Applied Ergonomics
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Module - 01
Lecture – 04

Hello and welcome to this lecture 4 of applied ergonomics. In the last 2 lectures you have seen how one can characterize works system and what are the different components associated with work system. You also tried to sort of estimate numerically how you could define labour productivity or general the labour productivity index of such as system an what is the importance of doing that for benefit in the society at large. The basic thumb rule is that you are investing lesser and lesser and trying to get more and more output towards a common goal which is the good of the society. So, today let us look at some of the basics which are related to how once this whole task or this owners of better optimised work management is given 2 section of people.

How what are the kind of methods that they can follow or are there any standard which are being said to do such classifications.

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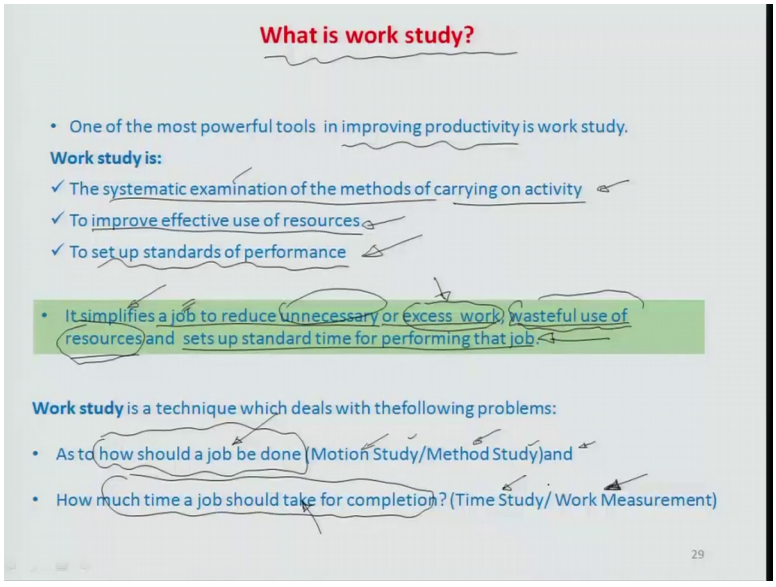

So, I am going to today start this topic of work study and there are certain it is very scientific process laid by some of the very a pioneering researchers in that area like frank gilbert as well as tailor, who actually suggested series of hypothesis postulates methods which would be used for representation, in a very scientific manner in a very short manner, conscience manner. And typically for people to see at one glance and to be able to see what is there in the process which can be changed.

So, the field of work study really concerns the central question of how to improve the productivity, and it is a systematic examination of methods of methods for carrying out some of the activities at by activities, I mean the tasks the you know, the division of the work into simpler tasks is what makes you visualise what is going on within a certain domain of the whole production facility say or whole unit. And if you can focus at that level were even individual motions related to operations which are being put on the assembly or which or put on the product are analysed to the minuet test details. That is where you could make a start point for doing productivity improvement.

So, the purpose of work studied typically is a systematic examination of such let say splitting down to the minutes test details, the whole task quantum which is available to work system. Also it can of improve the effective uses of all your resources you know exactly what kind of man power is needed for what kind of task or what kind of equipments are needed for handling what kind of task. And then of course, to setup standards of performance one needs to do these studies in a very organised manner. So, it simplifies in in a nutshell a job to reduce unnecessary or excess work and wasteful use of resources.

So, this very important. So, it simplifies the task which is already been carried out in a certain manner using some kind of resources. So, that the unnecessary component of it could be identified and we are excess work is being carried out for achieving of a non valuated goal which we otherwise not be important of the product. So, identification of that is very important. And then also it wasteful uses some of the resources which come up in order to produce. And then also a there is a there is a way to set up standard time for performing that job and there is a gold towards standardization of such job

So, that you know if the job is repetitive in nature and it is done for every product on every cycle. You should have a well defined standard within which the job must operate

the task must operate. So, that you know any deviation from that any abnormal deviation from that influences, the way that the whole assembly line works for example, are even you know the product assembly works. So, work study is the technique typically which deals with the following problems.

