

Work System Design
Dr. Inderdeep Singh
Department of Mechanical & Industrial Engineering
Indian Institute of Technology – Roorkee

Lecture - 13
Concept of Work Content

Namaskar friends, welcome to session 13 in our discussion on the course work system design. We are in the third week of our discussion and we are trying to understand the basic concept of work study in this week. In the previous 2 weeks our focus was primarily on understanding the importance of productivity for an organization and we have seen that what is the basic concept of productivity, how it is different from performance, efficiency, effectiveness.

What are the various techniques to measure the productivity? What are the various productivity measurement models? We have also tried to understand the causes for low productivity and various productivity improvement techniques. We have tried to solve some numerical problems based on the concept of productivity and I have tried to understand certain case studies in which we have seen that how the product improvement or how the design improvement of the product.

How the process improvement, how the employee involvement and morale can affect the productivity of an organization? So we have dedicated 2 weeks for our discussion on productivity and now third week our focus primarily is to understand the basic concept of work study. We have already discussed the definitions of work study. Today, our target will be understanding the concept of work content. Now what is work content?

Basically the work content is the amount of work that has to be done. It can be divided into various tasks, various job elements which when accomplished successfully lead to the completion of the work. So we will try to understand that what is work content? Why do we need to identify the work content? and what can be the reasons of additional work that we are unnecessarily putting.

And which is leading to our low productivity as we have seen in productivity the basic definition is output/input. So the input is we are putting additional time, additional man-hours, may be

additional money is being spent, everything is leading to low productivity. So if we can optimize our input in such a way that we are making optimal utilization of our resources, the productivity is bound to improve or is bound to be high.

Our today's discussion we will see that what is the basic work content which is an ideal work content which must be accomplished in order to complete the task or the project at hand, then what are the reasons for additional work content or excess work content, and how we can eliminate the excess work content. So that is going to be the target, the objective of our discussion today. So let us start our discussion now.

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Source: Introduction to Work Study, ILO,
Geneva, Oxford and IBH Publishing Co.
Pvt. Ltd. {Third (Revised) Edition}

This topic has been taken from a very standard book of work study which is introduction to work study published by international labour organization, Oxford and IBH publishing company private limited, third edition. So this topic that we are discussing today is available in this book. So if you want to refer the book and try to see certain examples which have been in the book for better understanding, you can refer to that standard book of work study. Now let us see the concept of work content what is how it can be defined.

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Concept of Work Content

- Work content means the amount of work “contained in” a given product or job or process measured in **man-hours or machine-hours**.
- Work content determination for each job is the **prime requirement** for the effective utilization of a man as productive element.
- It must be specified in terms of the related **tasks** to be performed and the responsibility for planning and control of these tasks.

Now work content means the amount of work contained in. So you can see the amount of work contained in. A given product or a job or process measured in man-hours or machine hours. So the work content usually is measured in man-hours or machine-hour or it is the amount of work. This is very, very important. So work content as for the literal meaning also it goes that work and content what is the amount of work that has to be accomplished.

Now why the determination of work content is important because when we are planning our work study we have to see that what is the actual amount of work to be done because in many places we will see that the actual amount of work to be done may not be the total amount of work we are doing. So the difference between the total amount of work that we are putting in and the actual amount of work that must be done will lead to certain wastage.

And that is the area where we have to focus our efforts that first we must know what is the basic work to be done and then we should design our work system to accomplish that work. Many times we are doing unnecessary work that we will try to understand, we will try to outline, we will try to classify the reasons that lead to the excess work content. So our first focus is what is the amount of work required to complete the job.

Or the process at hand and the units are also given normally it can be expressed in terms of man-hours or machine-hours. If the work is to be done by machine, we can measure the work content

in machine-hours. If the work has to be done by man or manually the work content can be determined in terms of man-hours spent and we will try to see in our last session that is the session 15.

