THE AMERICAN UNIVERSITY IN CAIRO

MENG 344
Work Analysis and Design

Method Study

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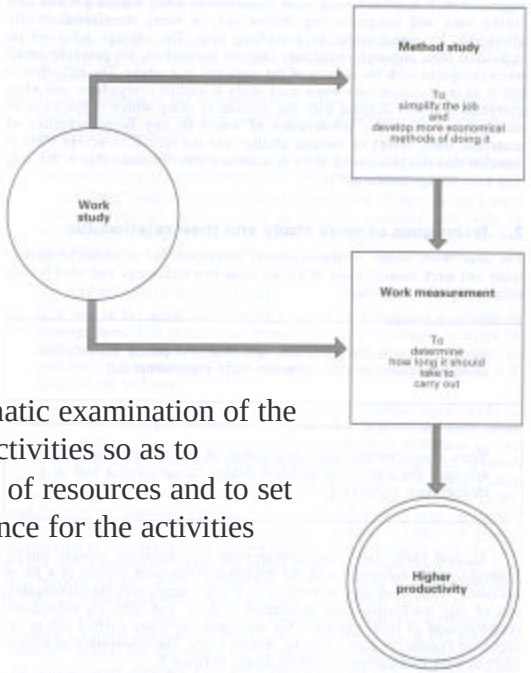
Based on *Introduction to work study*. 3rd ed. International Labor Office, Geneva, 1992.

Work Study



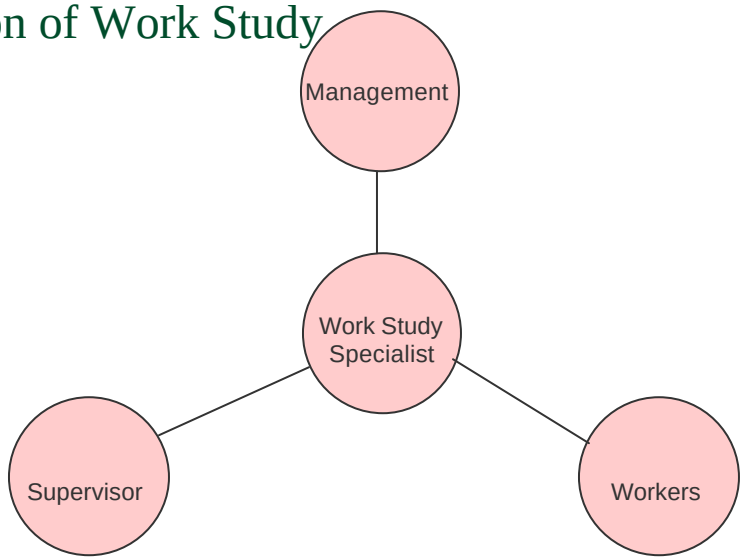
Work Study is the systematic examination of the methods of carrying on activities so as to improve the effective use of resources and to set up standards of performance for the activities being carried out.

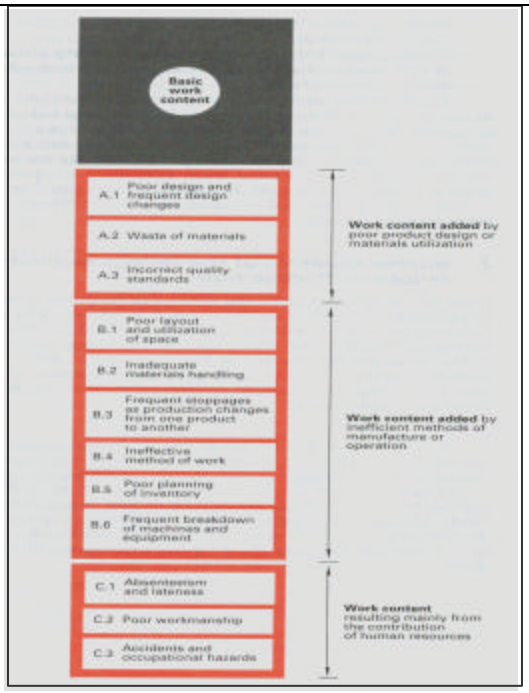
Method Study

Method study examines the way a task (changing the clutch on a car, preparing a flower bed for planting, cleaning a hotel room) is done. The industrial engineer has an eye on operational efficiencies and costs, quality of processes, service reliability, staff safety etc. Method study techniques are applicable from factory/workshop manufacturing to cabin crew activities on an international flight and office clerical work.

A collection of techniques used to examine work - what is done and how it is done - so that there is systematic analysis of all the elements, factors, resources and relationships affecting the efficiency and effectiveness of the work being studied.

The Human Factor in The Application of Work Study





Work study and the Management

- Importance of management.
- How to gain the management support:
  - Make them feel that it is not their fault.
  - Make them understand the purpose and techniques of work study.

Work Study and the Supervisor

The importance of the supervisor:

- Mostly affected by work study.
- A personal challenge.
- Responsibilities are taken away.

Work Study and the Supervisor

Do's and Don'ts

- Never give a direct order to a worker.
- Always refer worker's questions to the supervisor.
- Never express opinions to workers.
- Don't allow worker's to get you to alter decisions made by the supervisor.
- Seek the supervisor advice whenever possible.
- Always be introduced to workers by the supervisor.