So, the first problem is how should a job be done. This is a very important aspect. I have already given several examples earlier in automotive manufacturing process, where are the process starts let say with the press shop well shop paint shop in assembly. And several different stages and then there are engine assembly is doors of assembly is there all coming together in order to produce the final vehicle. So, first question that is asked here in this work stance system, if you want do proper work study is that if we have characterised the minutes amount of jobs of tasks, which are there, in the whole assembly. What you know should we do in terms of fling outlying out clearly how should a job be performed.

Now, this how should a job could address questions like what is being wasted. Right now in the current practice and what could be avoided. So, that the job becomes a proper job which really contributes enough value. So, for doing that there are organised techniques call motion study and method study, which are put in use and I am going to come with use this problem in a more detailed manner in the following slides. And then the other question which needs to be addressed which is the central theme of studies how much time a job should take for completion.

So, how should a job be done and with what kind of time scale the job be done, these are the 2 basic question that are post if you want to organised the task set into a very thorough work study means. And here the goal is to perform the times study of all the jobs which have been identified, standard jobs which have been identified which are isolated of the ones which are contributing value to a product. And then do again measurement of the quantum of work which is involved in do in this time. And try to optimise that how much work which goes in to the actual valuated product is useful and the remaining may be eliminated in that manner.

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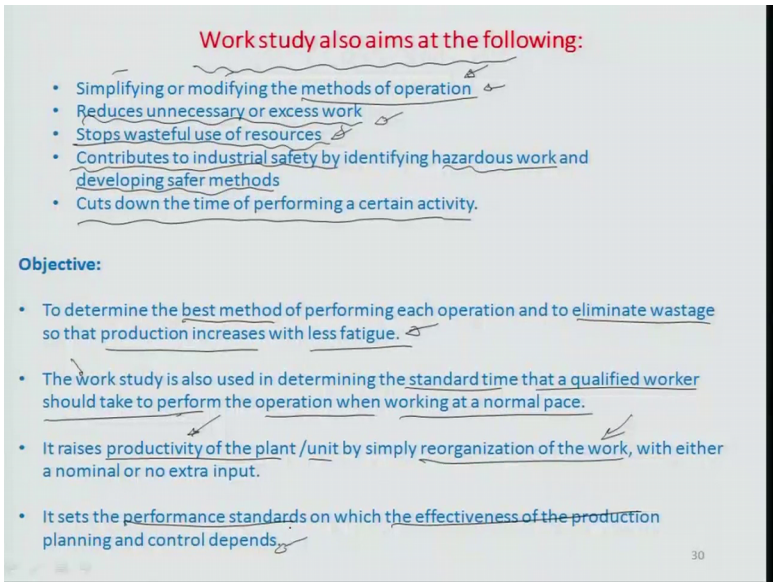

So, in order to through to that that there are several other aims. Of course, of that work study also addresses and some of them are it simplifies or modifies the existing method of operations, I had mention in grate details yesterday about how just by making this system a little more automatic by making a carriage which carries a coolant gun along with a vehicle, when we are filling the coolant in the final line or final assembly line of a product. You could actually avoid the unsafe practice being carried by an operator, where the operator does the job himself of filing while movement forward.

So, simplifying or modifying task some many more connotations that just productivity improvement one of them being bringing an overall safe and jovial atmosphere, for the worker to deliver or for the work professional, to deliver the work the quantum of the work in a very timely manner in very happy state of mine. You know the quality aspects of product which comes later down the line when the product sold to a customer etcetera is really dependent on the mine set of the persons making the product. And somehow you have to create an environment as well administratively.

So, that people were contributing to him the whole the work environment have a ownership you know associated with the product, of the selling of the product and if that can have only then you can get very good complains to standard are very good you know very less latitude issues which otherwise should not come into any production process. And therefore, simplifying and modifying methods of operations sort of the first step to

go ahead, we talked about work study it reduces the unnecessary or excess work. I think I have emphasize is enough need not spend more time on it and then it stops the wasteful uses of resources.

