, moved or examined; and
- Those in which it is not being touched, being either in storage or at a standstill owing to a delay.

Activity in the first category may be subdivided into three groups:

- MAKE READY activities required to prepare the material or work-piece and set it in position ready to be worked on.
- DO operations in which a change is made in the shape, chemical composition or physical condition of the product.
- PUT AWAY activities during which the work is moved aside from the machine or workplace. The "put away" activities of one operation may be the "make ready" activities of the next.

"Make ready" and "put away" activities may be represented by "transport" and "inspection" symbols but "do" operations can only be represented by "operation" symbols. The aim is to have as high a proportion of "do" operations as possible since these are the only ones which carry the product forward in its progress from raw material to completion. These are "productive" activities; all others, however necessary may be considered as "non-productive", including storage and delay, which represent tied-up capital.

The questioning sequence used follows a well-established pattern, which examines the following:

The PURPOSE	for which	
The PLACE	at which	
The SEQUENCE	in which	the activities are undertaken
The PERSON	by whom	
The MEANS	by which	

	ELIMINATE	
	COMBINE	
With a view to	REARRANGE	those activities
	or	
	SIMPLIFY	

In the first stage of the questioning technique, the purpose, place, sequence, person and means of every activity recorded are systematically queried, and a reason for each reply is sought. The primary questions are listed in Table 2.3.

Table 2.3: Primary Questions

PURPOSE	What Why	is actually done? 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 wherever possible or REARRANGE the sequence of operations for more effective results.
SEQUENCE	When	is it done? Why is it done at that particular time?	
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 questions cover the second stage of the questioning technique, during which the answers to the primary questions are subjected to further query to determine whether possible alternatives of place, sequence, persons and/or means are practicable and preferable as a means of improvement upon the existing method. "What else might be done?" and "What should be done?" are secondary questions to further query what the primary questions have obtained.

The complete questioning technique (both primary and secondary) in Table 2.4, should be asked in the sequence from primary to secondary systematically each time a method study is performed.

Table 2.4: Primary and Secondary Questions

	Primary	Secondary
PURPOSE	What is done? Why is it done?	What else might be done? What 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 then?	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?

2.3.4 Step 4: Develop the improved method

A good notion about the shortcomings of the present operation and the possibilities of a new improved method can be developed using the following questioning sequence:

- What should be done?
- Where should it be done?
- When should it be done?
- Who should do it?
- How should it be done?

Some solutions are very visible and straightforward but in many cases, the solution is not that obvious and further investigation may be needed elsewhere. There may be many options available and an evaluation will have to be made to choose the most optimum choice.

2.3.5 Step 5: Evaluating alternative methods

The DEVELOP stage of the method study procedure should result in proposed changes to existing ways of carrying out the work under review. Sometimes the changes made are clear-cut and a revised method can be clearly defined. In most cases, the method study may highlight a number of possible changes and thus a number of potential new methods. Some of these may be capable of immediate introduction while others may require further actions to be carried out before they can be implemented. The sponsors/management must make a decision as to the preferred solution. To make this decision, they need appropriate information on the alternative methods, the likely results of the proposed changes and the costs of implementation. Typically a cost-benefit analysis for each proposed method is prepared and this is done in several stages.

A first pass analysis is carried out in which very broad costs and benefits are associated with each potential change. This can often be done very quickly and gives sufficient information to exclude a number of possible changes and methods from the more detailed evaluation process. It is important to include not only those that can be easily quantified (e.g. direct financial savings) but also those that can be expressed only in qualitative terms. Such benefits (e.g. improvements in job satisfaction, employee satisfaction, employee morale or industrial relations) can have significant long-term effects on financial performance and should be included in the evaluation process.

In order to allow the inclusion of qualitative factors alongside quantitative factors as part of the evaluation of alternative methods, the pseudo-quantitative techniques are used. These express the qualitative benefits in quantitative terms (by translating subjective judgements into numerical scores), allowing the quantitative and qualitative benefits to be combined in an overall evaluation.

A common approach is to use a combination of scoring and weighting. The various factors (normally benefits, but can include negative effects or disadvantages) that relate to the potential solutions are listed. This list may include such entries as direct cost savings, improved safety, greater labour flexibility and so on. Relative weighting is assigned to each factor to indicate its relative importance to the organisation. This weighting must be achieved by discussion with the managers and supervisors involved in the work area. One advantage of this method is that it requires those responsible for the decision making process to think carefully about their priorities.

