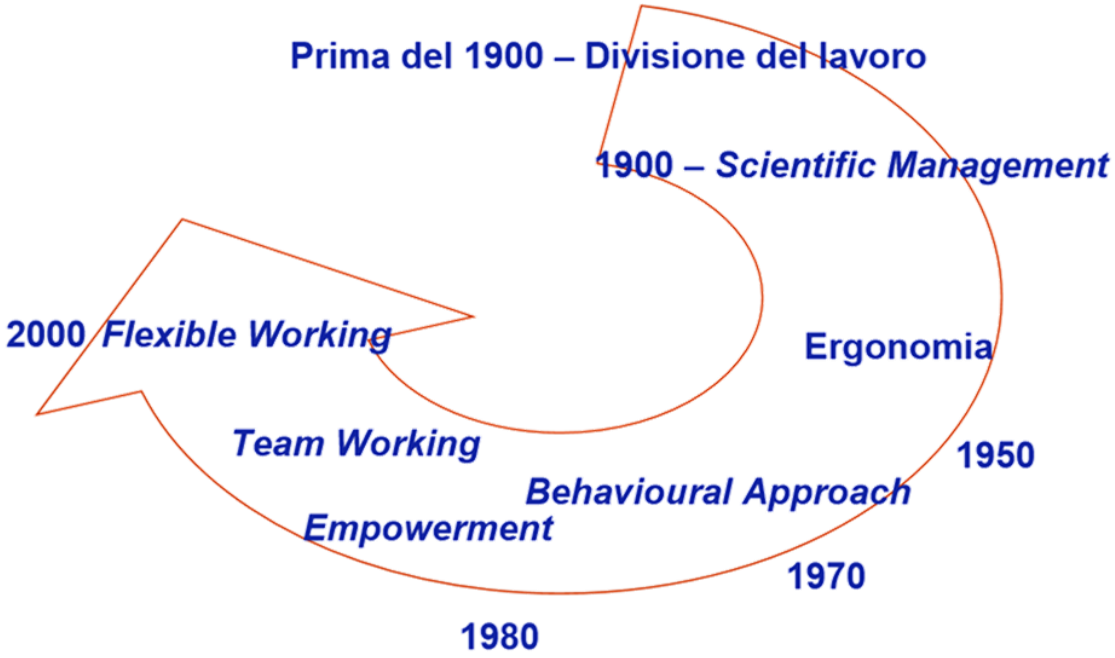
TIME AND METHOD

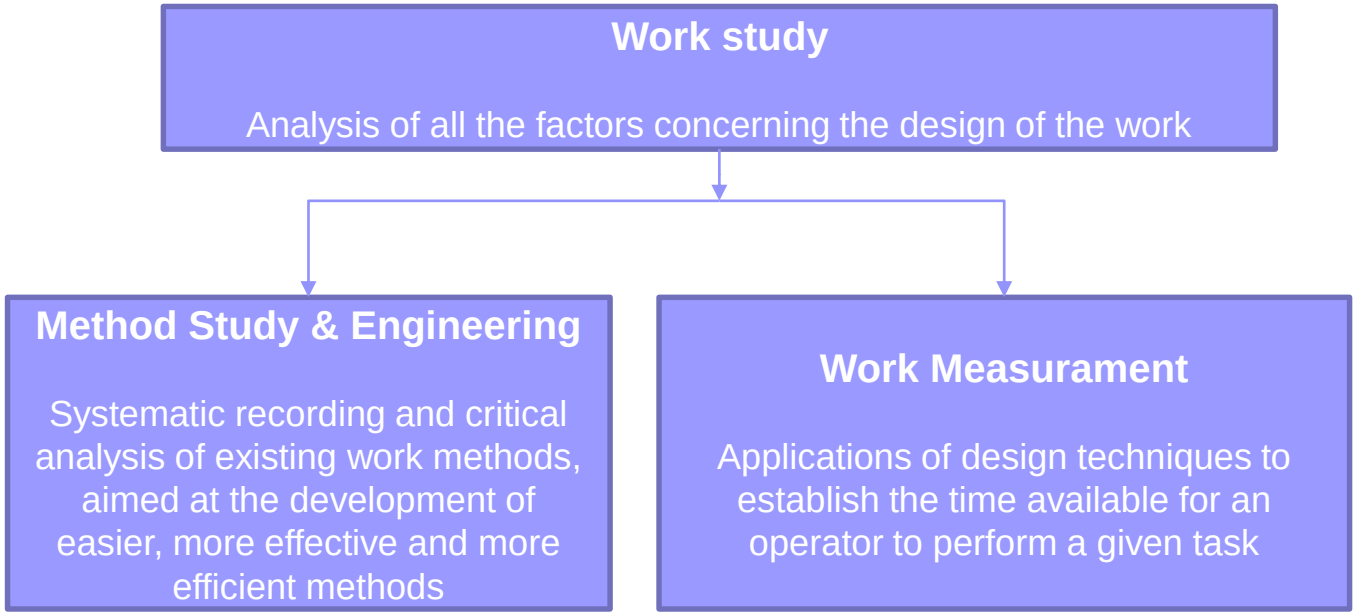
Scientific Work Management

- Fredrick Winslow Taylor published a book entitled "Scientific Management" in 1911, where he identified the principles of scientific management and planning of work
- All aspects of the work must be studied in a scientific way, to establish laws, rules and formulas to govern the best working methods
- This study serves to set the size of the "typical working day"
- Workers must be selected, educated and trained methodologically to carry out their tasks
- Managers must act as job planners by analyzing tasks and standardizing the best methods, while workers must be empowered to improve their work by standards
- Between leaders and workers there must be cooperation to achieve "maximum prosperity" with each other