Work Study and the Worker

- Work study improves industrial relations:
  - Workers feel that the management cares for them.
  - Workers discover that there are managers who highly understand their job.
  - Improving the feeling of confidence.
  - Workers are more able to carry out their jobs.

Work study and the Worker

- Why workers resist the work study:
  - It will change their familiar work methods.
  - Many workers resent being timed.
  - Fear of being fired.

Problem Solving

- Problem definition
  - statement of purpose, goal, objective
  - criteria of judging successful solution
  - output requirements
  - completion date
- Analysis of problem
  - constraints or specifications
  - description of the present method
  - review problem definition and criteria

Problem Solving

- Search for possible solutions
  - identify the basic cause that creates problem;
  - eliminate all unnecessary work
  - combine operations or elements
  - change sequence of operations
  - simplify the necessary operations
- Evaluation of alternatives
  - in terms of criteria and original specification

Problem Solving

- Recommendation for action
  - written reports to senior managers
  - presentations to senior managers and shop floor employees
  - development of soft skills, listening, negotiating,
- Marketing recommendations
  - target relevant groups

How do we measure performance?

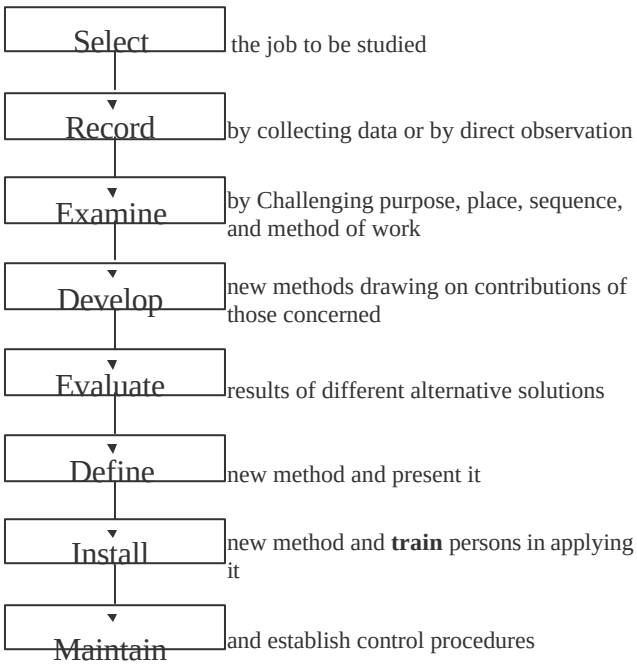
- Profit
- Financial measures
- Productivity – output/input ratios
- Cycle time

Possible Performance Measures

- **Quality** expressed as % scrap value, % returns, % downtime
- **Costs** expressed as inventory turnover, value added to incoming material
- **Delivery** expressed as % on time delivery, cycle time
- **Flexibility** as Average number of setups /day, % of common parts/product
- **Innovation** as % sales from products introduced in last 3 years

Method Study

To Simplify the job and develop more economical methods of doing it



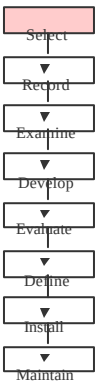
Select – Where to Look

- Poor use of resources
- Bad layout
- Bottlenecks
- Inconsistent quality
- High fatiguing work
- Excessive overtime
- Employee's complaints

Select – Economic Considerations

Will it pay to begin, or continue, a method study of this job?

- Key profit- generating operations
- Key costly operations
- Repetitive work
- Long travels
- Excessive overtime



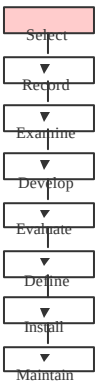
Select – Technical Considerations

Desire to acquire more advanced technology

- Extensive paperwork
- Repetitive work (automation)
- Hazardous work
- Inconsistent quality

Select – Human Considerations

Workers satisfaction/resentment



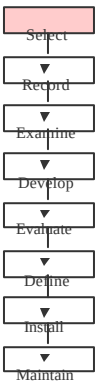
- Satisfaction level
- Start with non-controversial jobs
- HSE

Select – Limiting the Scope

Setting boundaries and determining content

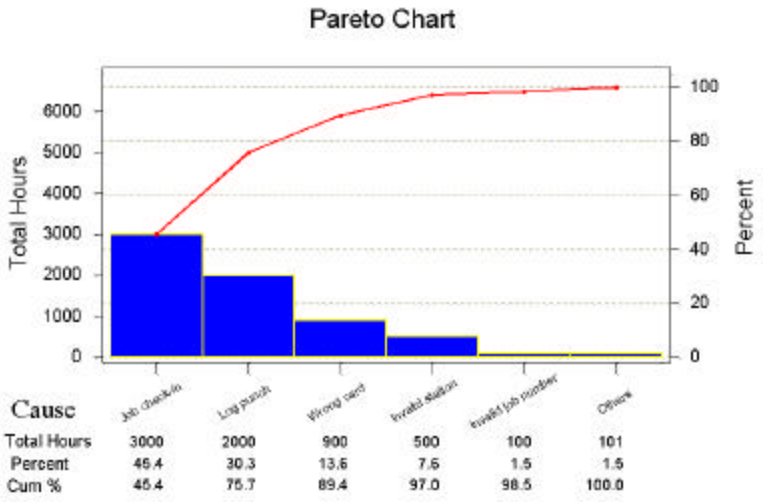
- One operation or a sequence
- The whole operation or part
- Which aspect: worker, materials, equipment, … etc.