Each potential method is then scored against each factor (normally on a simple 1 to 10 scale). This scoring can be based on quantitative data, where available, or on subjective judgement. Finally the score of each factor is multiplied by the weighting for that factor and the resultant sum gives an overall score for that particular potential method. The main advantage of this method is not that it produces a numerical result but that it forces those involved in the evaluation process to consider all factors (even those that are not easily measurable) and makes them think carefully about the relative importance of each one. The final figures are guidelines only.

The nature of the evaluation depends on the nature of the situation under review and the scope and scale of the proposed changes. If the change is minor (both in terms of disruption and cost), the evaluation can be carried out in a matter of minutes and a decision taken by the supervisor. In other cases it may require a significant investigation in its own right to determine and assess the likely costs and benefits.

2.3.6 Step 6: Defining the Improved Method

Once a decision has been taken on the changes in method to be adopted, it is important that the new method should be strictly defined. For all jobs other than those performed on standard machine tools or specialised machines where the process and methods are virtually controlled by the machine, it is desirable to prepare a written standard practice, also known as an "operative instruction sheet". This serves several purposes:

1. It records the improved method for future reference in as much detail as possible.
2. It can be used to explain the new method to management, supervisors and operatives. It also advises all concerned, including the engineers, of any new equipment required or of changes needed in the layout of machines or work places.
3. It is an aid to training or retraining operatives and can be used by them for reference until they are fully conversant with the new method.
4. It forms the basis on which time studies may be taken for setting standards although the breakdown by element will not necessarily be the same as the breakdown by motion.

The written standard practice outlines in simple terms the methods to be used by the operative. Three sorts of information will normally be required:

1. The tools and equipment to be used and the general operating conditions.

2. A description of the method. The amount of detail required will depend on the nature of the job and the probable volume of the production.
3. A diagram of the work place layout, and possibly, sketches of special tools, jigs or fixtures.

2.3.7 Step 7: Installing the improved method

The final stages in the basic procedure are perhaps the most difficult of all. It is at this point that active support is required from management and workers alike. Installation can be divided into five stages namely:

1. Gaining acceptance of the change by management.
2. Gaining acceptance of the change by the departmental supervision.
3. Gaining acceptance of the change by the workers and their representatives.
4. Preparing to make the changes.
5. Controlling the change-over.

Where redundancy or a transfer are not likely to be involved, the workers are much more likely to accept new methods if they have been allowed to share in their development. It is important that the change-over from an existing method to a revised one is properly planned. The first task is to identify the various activities that must be undertaken before the new method can be implemented. The most obvious ones are the purchase or construction of new equipment, tools, fixtures and so on, but the list may include the alteration of layouts or the training of operators. Each of these will have a different "lead time" before it can be completed, and thus an overall implementation schedule must be constructed to ensure that each activity is completed before the final change-over to the new method is made.

In the training or retraining of operatives, the important thing is to develop the habit of doing the job in the correct way. Habit is a valuable aid to increase productivity as it reduces the need for conscious thought.

Even though a new method is more efficient and will ultimately result in greater output, there is often an interim period when output falls, while the workers get up to speed on the new method. This should not coincide with a crisis such as the completion of an urgent order, unless additional staff can be used on a temporary basis to keep output levels up. The change-over date should be chosen to be as convenient as possible.

Having established the date of the change-over critical path of activities can be identified. For complex changes, a formal project planning and control technique may be used.

2.3.8 Step 8: Maintaining the new method

It is important that when a method is installed, it should be maintained in its specified form and that workers should not be permitted to slip back into old methods, or introduce elements not allowed for, unless there is very good reason for doing so. To be maintained, a method must first be very clearly defined and specified. This is especially important where it is to be used for setting time standards for incentive or other purposes. Tools, layout and elements of movement must be specified beyond any risk of misinterpretation.

Workers and supervisors will tend to allow a drift away from the method laid down if there is no check. Many disputes over time standards arise because the method being followed is not the one for which the time was specified; foreign elements have crept in. If the method is properly maintained, this should not happen. If it is found that an improvement can be made, this should be officially incorporated, a new specification drawn up and new time standards set. It may be necessary to establish a formal method review or method auditing procedure to check on the conformance of the new method.