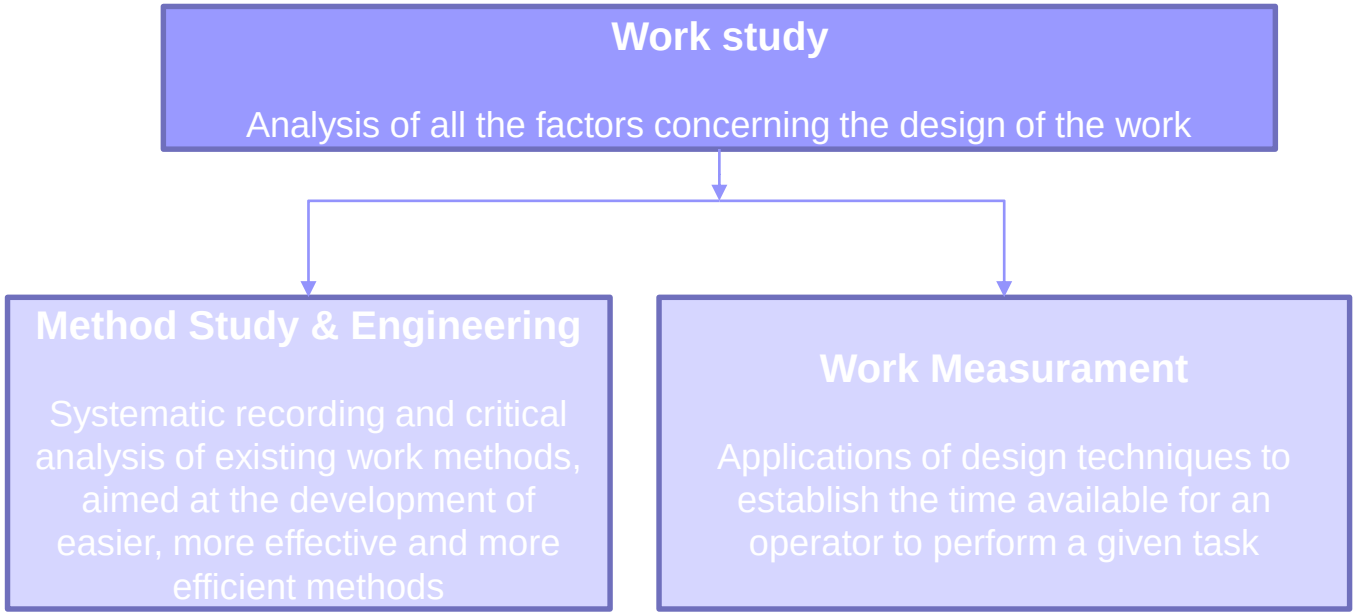
Job design


Prima del 1900 – Divisione del lavoro
1900 – Scientific Management
Ergonomia
1950
Behavioural Approach
1970
Empowerment
1980
Team Working
2000 Flexible Working

Work study


Work study
Analysis of all the factors concerning the design of the work
Method Study & Engineering
Systematic recording and critical analysis of existing work methods, aimed at the development of easier, more effective and more efficient methods
Work Measurament
Applications of design techniques to establish the time available for an operator to perform a given task

Work study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Work study

- According to the British Standard Institution, “Work Study is a generic term for those techniques, particularly Method Study and Work Measurement, which are used in all its context, and which lead systematically to the investigation of all the factors , which affect the efficiency and economy of the situation being reviewed in order to effect improvement”.

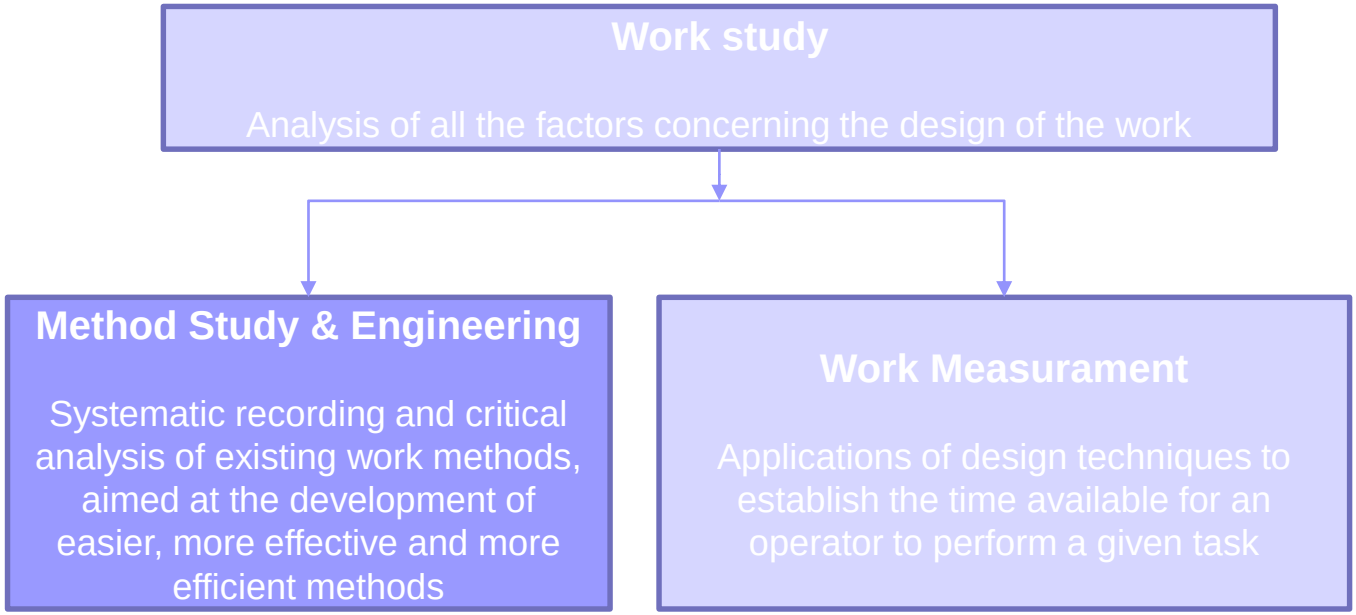
Objective of work study

- Objectives of Work Study
- To analyze the present method of doing the job in order to develop a better method.
- To measure the work content of the job by measuring the time required to do the job for a qualified worker and hence to establish the standard time.
- To increase the productivity by ensuring best possible use of human, machine and material resources and to achieve best quality product/service at minimum possible cost
- To improve operational efficiency
- To motivate the operators

Benefits of Work study

- Increased productivity and operational efficiency
- Reduced manufacturing cost.
- Improved work place layout.
- Better manpower planning and capacity planning.
- Fair wages to employees.
- Better working conditions to employees
- Improved work flow.
- Reduced material handling cost.
- Provides a Standard of Performance to measure labor efficiency.
- Better Industrial Relations and Employee morale.
- Basis for sound incentive schemes.

Work study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Method study introduction

- Method Study is a technique to reduce the work content by analyzing each operation of a given piece of work very closely in order to eliminate unnecessary operations/movements by workers, materials or equipments. It includes standardization of equipment, method and working conditions, and training the operators to follow the standard method
- However, even after that, there could be substantial unnecessary time taken for the process because of lack of management control or inaction of worker.
- Method Study approaches and tools of Method Analyst:
  - Flow Diagrams & Process Charts
  - Critical question techniques

Method Study definition

- "Systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective method and thereby reducing costs"

- "The analytical study of methods of doing jobs with the aim of finding the best or an improved job method"

Methods study objectives

- Improvement of processes and procedures so as to improve productivity and thereby reduce operating cost.
- Improvement in the design of plant and equipment.
- Improvement of layout.
- Improvement in the use of men, materials and machines.
- Economy in human effort and reduction of unnecessary effort.
- To Standardize work methods or processes, machinery, equipment and tools
- Development of better working environment

Methods work benefits

1. Work Simplification
2. Improved working method
3. Better product quality
4. Improved workplace layout
5. Improved equipment Design.
6. Better working conditions/environment
7. Better materials handling and lesser material handling cost.
8. Improved work flow.
9. Less effort to workforce.
10. Optimum utilization of all resources.
11. Shorter production cycle time.
12. Higher job satisfaction for workmen.
13. Reduced material consumption and wastages.
14. Reduced manufacturing cost and higher productivity