The behavioral aspect we will see that when man is used as the product value and what are the advantages and limitations. When the machine is used as a productive value and what are the advantages and limitations that is going to be a topic of our discussion in session 15 that will be the last session for this course. Today we are currently discussion session number 13. Today our target is to understand the work content.

So work content determination for each job is the prime requirement for the effective utilization of a man as a productive element. So we need to understand that how much work has to be done or what is the man-hour representative of the work at hand. For example, may be pile of bricks has to be transported from 1 floor to another floor this is a work which has to be accomplished then how we can specify this in terms of units.

The units can be this much man may be x number of man-hours are required to manually transport this pile of bricks from this floor to the next floor or to the another floor. So that is basically an example of work content determination this is important from planning point. We need to plan our day; we need to plan our work force allocations. So for all those purposes, determination of work content is very, very important.

As well as many times to specify the use of a machine to automate a particular work we need to understand that what is the total work content? If the work content is not that much it does not justify the additional investment that we need to automate the work or automate the process. Many times we may decide otherwise that we do not have that much of work so we do not need automation of this work it is being done manually.

And easily it can be done manually in future also, but in many cases may be if it is a repetitive type of work and the person who is doing the job may feel monotonous, may not be able to deliver the quality, deliver the precision with which the work has to be accomplished in that case

we may say 2 repetitive people are not able to concentrate for long periods of time, let us automate this work.

So therefore our work content determination is very, very important in our decision making process. So it must be specified in terms of relative tasks to be performed and the responsibility for planning and control of this task. So it is important I have taken 2 or 3 examples also just to emphasize the importance of work content as well as the work content determination.

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Tasks Related to Work Content

- Work content of a job consists of **mental and physical** tasks.

- Mental tasks vary from simple activities of **collecting and storing data** to complex activities of **problem solving and creative thinking**.

- Physical tasks involve use of **muscular power**.

Now tasks related to work content of a job consists of mental and physical tasks. I think this I have tried to explain earlier also. So if a person is operating a lathe machine or if a person is making ice cream cones, physical and mental combination of tasks are there. Physically suppose he is making ice cream cone he has to take a cone then he has to switch on the machine, he has to move his hand so that the ice cream is deposited properly in the cone.

So that is the physical part of his job. Now somebody may say that I do not want more ice cream, just put less ice cream only or he wants or she wants a combination of ice cream in his or her cone so that now a mental task is coming to picture. He has to now take a decision that how much time he has to put the cone under the vending machine. When he has to close the machine and move the cone to the other outlet from where the other ice cream is going to come as it is a combination of 2.

So physical task also and the mental or the decision making task also. So work content of a job consists of mental and physical tasks. So we have both types of tasks which have to be accomplished. Mental tasks vary from simple activities of collecting and recording the data or storing the data to complex activities of problem solving and creative thinking. So different types of work that all of us are doing.

Some of us may be doing a work which is more of physical nature, less of mental nature or less of cognitive level or less of cognitive nature. Many of us may be doing exactly opposite, where the task or the work that we are doing is more involved mentally, but less involved physically so every work that is being accomplished is a combination of 2, the mental and the physical tasks. Physical tasks involve use of muscular power.

So mental tasks involve decision making, creative thinking, assimilating the data, storing the data, taking decisions based on that data so mental or cognitive level of task as well as the muscular or physical tasks. So we have to see that for a particular work what is the combination of the 2 and accordingly we have to take a decision that how to design a work system for this type of tasks.

For example, if the tasks involved or the work involves lot of thinking or creative thinking we must provide an atmosphere, we must provide an environment, where a person can sit, think and relax, like suppose there is lot of sound. The sound proofing is not proper, too many air-crafts are crossing over the building and then there is a railway line also crossing nearby, may be the person may not be able to concentrate and come up with creative thinking or creative solutions to the problem.

So that is may be the design of the work system must be such that the person is able to sit, relax, and creatively develop new things or creatively find solutions to the existing problem. so for creative thinking, mental tasks we require a different set of environment. For physical work, we require a different set of environment and the environment can be loosely called as a work system that we are thinking, that we are studying to design.