For example, if supposing you know I was exemplifying yesterday about the assembly line on a practice that, covers are being put on all 4 sides of the automotives for preventing the doors from getting dense during the assembly operations. So, the option that was suggested that is the doors of assembly can be made separately were pulling out the door at the printed body stage. And then separately supplying on the final line with the doors are again assemble back.

These whole problem of using extra covers extra material you know maintaining those things and then you know material movement, related to those things when employing different manpower that would completely been eliminated. So, the advantage of waste full uses of resources comes up when such kind of decisions need to be taken about doing something or may be putting a slide amount of work more into the system. So, that this whole business of you know getting quality issues in the product later because of some follow up processes could be completely eliminated and at the behest of using lesser resources.

So, contributes to understand or 2 to basically create a safe environment, I thing I have emphasises enough. It identify the hazardous work and tries to develop either safer method. So, try to eliminate wherever possible. And there of course, work study also cuts down the time of performing a certain activity. And helps to thus improve the productivity the objectives that work study would have to typically is first to determined the best method.

Of performing of an operation and eliminate wastage. So, that production increases with lesser fatigue of the operators. So, if I look at again the automotive assembly, you know one thing which comes to my mind which has been done from time to time is how to avoid putting workers in a very uncomfortable zone. So, the work study is also sort of used to determined the standard time that a qualified worker should take to perform the operation. And that too when working at a normal face between operators there are; obviously, going to be variations because some of the operators may operate more efficiently some at less efficiency.

So, there has to be some mathematical factor which rates the operator in a manner. So, that his deliverance or the way that he sort of complies to a task is included in terms of being over efficient or less sufficient. So, that aspect does come in work study. It also raises productivity of the plan or the unit by simple reorganisation of the task some cases if you change, the contemn of the task by just reorganising the work centres. For example, as I told the in the case of doors subassembly we what we had essentially doing is we are taking work out of the normal assembly line which otherwise was done in hanging doors are coming out of the vehicle and putting as a sub assembly somewhere.

So, basically we are changing work centres and trying to redistribute they are located work between the assembly line on this new assembly sub assembly line that we are incorporating. And what is happening as a result of it is that things can be more efficiently packaged. And at the behest of very less defects or problems or where a lot of other offline time would be utilised for were in those in terms of pulling out components trying to repair dents from interiors so on and so forth. Approaching the vehicle from the interior side etcetera. So, that would kind of get avoided.

So, it raises the productivity definitely by such reorganisations of between different work centres. And it of course, sets the performance standards on which the effectiveness of the production planning and control depends. Because once you have a very simplified measurable basis of your individual small tasks which group together as that whole major task. So, you basically controlling everything down to the minuscule micro level I would say and then the control is more efficacies if such a control can be carried out administratively. So, that is in general the objectives of work study.

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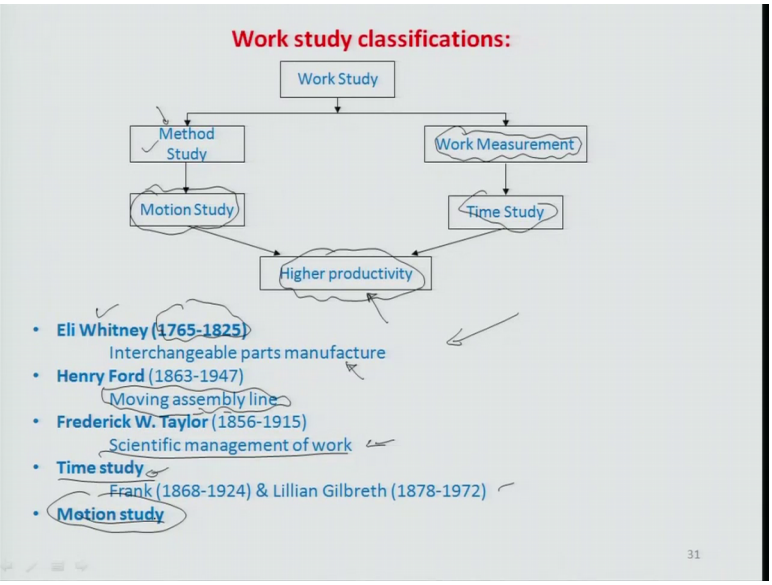