Method study analysis

- The need for improvement is not always apparent. However, following are some of the pointers which may indicate the need for Method Study :
- Operating costs-running higher than normal or gradually increasing
- High wastage-poor use of materials, machinery, labor, space and services.
- Excessive movement and backtracking, handling of materials and men.
- Existence of production bottlenecks
- Excessive overtime
- Excessive rejections and reworks, poor quality
- Complaints from workers -poor work condition for heavy job
- Increasing number of accidents

Method study analysis

- Procedure to accomplish method study, called "SREDIM" shall be as follow:

1. Select: the job or operation that needs improvement
2. Record: all facts, how work is done by chart methods,
3. Examine: every aspect of the job by asking; what, why, where, when, who and how
4. Develop: review ideas, eliminate, simplify, combine, rearrange, make new method which more safe, chart new method, submit for approval,
5. Install: the new method, consider best time to introduce, convince all, train users
6. Maintain: check frequency, match results, corrects deviations

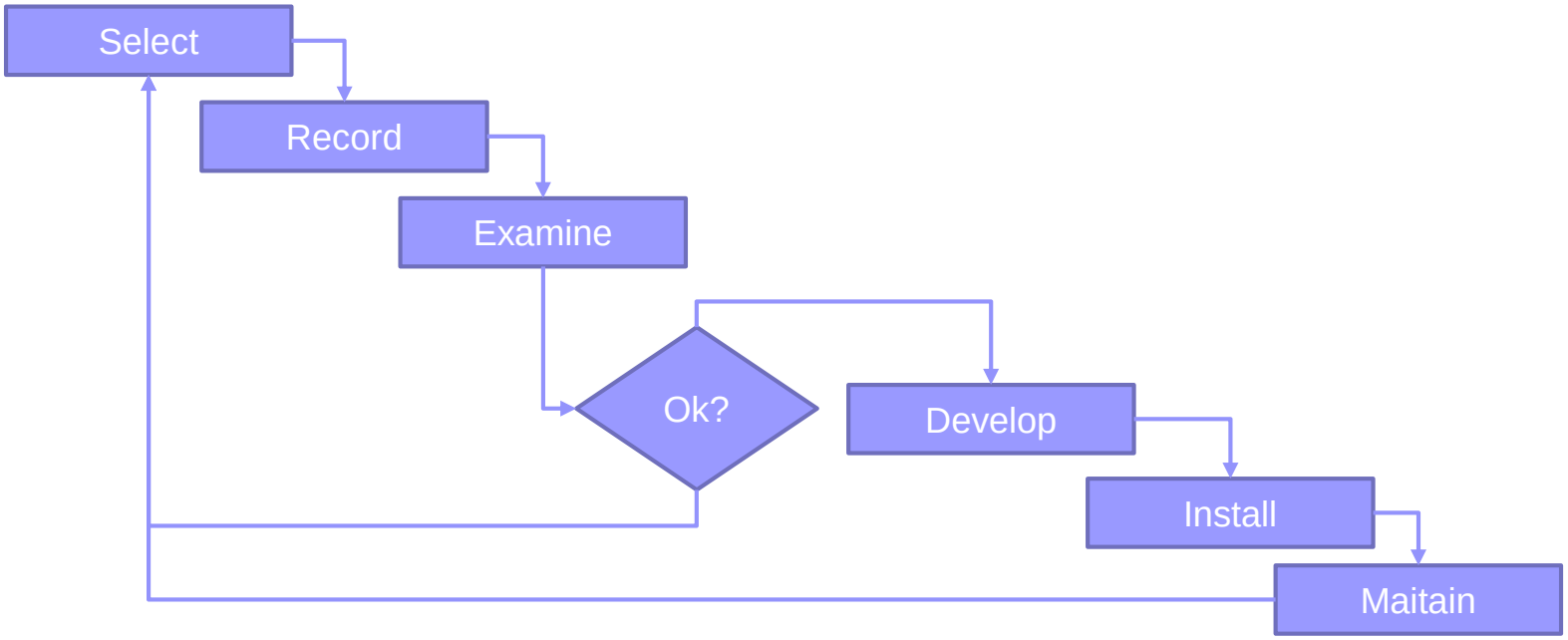
Selection

- While selecting a job for method study, the following factors are to be considered:
- Economical considerations: The cost of study , loss of time due to investigation, costs short term and long term associated with prospective changes in the recommended working method of the job should be carefully estimated and examined . if the accumulated estimated benefits outweigh the estimated total cost, as mentioned above, then it should be taken up.
- Based on economical considerations the following jobs are selected :
  - Operations having bottlenecks(which hold up production)
  - Operations done repetitively
  - Operations having a great amount of manual work.
  - Operations where materials are moved for a long distance

Selection

- Technical considerations: The important point is to make sure that adequate technical knowledge is available with which to carry out the study. Examples are:
  - A machine tool constituting a bottleneck in production is known to be running at a speed at which the high speed or ceramic cutting tools will not operative effectively. Can it be speeded up or is the machine is itself not robust enough to take faster cut?. This calls for advice of a machine tool expert.
- Human reactions : These are the most important considerations to be made, since mental and emotional reactions to investigation , and change of method has to be anticipated. Trade Union representative have to be educated on the general objectives of the method study. If however the study of a particular job is creating unrest or ill feeling amongst the workmen ,leave it alone however promising it may be for economic point of view.

Methodology



Method study tools

- Exploratory Tools
  - Pareto Analysis
  - Fish & Bone Diagrams
  - Gantt and PERT charts
- Recording and Analysis Tools
  - Outline Process Chart
  - Flow process chart
  - Flow diagram
  - Worker and Machine Process Charts
  - Gang Process charts
  - Synchronous Servicing

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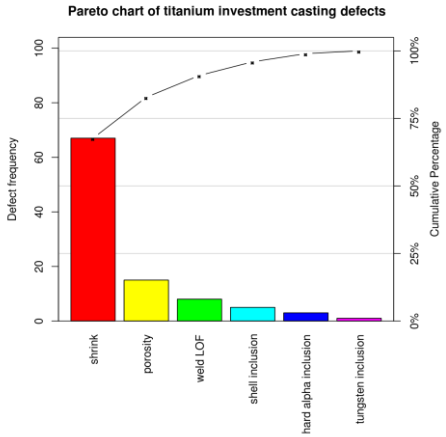
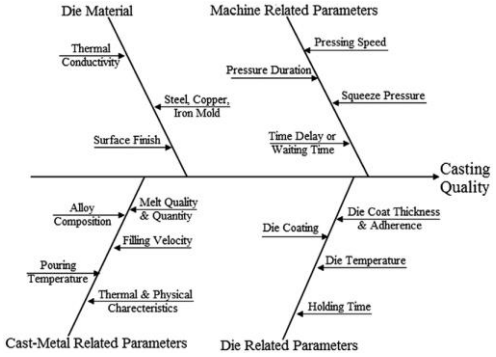
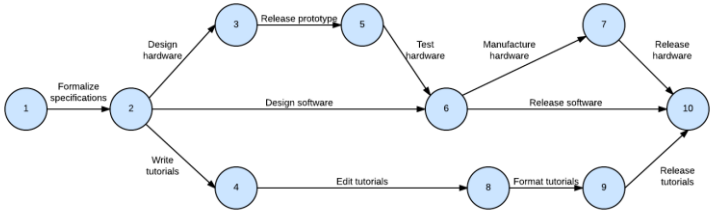






Recording techniques

- Outline process chart is a process chart which gives an overall view of a process by recording only the main operations and sequences in proper sequence.
- Flow process chart (man-type, material-type and equipment-type): This is the use of symbols and description to chart the sequence of work. The process, then, show what is happening at different stages. The distances and time may be given.