To our work system we have this has an input that what type of work has to be accomplished and depending upon the type of work to be accomplished, decisions will be taken regarding the design of the work system. Now constituents of work content, 1 basic classification already we have seen that work content can be broadly classified into physical and mental tasks.

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Constituents of Work Content

- Basic work content
- Excess work content or Excess time

Total work content = Basic work content + Excess time

Then the work content can also be classified as a basic work content and the excess work content or the additional work content or the excess time that is being spent because we have seen that what are the units of work content in the previous to previous slide we have seen the units of work content are usually in terms of man hours or machine hours. So here the basic work content will also be represented in terms of time and the excess work content can also be represented as the excess time that we are putting to accomplish the work.

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Basic Work Content

Basic work content is the irreducible minimum time theoretically required to produce one unit of output.

Basic work content will result in the following conditions:

- 1) The design and the specification are perfect.
- 2) Process of manufacture is exactly followed.
- 3) No loss of working time due to any other reasons.

Thus, the basic work content represents an ideal condition which is not possible to achieve

Now, basic work content is irreducible so please keep in mind this particular word which is irreducible which cannot be reduced further. Basic work content is irreducible minimum time also theoretically. This is very, very important, because theoretically we can assume or we can find out that this is the minimum time required to perform this task or this is the work content related to this particular task or job.

But practically there will be n number of reasons which will always lead to excess time. So, basic work content is the irreducible minimum time theoretically required to produce 1 unit of output. So this is the basic work content which is important and we will see in the previous slide we have seen that the total work content is dependent upon 2 important quantities that is total work content. Total work content = basic work content + excess time.

So now we are trying to understand the basic work content. So basic work contents are irreducible which cannot be reduced further, minimum time require theoretically to produce 1 unit of output. Basic work content will result in the following conditions. So it is theoretical, why it is theoretical, it is only possible if these 3 conditions are met. Now what are these 3 conditions? The design and the specifications are perfect.

So we have already done 110-hour course on product design and development and we know the importance of product design. So if the product design is best it is able to satisfy the customer, it

is as per the specifications. We can say that it is a good design, then good design also has got lot of connotations, lot of requirements, but we will not go into that, but here we assume that if the design of the product that we want to make is good it is as per specification.

It will lead to a basic work content only there will be no additional excess time spent on producing this product. The process of manufacture is exactly followed. So your product design is good, you are using the standard procedure, standard process, standard sequence of operations to produce your product, yes, still you will be focusing only on the basic content, there will be no excess time or wastage of time.

No loss of working time due to any other reasons. There can be n number of other reasons which may lead to where excess work content, but here we are saying that there is no loss of time, so these are the 3 ideal conditions. Now 3 ideal conditions are our design is finalized, it is best design so there is no problem with the design. There is no problem with the process and there is no problem with the random reasons which may be lead to excess time.

So automatically you can very easily assume that if everything is going on normally, everything is going on theoretically you will be able to complete your work in the basic work content time only. So there is no chance of any excess work content. Thus the basic work content represents an ideal condition which is you can say a very theoretical condition which is not possible to achieve. I will say the sentence which is not possible to achieve may not be the correct representation in the 21st century.

It is possible, but may be in rare cases we may be able to achieve this situation. There may be maximum times that one or the other reason may lead to the excess work content and what can be the reasons for excess work content that we are going to study. So the total work content is a summation of basic work content plus the excess work content or the excess time. So what do we mean by basic work content, we have understood, now let us try to understand what is the excess work content? What is the excess work content?

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Excess Work Content

- The actual time required to complete an operation or a job is more than the basic time in practical situations.
- This additional portion of work content is called excess work content.

Excess time = Time due to defects in design or specification of the product + Time due to inefficient methods of manufacture or operation

So the actual time required to complete an operation or a job is more than the basic time in practical situations. So in the previous slide we have use the word theoretical, here we are using the word practical. So practical situations many times our time spent for completing the work or completing a job or completing a task may be more than the basic work content why? There are certain reasons outlined in this book so that we will try to understand.