In fact, if I wanted to look at the whole domain of work study can be classified into method study were we are talking about quant quanta ting quantitating or laying out things are small tasks and the correct job methods to be used as such to describe those ask. And then this is associated with this big area of motion study where each task is of course, associated with motions of hands motions of limes associated with workers who are delivering.

Let say for example you want to put a window regulator inside the let say front doors of an automotive assembly. So; obviously, the question the many questions come into picture. So, the regulator is being supplied from offline to online with some kind of a roller conveyor in bins or carries a carriages or racks. So, the operator has to go up to the rack pick up that particular window regulator pick up that fastener pick up gun which is otherwise carrying. Then come back to the vehicle move along with the vehicle place the window regulator from you know within the door.

So, the door generally has a inner and outer parts the window regulator has to go from the skeletal structure of the inner parts. So, that it goes in at pence itself to the inner parts and then you have the alien the holds wholes and then put the screws of the bolds. So, that the regulator can finally, be fastened by the gun. So, all this has to be broken down into small tasks, you know and then there is a standard way in which this

accomplishment can be made of carrying out the whole activity at minimum interference with minimum wastages and minimum operation time.

So, that is considered to be the standard way of delivering that particular task. So, in a way in the whole assembly whatever you are doing these task that to be split up in the in that manner in terms of motion sequences of the operators. And there are very good organised techniques and I will like to even sort of give you prospective how historical this evolved, where all the motions are classified as either wasteful motions or motions which will slow down on motions which actually a productive motions which will add value.

So, with all this classification we could try to do motion study. And the goal; obviously, is higher productivity similarly work measurement can be done through time study techniques typically the best techniques that is used this filming, filming of a certain task or certain process. And this should not be done without with a worker keeping in knowledge in the knowledge of the worker. So, we will not do his best performance. So, you do it on a very routine basis over a large span of time. And then try to calculate or try to split up this frame by frame and look at the different motion sequences the operations that is being done in terms of times scales. And then suggest sequence which will have minimum time scale.

So, that time study. So, all motion as well as time study the main idea is that through that it should be able to adjust this need for higher productivity of any system. So, historically if we look at eli Whitney for the first time in let say early part of the 18 century, a suggested the importance of interchangeability of part during manufacturer I think I have read this issue earlier name of my lecture, where we talk about fasteners. And how important to these to have fasteners of uniform shapes and sizes because if supposing there are many such fasteners with different lens different diameter is very difficult to manage all the material in perspective of where it is used. So, if you can control to an extent we can control is dictated by the design the fastener should be interchangeable in nature.

So, therefore, the fasteners made for one side of products to get a symbol should be identical to the fasteners made by the others steering. In fact, during the design phase of the product designer should take into account all these. So, the design involves in that

way. So, that interchangeability of parts should be promoted as much as possible. And the technique is also known as organised design for manufacturing and assembly, I will come to that part probably later along the lines. So, this interchangeability part was suggested way back in 1 1765 followed by the first assembly line concept, which was again formulated by henry ford which was during the period 1863 to 947. Again very good principles of scientific management of work as well as time study proposed by Frederick Taylor, and the later on again frank and Lillian gilbert who proposed the motion study.

So, these are some historical revolutions times scales saying how this process of work study evolved in a very organised manner today. And so now, you can actually represent the work in a in a manner. So, that at a glance you could really make the difference between useful and useless work and try to separate them by looking at the process.