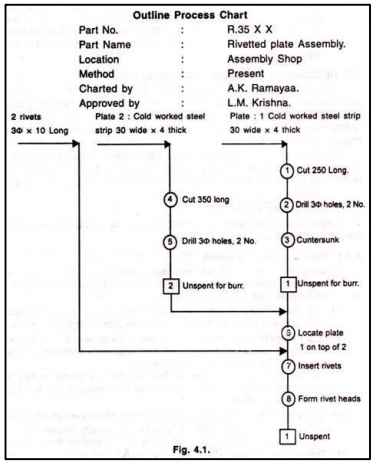
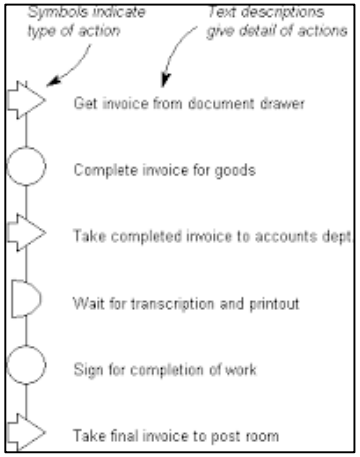


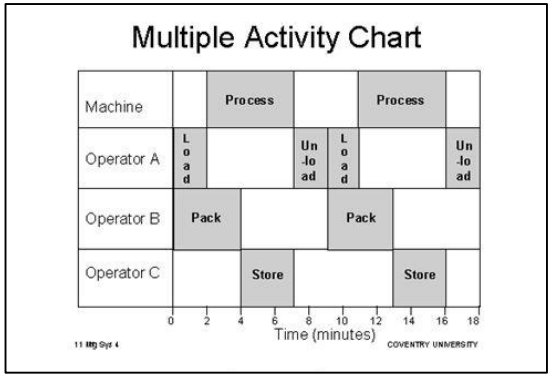
Fig. 4.1.



Recording techniques

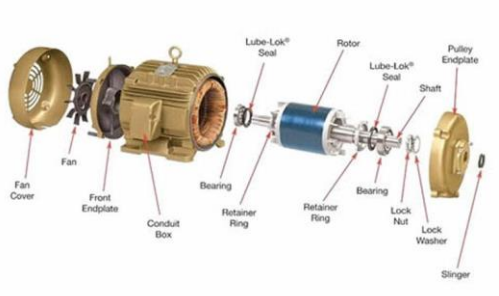
- Two hands process charts It is a motion study where the motions are analyzed in performing an activity. The aim of this investigation is to eliminate or reduce the unwanted motion to minimum and to arrange the best of motions in a possible sequence. Two handed process chart is also known as Left and Right Hand process chart.
- Multiple activity charts: This technique is used to solve problems where a number of items are dependent on each other. The aim is to reduce idle times by using the optimum number of each item. It depicts the occupied times-broken down into the number

Activity	*Symbol*	*Summary*
Operation	O	Whenever the hand grasps, releases or assemble materials.
Transport	⇒	Whenever hand moves from one point to other.
Delay	D	Whenever the hand is idle or it is not performing any activity.
Hold	∇	The symbol is same, as we used for storage. But new, term hold is used, whenever hand holds an object in order to perform an operation on object by other hand.



Recording techniques

- Diagrams and models (2-D and/or 3-D)
- Flow diagrams, which is the use of symbols for flow process charts, superimposed on drawings and the "descriptions" are not necessary.
- String diagrams, which is used for solving movement problems since it shows congestions and excessive distances.
- 3-D models.
- Photographs
- Films
- Video



Flow chart

- Flow chart is a process chart giving an overall picture by recording in sequence only the main operations and inspections.
- While preparing the outline process chart we use Symbols of Operation and Inspection
- A brief note of the nature of each operation is made beside the symbol
- In an flow chart, only the principal operations and the inspections carried out are recorded to ensure effectiveness

Flow chart

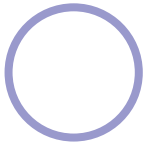
- Flow process charts are graphic representations of the sequences of operations, transportation, inspections, delays and storages occurring during a process or a procedure and include information considered for analysis such as, time required and distance moved.
- To develop an understanding how a process or work happening and clearly documenting how a particular job is done, in addition of that mapping a process in flow chart format helps us where the process can be improved

Flow chart

- Material or product type flow process chart: Records what happens to the material or product i.e. the changes the material or product undergoes in location or condition (includes operation and transportation).
- Man type process flow process chart: Records the activities of worker or operator i.e. what a worker or operator does. In this type of chart usually storage term is not applicable.
- Machine or equipment type flow process charts: Records the manner in which a machine or an equipment is used

Flow chart

1.Operation

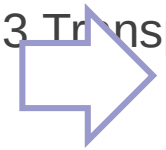


- Indicates the main steps in a process, method or procedure. Usually the part, material or product concerned is modified or changed during the operation.