Select – Possible Results



- Increased production rate
- Reduced cost
- Less labor, materials, or equipment
- Improved quality
- Improved safety
- Reduced scrap
- Improved standards of cleanliness

Select – Pareto Analysis



Record- Symbols

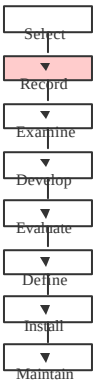
Operation (Make ready, Do, Put away)

Inspection

Transport

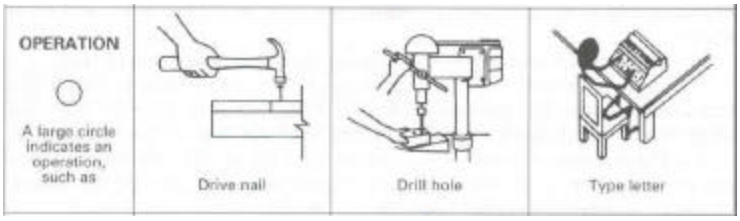
Delay

Storage



Record- Symbols

Operation (Make ready, Do, Put away)



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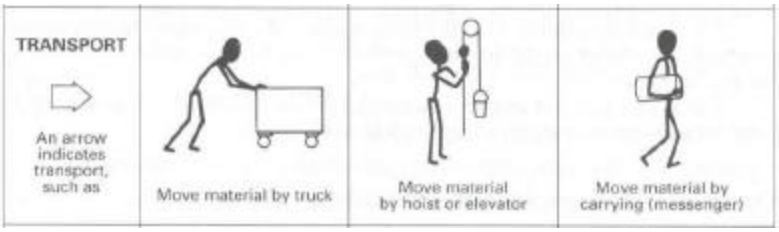

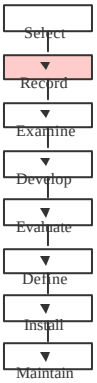

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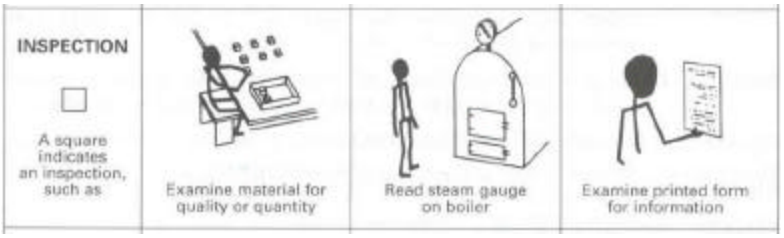

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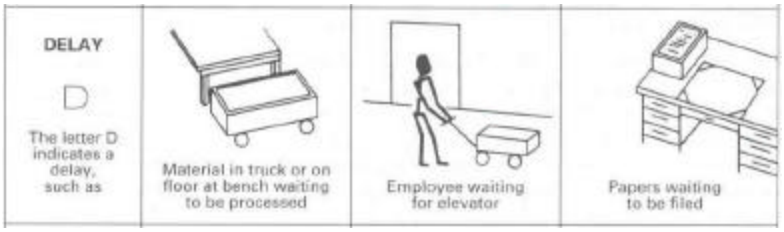

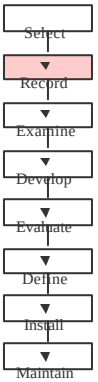

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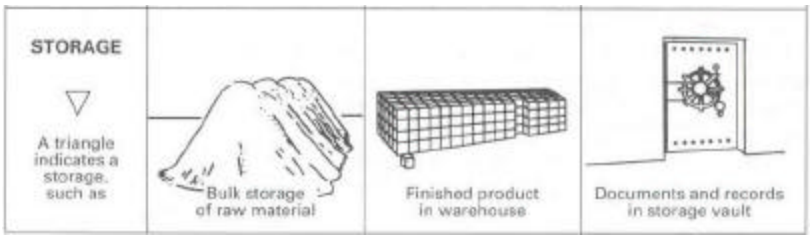


Record- Charts and Diagrams

Outline Process Chart

Flow Process Chart (Worker, Material, Equipment)