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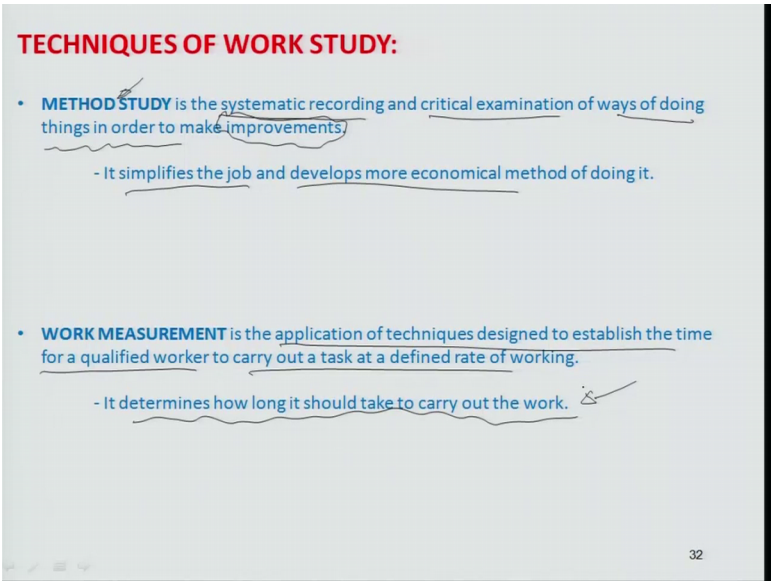

Let us talk about a details of such studies. So, method study. So, this basically the represents the systematic recording and critical examination of ways of doing work. And it should aim at continuous improvements of such laying out or deciding of methods. So, it the basic purpose is that simplifies the overall job develops more economical method of doing it. There is something call the best method of doing a task and so the idea if I can aniline all task in a manner.

So, that they are carried out at their best methodology, that is the way that you can have the best productivity of particular system coming out and the other is work measurement. So, it is application of techniques design to establish the time for qualified worker to carry our task at a define rate of working. It determines how long it should take to carry out the work. In fact, times scales attached to the work is very important aspect because the overall cycle time particularly in assembly lines and things related to let us say even subassembly lines are really related to that time component, the work station which has the highest task time would be determinant of what is going to be the overall cycle time. So, that much time has to be at least given to that particular station for the whole task to be execute. And so that would be the minimum cycle time that can be there, of record on record on this whole assembly or subassembly unit.

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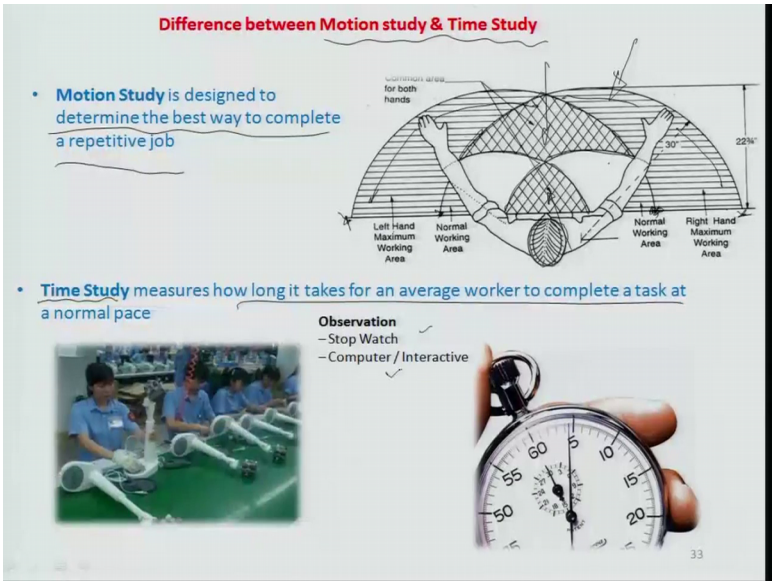

So, it is important that time scale be attached to work in that sense. So, what is the basic difference between motion and time study. So, it is very simple let us look at this example here the schematic here talks about a man, whose head is visible in this cartoon here with 2 hands. And he basically has a span of motion of the hands is left in right hand in a manner. So, that it shows up to what extent the left hand can reach let us say up to this point, upto what is extent the right hand can reach. And similarly it also shows about how much or what extent the left hand can reach the right side. So, this is determined by something like this particular point and similarly the left hand on the right side

determined by this point. And therefore, there is a common area where both the hands can be present which is represented by this shaded area.