2.Inspection

- Indicates an inspection for quality and / or check for quantity

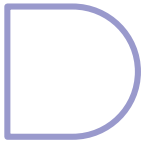
3.Transport



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

Flow chart

1.Temporary storage or Delay



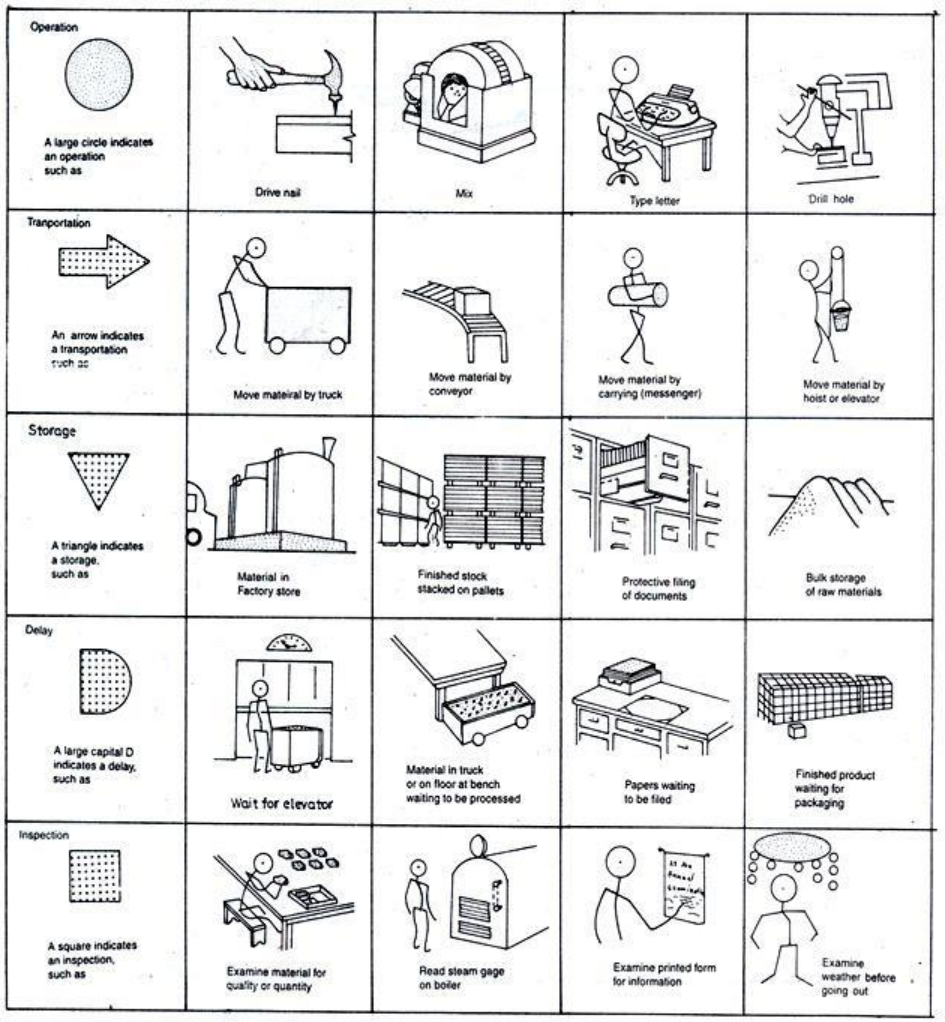
- Temporary Storage or Delay or Delay

2.Permanet storage

- Indicates a delay in the sequence of events : for example, work waiting between consecutive operations, or any object laid aside temporarily without record until required.

6.Combined activities

- Indicates a Two symbols may be combined when two activities are performed concurrently operation and inspection.


Operation
A large circle indicates an operation such as
Drive nail
Mix
Type letter
Drill hole
Tranportation
An arrow indicates a transportation such as
Move mateiral by truck
Move material by conveyor
Move material by carrying (messenger)
Move material by hoist or elevator
Storage
A triangle indicates a storage, such as
Material in Factory store
Finished stock stacked on pallets
Protective filing of documents
Bulk storage of raw materials
Delay
A large capital D indicates a delay, such as
Wait for elevator
Material in truck or on floor at bench waiting to be processed
Papers waiting to be filed
Finished product waiting for packaging
Inspection
A square indicates an inspection, such as
Examine material for quality or quantity
Read steam gage on boiler
Examine printed form for information
Examine weather before going out

Flow Process Chart

Page of

Location:	
Activity:	
Date:	
Operator:	Analyst:
Circle appropriate Method and Type:	
Method: *Present* *Proposed*	
Type: *Worker* *Material* *Machine*	
Remarks:	

Summary

Event	Present	Proposed	Savings
Operation			
Transport			
Delay			
Inspection			
Storage			
Time (min)			
Distance (ft)			
Cost			

Event Description	Symbol	Time (In Minutes)	Distance (In Feet)	Method Recommendation
	○ ⇨ D □ ▽			
	○ ⇨ D □ ▽			
	○ ⇨ D □ ▽			
	○ ⇨ D □ ▽			
	○ ⇨ D □ ▽			
	○ ⇨ D □ ▽			

Flow chart

- Create a process chart for the pilot activity in changing the wheels

Two hands process chart

- Two-Handed Flow Process Chart, is a motion study where the study is done to analyze the motions used by the worker in performing an activity. In this chart the activities of a worker's hands (or limbs) are recorded in their relationship to one another. A Two-Handed Process Flow Chart individually shows the movement of each hand in a manual process. It is typically used for repetitive operation when analyzing a manual assembly process, to help make it easier to perform.

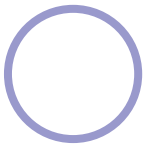
Two hands process chart

- Useful in analyzing the work performed by one person at one specific workstation. As the name implies, the chart follows the motion of the left and right hands of one operator .
- Each hand of the worker is treated as an activity.
- Each hand’s activities are broken into work elements and plotted side by side on time scale

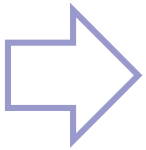
Two hands process chart

Lists the work performed simultaneously by each hand

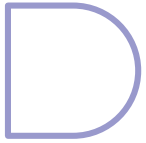
- To assist in finding a better method of performing the task and
- To train the operator in the preferred method



An operation occurs when the hand grasps, releases or assembles tool, material, component etc.



Transport occurs when the hand moves from one position to another at the work place.



Delay occurs when the hand is Idle in the sense that it is not performing any activity.

The term storage is not used in connection with the two handed process chart. Instead the symbol is re designated as hold. A hold occurs when the hand holds an object so that the other hand may be able to do something to that object.

Generally not use

Two hands process chart

Two-Hand Process Chart Page of

Operation:	Part:	**Summary**	Left Hand	Right Hand
Operator Name and No.:		Effective Time:		
Analyst:	Date:	Ineffective		
Method (circle choice): *Present* *Proposed*		Cycle Time =		
Sketch:				

Left Hand Description	Sym-bol	Time		Time	Sym-bol	**Right Hand Description**

Two hands process chart

- Create the two hands process chart for making a real italian coffee

Micro motion

- Micro motion study is the study of fundamental element or subdivision of an operation and timing device which accurately indicates the time interval on motion.
- Micro motion study provides a valuable technique for making minute analysis of those operation that are short in cycle contain rapid movement and involve high production over a long period of time.

Micro motion

- Applicable for operations with very short cycles which are repeated thousands of times.
- Goes into greater details to determine where movements and efforts can be saved and to develop the best possible patterns of movements.
- Enables operators to perform the operation repeatedly with minimum effort and labor.
- The technique used for this typically involves filming/observing the operation and hence is known as micromotion study.
- Examples of operators studied could be cashier in the bank – routine job of taking payment slips from customer and issuing cash!