Two-Handed Process Chart

Procedure Chart

Simultaneous motion Cycle Chart

Multiple Activity Chart

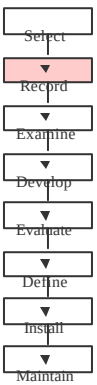
Flow Diagram

String Diagram

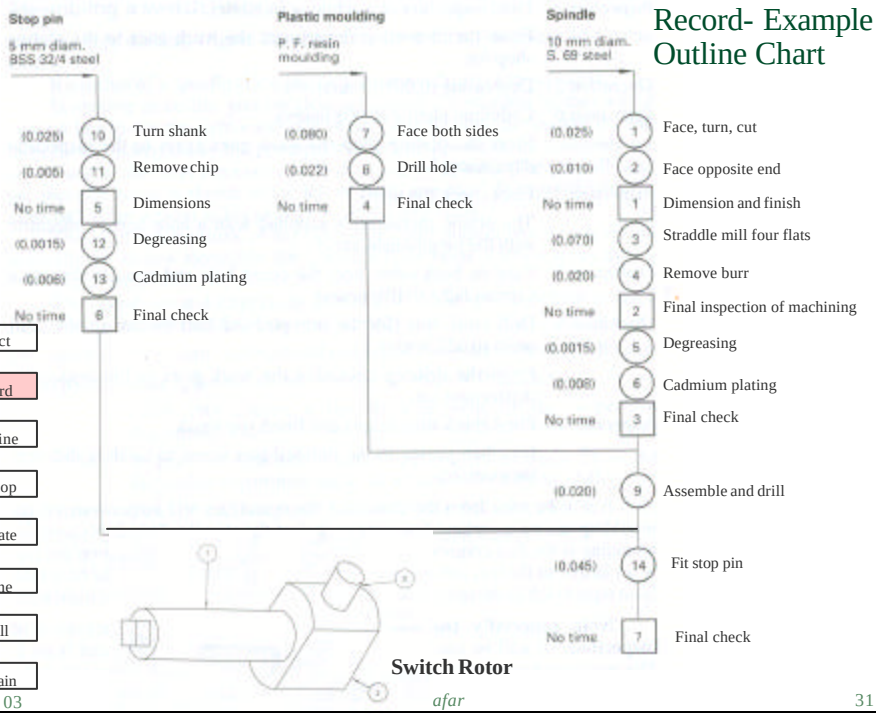
Cyclegraph

Chronocyclegraph

Travel Chart

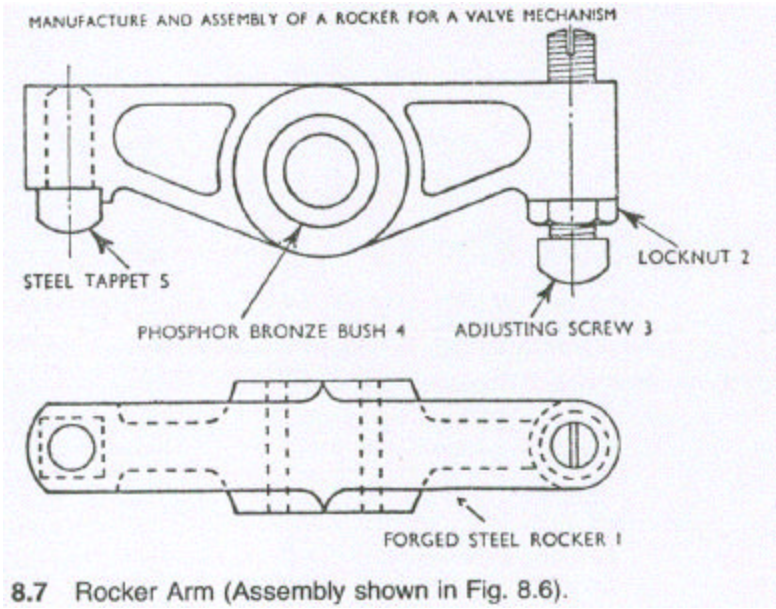


Record- Example Outline Chart



Select
Record
Examine
Develop
Evaluate
Define
Install
Maintain

Record- Example



Select
Record
Examine
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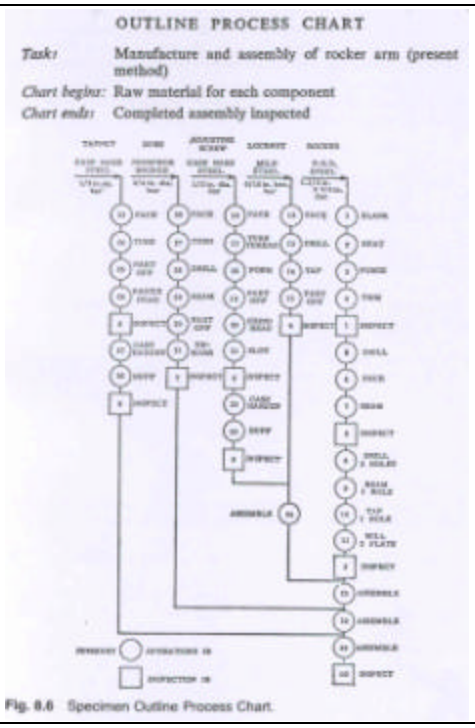
Define
Install
Maintain

Record- Example Outline Chart


OUTLINE PROCESS CHART

Task: Manufacture and assembly of rocker arm (present method)

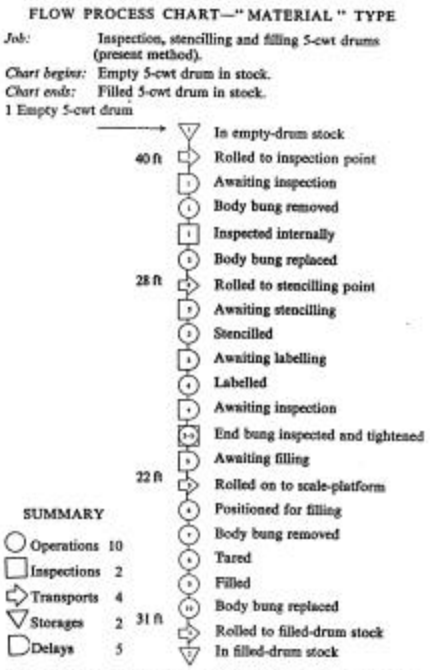
Chart begins: Raw material for each component

Chart ends: Completed assembly inspected

Fig. 8.6 Specimen Outline Process Chart.