So, it is a sort of convenience inconvenience question you basically move both of your hands in both the directions. And let say you are basically in in in the workers positions as you know that you know, there is a span up to which the 2 hands can go right and then your left hand can go upto certain span. And similarly right hand can go only up to certain span it cannot go beyond that span. So, therefore, there is of course, a zone we are both hands are present and this would be typically the zone were all the assembly subassembly should be carried out. There is the whole idea behind such motion studies. So, I would like to incorporate something which is not out of reach of the hand either left or right of an operator while doing carrying or things related to orientation one hand could be used, but while doing an assembly where 2 hands are needed that should typically in that criss cross zone where both the hands are accessible.

So, this how we would like to do motion study is basically design to determine the best way to complete a repetitive job. And this mind you we are talking about the case it is not a onetime deliverance, but many cycles of this has to be done for completing what you call production on a particular line. Similarly, is the time study concept which measures how long it takes an average worker to complete a task at a normal piece. So, some tools like stopwatches, an even some video recording let say computerisation an interactive tools can be utilised for predicting how long it should typically take or how long it actually takes and try to do some time sequencing of the different methods which have been formulated by motion study.

So, that we can have a possible impossible job classification. So, that is the basic difference between motion and time study.

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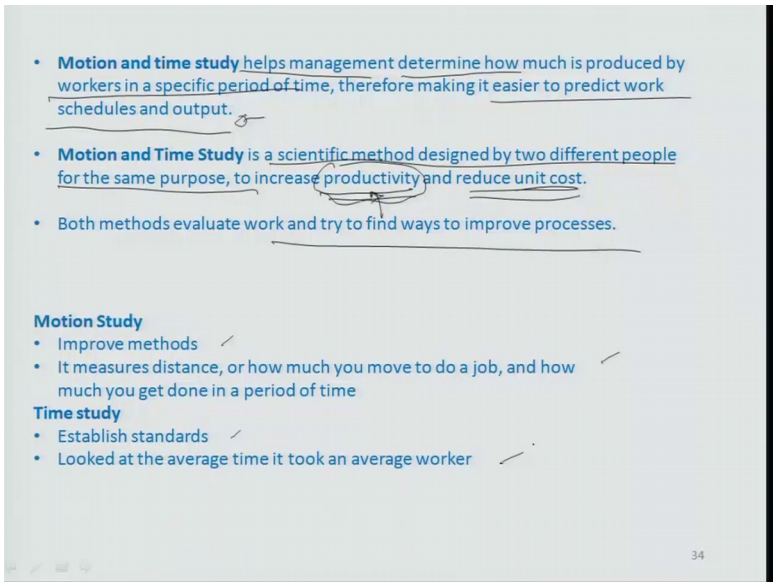

So, if we look at what are the advantages so; obviously, both help to manage and determine how much is produced by the workers in a specific period of time. It makes it easier to predict the work schedules and output. So, if I am aware of what goes on down to almost the most minuscule scale. I would be very well equipped to have a thought of control down to that scale, in terms of even one independent task which gets carried out to perform the whole task. And so the better splitting up is there of all the task in a time scale or an motion scale the better it is for the management and control of such tasks. Of course, there are scientific methods which are designed by 2 different people here for the same purpose.

So, the main goal on main purpose how to effect this term here productivity. And how to reuse the unit cost of course, both methods evaluate work and try to find out ways improve it. So, far example motion study improves methods measure distances or how much you move to do a job and how much you get done over a period of time and time study on the other establish standards, looks at average time it took an average worker to do a job.

So, I think we a kind of aware of what these 2 concepts motion and time study do in work study. In the next lecture we would try to have details about how they can be practical implemented on for estimating cycle times and some other important parametrics. So, as of now.

Thank you very much.