Micro motion therbligs

- Based on the idea that human activity can be divided into movements or group of movements (therbligs) according to the purpose for which they are made.
- The therbligs cover movements or reasons for the absence of movement.
- Each therblig has specific color, symbol and letter for recording purposes.
- Therbligs refer primarily to motions of the human body at the workplace and to the mental activities associated with them

Micro motion

Sl. No.	*Code*	*Name*	*Description*	*Colour*
1.	SH	SEARCH	Locate and article	Black
2.	F	FIND	Mental reaction at end of search	Gray
3.	ST	SELECT	Selection from a member	Light Gray
4.	G	GRASP	Taking Hold	Red
5.	H	HOLD	Prolonged group	Gold Ochre
6.	TL	TRANSPORTED LOADED	Moving an article	Green
7.	P	POSITION	Placing in a definite location	Blue
8.	A	ASSEMBLE	Putting parts together	Violet
9.	U	USE	Causing a device to perform its function	Purple
10.	DA	DISASSEMBLE	Separating parts	Light Violet
11.	I	INSPECT	Examine or test	Burnt Ochre
12.	PP	PREPOSITION	Placing an article ready for use	Pale Blue
13.	RL	RELEASE LOAD	Release an article	Carmine red
14.	TE	TRANSPORT EMPTY	Movement of a body member	Olive Green
15.	R	REST	Pause to overcome fatigue	Orange
16.	JD	UNAVOIDABLE DELAY	Idle-outside persons control	Yellow
17.	PN	PLAN	Mental plan for future action	—

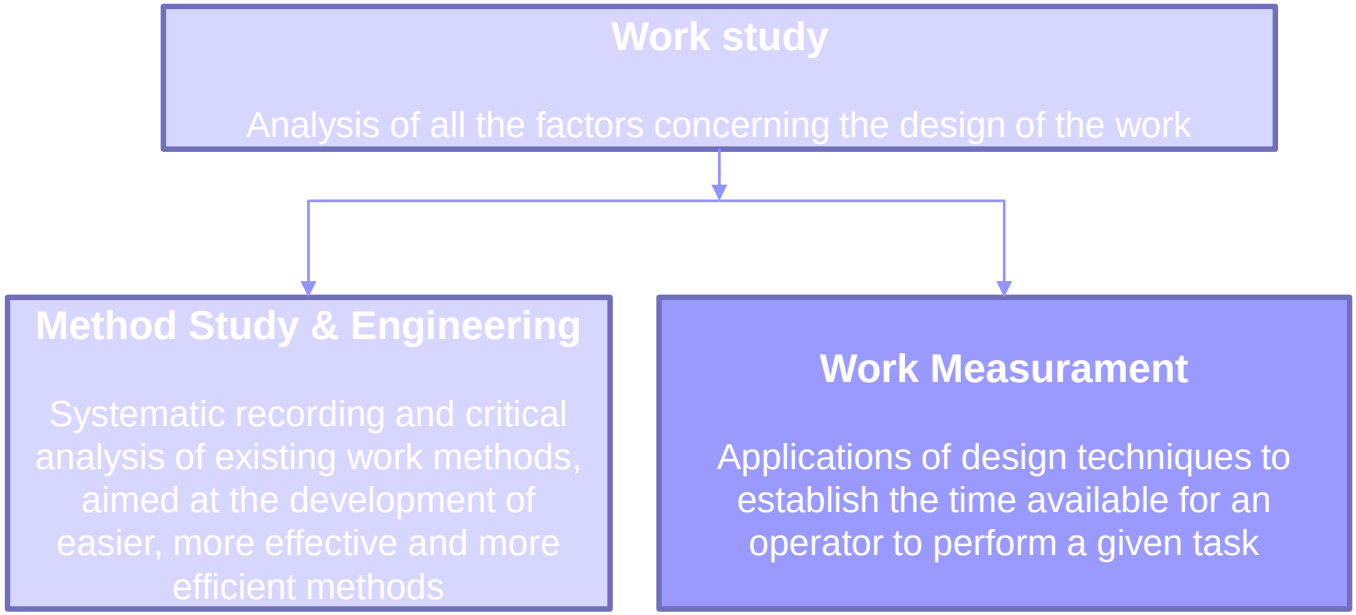
Micro motion

- They permit a much more precise and detailed description of the work than any other method described.
- Considerable practice is required in identification of therbligs before they can be used for analysis with confidence

Micro motion

- To find most efficient way of doing work
- Helps to study repetitive short cycle operation which cannot be studied by ordinary method.
- To train operator regarding motion economy.
- It is permanent means of keeping record of method.
- It assists in research project in the field of work study
- It helps to study complex activities of short duration performed with extreme rapidity.

Work study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Measure of work

- "The measure of work is the procedure by which it is possible measure or foresee the productive yield of an existing or planned operation, or determines how much time is spent in the various productive and non-productive activities of a process, of an operation or of a job"
- "The measure of work consists in applying techniques designed to establish the work content related to the specific task, determining the time required to perform it according to a defined performance standard by a qualified operator“
- “Work Measurement: the science that brings more and better knowledge to people about work and how to improve work”

Measure of work

- Work Measurement is used to set Standard Times for both simple and complex tasks
- The Standard Time is the theoretically necessary time to execute the pre-set work respecting a determined work cycle
  - Time needed for a normal performer, of normal, non-incentivized ability, working under normal conditions and at normal speed, to carry out an operation (or a job) with acceptable qualitative results

Standard time vs Actual time

- The Standard Times are the basis of the Estimated Cost calculations (they follow the Standard Costs)

The standard times are determined with regard to the specific company and reflect the conditions, the equipment, the methods, the technologies adopted in the company. The calculation of the standard times is also linked to the method / method of measurement of the work

- Actual Time is the time actually spent to perform an operation or a job

It differs from standard time for inefficiencies of: process, product design, materials, method management, environmental conditions, performer