- Select
- **Record**
- Examine
- Develop
- Evaluate
- Define
- Install
- Maintain

Record- Example Flow Chart


FLOW PROCESS CHART—"MATERIAL" TYPE

Job: Inspection, stencilling and filling 5-cwt drums (present method).

Chart begins: Empty 5-cwt drum in stock.

Chart ends: Filled 5-cwt drum in stock.

1 Empty 5-cwt drum

In empty-drum stock
40 ft — Rolled to inspection point
Awaiting inspection
Body bung removed
Inspected internally
Body bung replaced
28 ft — Rolled to stencilling point
Awaiting stencilling
Stencilled
Awaiting labelling
Labelled
Awaiting inspection
End bung inspected and tightened
Awaiting filling
22 ft — Rolled on to scale-platform
Positioned for filling
Body bung removed
Tared
Filled
Body bung replaced
31 ft — Rolled to filled-drum stock
In filled-drum stock

SUMMARY

Operations	10
Inspections	2
Transports	4
Storages	2
Delays	5

Fig. 8.9 Flow Process Chart showing progress of 'Material' through a Process.

- Select
- **Record**
- Examine
- Develop
- Evaluate
- Define
- Install
- Maintain

Record- Example Flow Chart

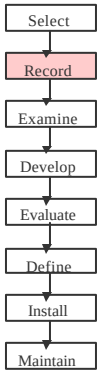
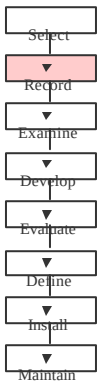


Chart begins: Typist in own office awaiting dictation.
Chart ends: Typist puts letter in "out" tray.

Man
(Typist)

- To author's office
- Take dictation
- To own office
- Prepare typing set
- Typist types letter and copy
- From m/c and separate copies
- Check
- Place in book for signature
- To author's office
- During checking and signing
- To own office
- Type envelope
- Letter to envelope
- Letter and copy aside to "out" tray

Record- Example Flow Chart



FLOW PROCESS CHART (AMPLIFIED)—
"MAN" TYPE

Job: Writing a letter using a shorthand-typist (present method).
Chart begins: Typist in own office awaiting dictation.
Chart ends: Typist puts letter and copy in out tray.

Typist's Office		*Author's Office*
To author's office	→	
	←	Take dictation
		To own office
Prepare typing set		
Type letter and copy		
From m/c and separate copies		
Check		
Place in book for signature		
To author's office	→	
	←	During checking and signature
		To own office
Type envelope		
Letter to envelope		
Letter and copy aside to "out" tray		

Fig. 8.11 'Man' Type Flow Process Chart from Fig. 8.10, amplified to Emphasize Distances Travelled.

Record- Example Flow Chart

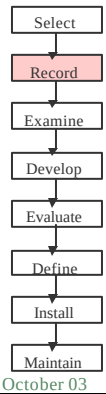
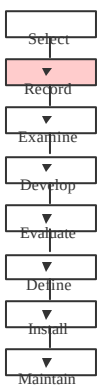


Chart begins: Contents awaiting dictation by author.
Chart ends: Contents of letter to " out " tray.

	Material (Contents of Letter)
1	Wait arrival of typist
1	Taken down in shorthand
2	To typist's office
2	Typist prepares to type
3	Typed in letter form
3	Typist separates copies
1	Checked
3	Placed in book for signature
2	To author's office
2	Checked
4	Signed
2	To typist's office
4	Delay while envelope typed
5	Inserted in envelope
6	Aside to " out " tray

Record- Example Flow Chart



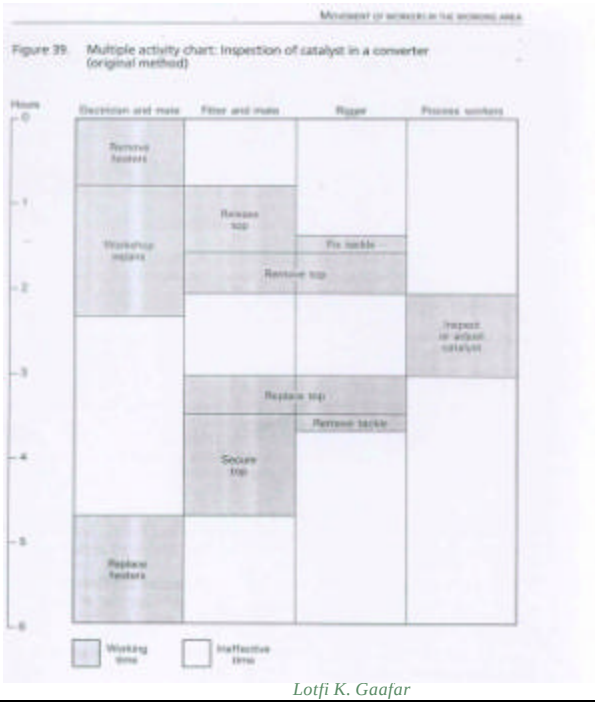
FLOW PROCESS CHARTS—" MAN " TYPE AND " MATERIAL " TYPE

Job: Writing a letter using a shorthand-typist (present method).