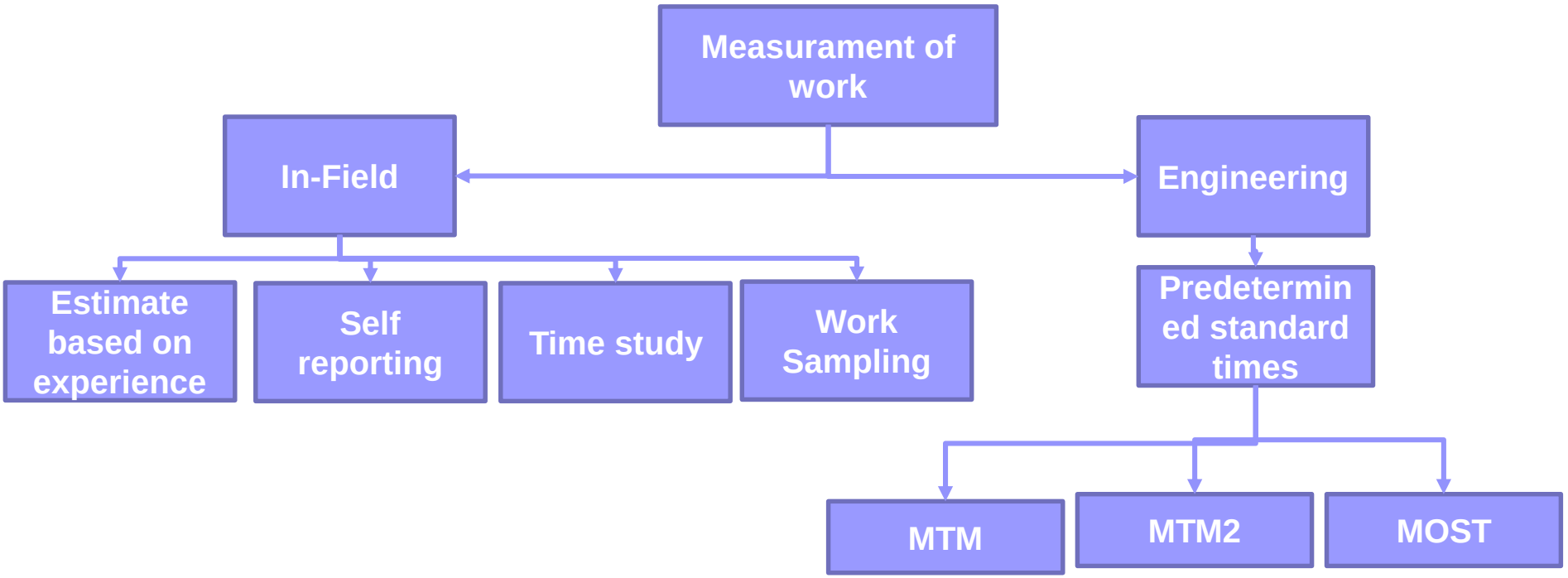
Standard time vs Actual time

- design defects or product specifications
  - lack of feasibility
  - rework
  - improper quality specifications
- inefficiency of the method
  - no availability / shortages of the necessary equipment or machines
  - lack of lay-out / in production flows
- causes attributable to management
  - excessive production variability (unsustainable programming from specification to production organization)
  - non-economic lots (not proportional to the production organization)
  - deficiencies in environmental conditions
- causes imputable to the operators
  - carelessness
  - negligence
  - other matters of a personal or social nature

Measure of work applications

- Analysis of working times
- Design and Estimate of a new product
- Design of an assembly line
- Calculation of the potential production volume and the resources required
- Production programming
- Forecast of delivery dates to customers
- Workload balancing
- To process spending budgets
- To perform the analysis of the deviations between planned and final activities (hence the trade union problem of the measure of work in factories ...)

Measure of work



Estimate based on experience

- Approximate and subjective technique based on the knowledge of historical data related to similar works and on the experience of evaluators

- The evaluator tends to overestimate the times
- It is valid when great precision is not required

Self reporting

- The person responsible for carrying out the evaluation is the operator who is the object of the investigation
- The individual tends to overestimate his own time in a manner superior to an external evaluator
- It is valid as the first form of understanding of the time dimension, considering a low degree of accuracy

Time study

- Technique used to determine as accurately as possible, using a limited number of observations, the time required to perform a certain activity according to established efficiency targets

- It is classified among the in-field methods because it requires an analyst in charge of detecting times in reality (eg on-line)
- The analyst represents a cost
- The analyzed is not in the standard condition, but under stress (with the related behavior changes)

Time study

- Subdivision of the cycle in phases identified by precise start and end moments (each phase must take at least a few seconds for the execution, but no more than a few minutes)
- Definition of the reference time (t) for each phase
- Definition of the number of timing to be performed
- Timing and recording of measurements
- Calculation of the standard cycle time (ST)
  - Calculation of the average phase time (t ')
  - Calculation of normal phase time (NT)
  - taking into account the yield factor (RF)
  - Sum of NTs to obtain normal cycle time (NTC)
  - NTC surcharge of an adjustment factor (A)

Time study

- Coffee cups packaging operation, consisting of 4 phases:
  1. Take two boxes
  2. Insertion of thicknesses
  3. Inserting cups in the carton
  4. Carton closing

Time study

- Definition of the reference time (t)
- A limited number of times is performed and the average value and standard deviation are calculated
- We make 40 observations, except for the first phase, since we take two boxes at a time

Fasi	Osservazioni	Tempo di rif (t) - min	Deviazione std. - min
1	20	0,5	0,0305
2	40	0,11	0,0171
3	40	0,71	0,0226
4	40	1,1	0,0241

Time study

Determination of the numbers of data collaction

$$n = \left[\left(\frac{z}{h} \right) * \left(\frac{\sigma}{t} \right) \right]^2$$

Livello di confidenza	z
90%	1,65
95%	1,96
99%	2,58

- z = factor linked to the desired level of confidence
- σ = standard deviation of the reference time
- h = percentage error margin allowed on evaluations
- t = reference time

Time study

- Confidence level = 95% (z = 1.96)
- Permissible error margin h = 4%

Fase 1 $$n = \left[\left(\frac{1{,}96}{0{,}04}\right) * \left(\frac{0{,}0305}{0{,}5}\right)\right]^2 = 9$$

Fase 2 $$n = \left[\left(\frac{1{,}96}{0{,}04}\right) * \left(\frac{0{,}0171}{0{,}11}\right)\right]^2 = 58$$

Fase 3 $$n = \left[\left(\frac{1{,}96}{0{,}04}\right) * \left(\frac{0{,}0226}{0{,}71}\right)\right]^2 = 3$$

Fase 4 $$n = \left[\left(\frac{1{,}96}{0{,}04}\right) * \left(\frac{0{,}0241}{1{,}1}\right)\right]^2 = 2$$

- The number of timing to be performed is the highest among the 4.
- Note that the noticeable difference between the calculated timing numbers depends on the high dispersion of the timed times in step 2

Time study

- Calculation of standard time
- Calculation of the average phase time

Average phases time t' $= \frac{\sum_{i=1}^{n} t_i}{n}$

Fase	t'
1	0,53
2	0,1
3	0,75
4	1,08

- ti= time taken by a worker for the execution of an elementary phase in each of the n times taken
- n = number of timekeeping performed (in theory with timing always performed on the same operator

Time study

- Calculation of normal phase time
- Normal phase time (NT) = t '* F * RF
- RF (Rating Factor) is used to take into account the average performance of the worker who will be assigned the execution of the phase (the RF value> 1 if the performance is lower than the average, <1 if higher)
- F = 1 / entity considered simultaneously, ie F indicates for how many entities the operation is performed simultaneously

Fase	F	RF	Operatore	NT
1	0,5	1,05	Operatore sopra la media	NT1 = 0,53 * 0,5 *1,05 = 0,28 min
2	1	0,95	Sotto	NT2 = 0,1 * 1 * 0,95 = 0,10 min
3	1	1,10	Sopra	NT3 = 0,75 * 1 * 1,10 = 0,83 min
4	1	0,9	Sotto	NT4 = 1,08 * 1 * 0,9 = 0,97 min