Man (Typist)	*Material* (Contents of Letter)
Chart begins: Typist in own office awaiting dictation.	*Chart begins:* Contents awaiting dictation by author.
Chart ends: Typist puts letter in " out " tray.	*Chart ends:* Contents of letter to " out " tray.
To author's office	Wait arrival of typist
Take dictation	Taken down in shorthand
To own office	To typist's office
Prepare typing set	Typist prepares to type
Typist types letter and copy	Typed in letter form
From m/c and separate copies	Typist separates copies
Check	Checked
Place in book for signature	Placed in book for signature
To author's office	To author's office
During checking and signing	Checked
To own office	Signed
Type envelope	To typist's office
Letter to envelope	Delay while envelope typed
Letter and copy aside to "out" tray	Inserted in envelope
	Aside to " out " tray

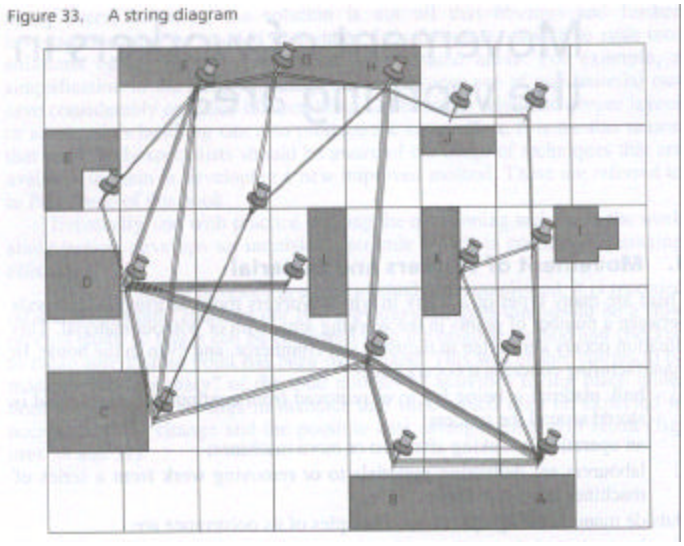
Fig. 8.10 Flow Process Charts, 'Man and Material' for the same job.

Record- Example Multiple activity Chart



- Select
- **Record**
- Examine
- Develop
- Evaluate
- Define
- Install
- Maintain

Record- Example String Diagram



- Select
- **Record**
- Examine
- Develop
- Evaluate
- Define
- Install
- Maintain

Record- Example String Diagram

Figure 34. A simple movement study sheet

Movement study sheet

Chart No. 1 Sheet No. 1 of 2	Operative(s):
Operation: *Transport biscuit tins*	
from inspection to storage	Charted by:
bins and unload into bins	Date:
Location: *Biscuit warehouse*	Cross-reference: *String diagrams 1 and 2*

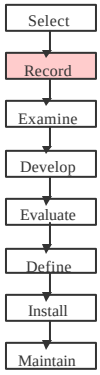
1 Time dep.	2 Time arr.	3 Time elapsed	4 Move to	5 Notes
			Inspection bench III	
			to Bin	*4*
				13
				5
				32
				18

Select
Record
Examine
Develop
Evaluate
Define
Install
Maintain

Record- Example Travel Chart

Select
Record
Examine
Develop
Evaluate
Define
Install
Maintain

Record- Example
Two-handed process Chart



Two-handed process chart

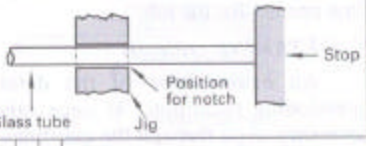
Chart No. 2 Sheet No. 1 of 1

Workplace layout

Drawing and part: *Glass tube 3 mm dia., 1 metre original length*

Operation: *Cut to lengths of 1.5 cm*

Improved method



Location: *General shop*

Operative:

Charted by Date:

Left-hand description	Right-hand description
Pushes tube to stop	*Holds file*
Rotates tube	*Notches with file*
Holds tube	*Taps with file: end drops to box*

Examine- The Questions

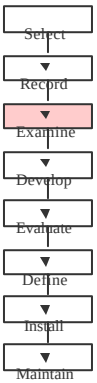
Purpose:	What is actually done?
	Why is it necessary?
Place:	Where? Why?
Sequence:	When? Why?
Person:	Who? Why?
Means:	How? Why?

With a view to:

Eliminate

Combine or Rearrange

Simplify



Examine- Secondary Questions

Purpose: **What** is done?

Why is it done?

What **else** might be done?

What **should** be done?

With a view to:

Eliminate

Simplify

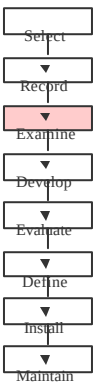
Examine- Secondary Questions

Place: **Where** is it done?

Why is it done **there**?

where **else** might it be done?

Where **should** it be done?



With a view to:

Combine or Rearrange

Examine- Secondary Questions

Sequence: **When** is it done?

Why is it done **then**?

when **might** it be done?

When **should** it be done?

With a view to:

Combine or Rearrange

Examine- Secondary Questions

Person: **Who** does it?

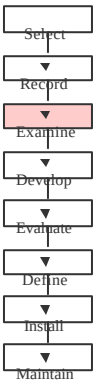
Why does **that** person do it?

Who **else** might do it?

Who **should** do it?

With a view to:

Combine or Rearrange



Examine- Secondary Questions

Means: **How** is it done?

Why is it done **that** way?

How **else** might it be done?

How **should** it be done?

With a view to:

Simplify

Develop

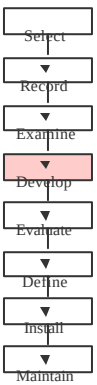
New Designs

Multidisciplinary Teams

Worker Involvement

Quality Circles

Simple Ideas (Spring Loaded Table)



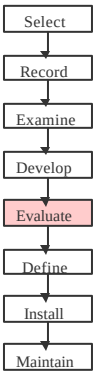
Evaluate

Multiple Improvement Ideas

Consider costs, benefits, and drawbacks

Report (ABC, Accurate, Brief, and Clear)

Example

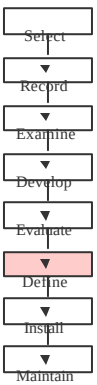


Define

The written standard practice

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.
2. It can be used to explain the new method to management, supervisors and operatives. It also advises all concerned, including the works engineers, of any new equipment required or of changes needed in the layout of machines or workplaces.
3. It is an aid to training or retraining operatives.
4. It forms the basis on which time studies.



Define

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.

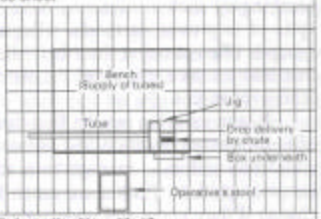
(2) A description of the method. The amount of detail required will depend on the nature of the job and the probable volume of production. For a job which will occupy several operatives for several months, the written standard practice may have to be very detailed, going into finger movements.

(3) A diagram of the workplace layout and, possibly, sketches of special tools, jigs or fixtures.

Define

Figure 56. Standard practice sheet

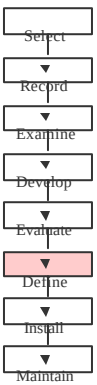
Standard practice sheet

Product: 3 mm diam. glass tube, supplied in 1 metre lengths	Equipment: Jig No. 231 Half-round 15 cm	
Operation: File and break to lengths of 1.5 cm		
Working conditions: Light good		

Location: Fitting shop — Ref. studies Nos. 12, 13

Operative: Clock No. 54 — Charted by: Date: — Approved by: Date:

EL	Left hand	Right hand	EL
1	Take tube between thumb and first two fingers; push forward to stop	Hold file; wait for L.H.	1
2	Rotate tube between thumb and fingers	Notch tube all round with edge of file held up against face of jig	2
3	Hold tube	Tap notched end of tube sharply with file so that it falls into chute	3



Install

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.

There is no point in trying to go any further if this approval and acceptance have not been obtained.

(3) Gaining acceptance of the change by the workers and their representatives.

(4) Preparing to make the changes.

(5) Controlling the changeover.

Install

Training

May use films to demonstrate the old and the new methods.

Films are particularly valuable when retraining.

Develop **the habit** of doing the job in the correct way.

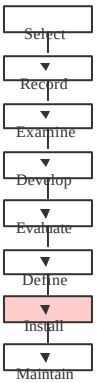
Train to follow a numbered sequence illustrated on a chart.

Learning curves

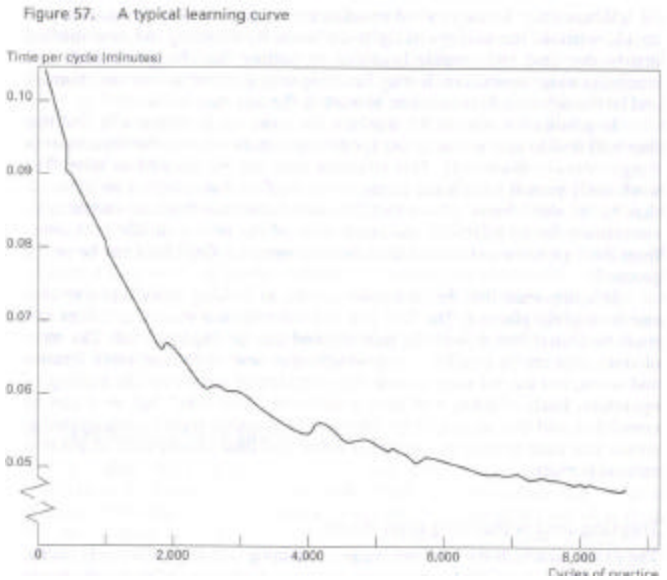
In the first stages of learning, rests between periods of practice should be longer than the periods of practice themselves.

When the operative has begun to grasp the new method and to pick up speed, rest periods can be very much shorter.

Nursing the new method.



Install



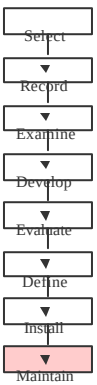
Maintain

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.