Time study

- Sum of the normal times of the single elements and calculation of the normal NTC cycle time

$$NTC = \sum_{j=1}^{m} NT_j$$

- j = 1 ... m indicates the number of monitored activities
- Standard Time ST = NTC * (1 + A)
- Where A = Adjustment factor, serves to consider the personal needs of workers

Work sampling

- Work sampling evaluates how a worker distributes the time he has available between the different tasks he has to perform
- The time distribution detected, during the period and the observations taken as a sample, is taken as a general reference for the calculation of the actual time to perform a job
- Work sampling is used to determine:
  - Breakdown of the amount of time spent, in particular the amount of unproductive time: it is estimated the percentage of time that the workers inevitably dedicate to unproductive activities
  - Setting the labor standards: to adequately define the labor standards the analyst must have sufficient experience to correctly classify the various activities carried out by the workers
  - Performance: with the sampling you can develop a performance index for the periodic evaluation of workers

Work sampling

1. Define activities
2. Define how to make random observations
3. Define the length of the study
4. Prepare the table for recording observations
5. Define the dimensions of a preliminary sample (eg 50) and make the observations to obtain the estimate of the values of the reference parameters
6. Calculate the actual sample size needed to obtain valid results
7. Observe the activities and record the data
8. Decide whether to continue in the comments
9. Calculation of normal time per unit / activity
10. Calculation of standard time per unit / activity

Work sampling

- Calculation of the sample size

$$n = \frac{z^2 p(1-p)}{h^2}$$

Livello di confidenza	z
68%	1
95,45%	2
99,7%	3

- n = sample size
- z = standard deviation coefficient corresponding to the desired confidence level
- p = estimate obtained through the preliminary sample of the value of the observed quantity (eg fraction of the time available during which the worker is engaged or stopped)
- h = level of accuracy desired (tolerance compared to the previous estimate expressed in percentage terms)

Work sampling

Example
h = 3%
Confidence level = 95.45% (z = 2)
Estimated percentage of time during which the worker is stationary = 25%

$$n = \frac{(2)^2 0{,}25 * (1 - 0{,}25)}{(0{,}03)^2}$$

The more the two alternative assets are unbalanced after the preliminary observations (with the other conditions being the same), the lower the overall number of observations to be carried out Maintaining the same levels of confidence and accuracy, given a 10% inactivity percentage, the necessary observations would be 400!

Work sampling

- Observing the activities and recording the results The WS method defines the number of observations to be made. In the observation one considers what activity the operator is performing, among those defined
- Observation of an operator at the counter of the citizen of a municipality. Analysis period 2 weeks, with 833 surveys

Numero di osservazioni	Attività
485	Al telefono o a colloquio con un cittadino
126	Non occupata
62	Riposo personale
23	In riunione con direttore
137	*Computer Data Entry*
833	

- 22.6% (62 + 126) / 833 of the time (therefore of time) the operator is not employed. Depending on what the expected%, decisions can be made on (increase or decrease tasks)

Work sampling

- The WS can also be used for the calculation of the times, as well as for the definition of the% of activities
- Calculation of normal time per unit / activity:

$$T_n = \frac{T_t * P_{occ} * RF}{N}$$

- Tt = total observation time
- Pocc = percentage of time in which the observed worker is occupied in the activity date
- N = number of pieces produced
- RF = Performance rating factor, used to take into account the average performance of the worker who will be assigned the execution of the phase (the RF value> 1 if the performance is lower than the average, <1 if higher

Work sampling

- Determination of standard time per unit / activity

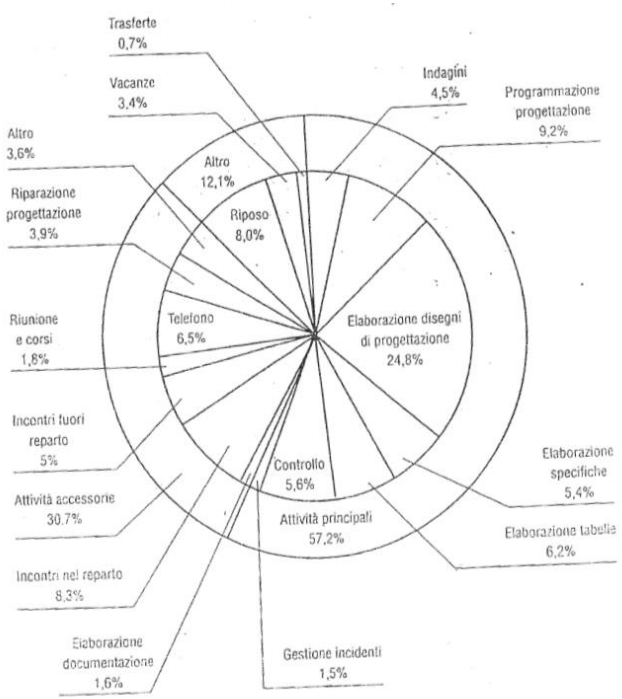
$$Tst = Tn/(1 - A)$$

- A = adjustment factor, expressed in terms of percentage fraction, used to consider the personal needs of workers, fatigue
- At the end of observations on an operator, with RF = 1, performed for a total of 80 hours (4,800 min) were produced
- 225 pieces
- % of time the operator was 80% busy.
- A = 25%
- Tn = (4,800 * 0.8 * 1) / 225 = 17,07 min / piece
- Tst = 17,07 / (1-0.25) = 22.76 min / piece

Work sampling

- The WS can also be performed on several activities and people at the same time (since it is only a survey of activities)
- It is noted at the same time which among the N possible activities K employees are performing with the same qualification engaged in the same type of work
- The observations are repeated following the same procedures for a prefixed number M of times
- At the end of the sampling period we will have K * M observations broken down among the N possible activities. Of each of the N activities it will therefore be possible to evaluate the weight%
- SI can thus deduce:
  - How much to increase the production time to get to standard time
  - What are the reasons for which time is unproductive
  - Which interventions can be implemented to improve performance

Work sampling



Work Sampling Observation Form

Date	Work Sampling Data Collection Form										Page of	
Period of Study							Activity Category (AC)					
Observer							1. Keypunch			5. Walking		
Department							2. Writing			6. Conversation		
Notes:							3. Filing			7. Personal		
							4. Telephone			8. Away		
	Subjects											
Observation Date and Time	Smith		Jones		Wang		Schneider		Kim		Kowalski	
	AC	PR	AC	PR	AC	PR	AC	PR	AC	PR	AC	PR

Key: AC = activity category, PR = performance rating.

Work sampling

The Work sampling vs the Time Study:

- It is less expensive, as only one observer can check multiple activities simultaneously and in less time
- There is no need for time detection systems, but only for activities
- It is not invasive and therefore does not change the behavior of the observed

On the other hand, compared to the Time Study:

- It does not break up the different elements of time
- It may be distorted by incorrect programming of observations (eg always at the same time)
- It is less accurate, especially on short cycle times