Assign a specialists permanently.

Formal review.



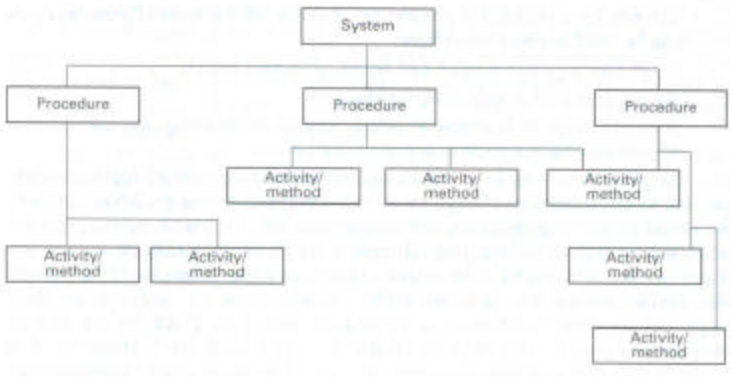
Method Study in the Office

Offices use resources, must be used efficiently.
Percentage of workers in offices continues to increase.
Administrative costs (overheads) must be controlled.
Introduction of advanced technology (machinery).
In most offices, most of the work is routine.
Look for areas or activities that:
Account for a significant proportion of office labor costs.
Are producing large numbers of errors or serious errors.
Are creating high levels of dissatisfaction.
Need to change in response to some external change.
Quality circle.

Method Study in the Office

Most office work can be placed on a hierarchy which includes systems, procedures, activities and methods.

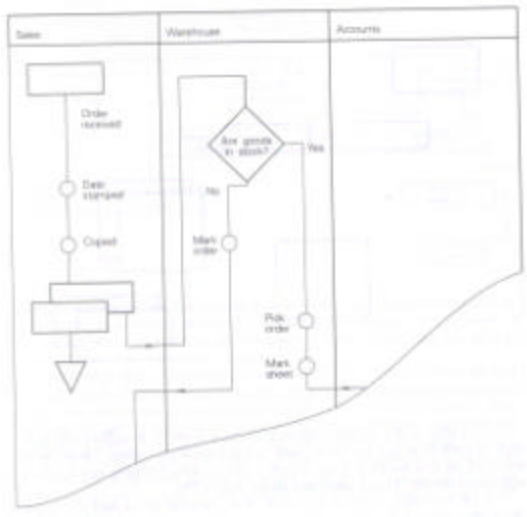
Figure 58. The hierarchy of office systems, procedures and methods



Method Study in the Office

Use the columnar chart form in which each column represents one department or section of the organization (figure 60).

Figure 60. A procedure flowchart



Method Study in the Office

Design of forms

Naturally, a document or form should be examined together with the procedure in which it is used. Changing a system or procedure may have automatic implications for forms used. Forms themselves should be examined when the procedure itself has been examined and improved or validated. Examination of a form follows the basic critical examination process, asking:

Why is the form necessary?

What information does it convey? Who uses it?

When do they use it? **Where** is it used?

How is it used? (Is the form produced by a computer, are entries typed on to the form, is it filled in manually, etc.?)

Then examining and evaluating alternatives.

Method Study in the Office

Design of forms

When designing forms we are trying to make the form:

compatible with its intended use

easy to complete

easy to use

Consideration must be given to: paper size; paper weight;
shape;
color;
maintaining any house style or corporate identity;
and balancing these with the cost involved.

Method Study in the Office

Details that affect design are:

the filing/retrieval process;

the routing of the form throughout the organization

the degree to which additional entries are made on the form at subsequent stages);

the nature of data entered on the form and the degree to which they can be grouped.

Figure 62. A personnel record form

Method Study in the Office

Control of forms

The most important part of controlling forms is to undertake regular audits to discover if each form is still necessary to serve a particular business function (MAINTAIN).

Where the purpose of the form is still valid, questions must be asked about the environment in which the form operates and whether changes here, for example, in technology or filing methods require changes to be made to the form.

Method Study in the Office

Control of forms

Other items to be considered are:

The production method:

How is the form produced and are there now better or cheaper ways?

How much stock of each form is held, and where is it held? Is this appropriate to the use of the form?

How are supplies to users reordered?

How is stock issued to users?

How is issued stock tracked?

Method Study in the Office

Control of forms

What is the useful life of information on the form? Are there any legal constraints on disposal?

How do we ensure that forms are disposed of, after their useful life is ended (to release valuable space)?

Are there security restrictions on disposal (should forms be shredded or burnt)?

Office Layout

Office layout study should consist of the following steps:

Record details of the major systems in use in the office.

Record details of the clerical procedures that support those systems.

Examine the working methods of those procedures and carry out a basic method study of each one.

Carry out a capacity assessment of each part of the procedure

Analyze volumes of output and question the senior managers to discover likely future trends.

Identify communication and contact paths and frequencies.

Design individual workstations (ergonomics)

From volume and capacity data, calculate total workstation requirements.

Decide on basic type of layout.

Identify any "external" constraints.

Draw up a schematic layout

Investigate available hardware solutions

Discuss the provisional layout with both the users

Modify the layout in accordance with the results of discussions and prepare the proposed layout.