This additional portion of work content is called as the excess work content which is also represented in terms of time only. So the excess time = time due to defects in design or specifications of the product + time due to inefficient methods of manufacture or operation. So we have seen in the previous slide that basic work content is possible we are able to complete the work in the basic time only how 3 conditions have to be met.

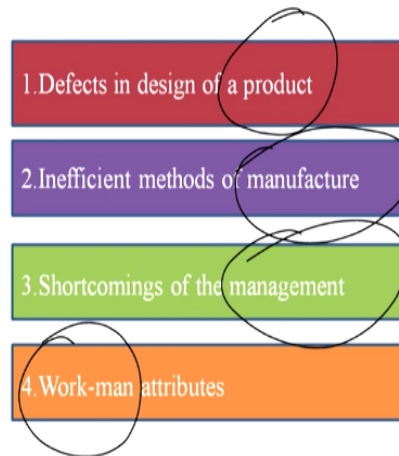
The design must be excellent, it must be perfect, the process to be followed is perfect and there is no random variation. So there is no problem during the processing of the product while completing the work. These are 3 important conditions ideal conditions, but practically the ideal conditions may not be possible, so when the design is not good, there are problems with the design, we have to redesign or may be some changes we have to do here and there.

Then the process also has some flaws or there are few issues with the process, automatically the excess time will add to the basic time and which will lead to the total work content that is basic

work content plus the additional work content or the excess time. Now we will try to understand today that what are the reasons for the excess work content and how they can be removed or how these reasons can be taken care off. So quickly we will see.

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Reasons For Excess Work Content (WC)



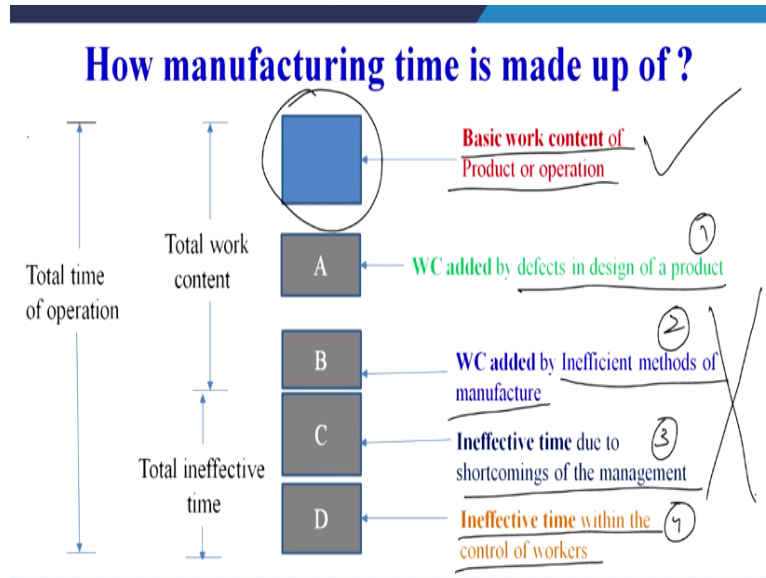
The reasons for excess work content are 2 are already highlighted, one is related with the product, other one is related to the process. So here we will see the first one is again it is again related to the product, so defects in the design of the product, inefficient methods of manufacture, shortcomings of the management, and work-man related attributes. So these are the 4 important things, so one is the product, focus area is product, manufacture, management, and the man who is going to perform the task.

So these 4 things if we are able to take into account and we are able to choose the best design, the best method of manufacture, so management practices policies are also the best in the industry, the person is skilled enough to perform the task there is not going to be much problem and we will be able to complete the work or our work content will be the basic work content only there will not be any additional or excess work content added due to these 4 reasons.

But these reasons may further we studied in terms of may be let us focus 1 by 1 what is the product, what are the problems with the product, what are the problems with the methods of

manufacture, what are the problems with the management policies, what are the problems with the work man related issues.

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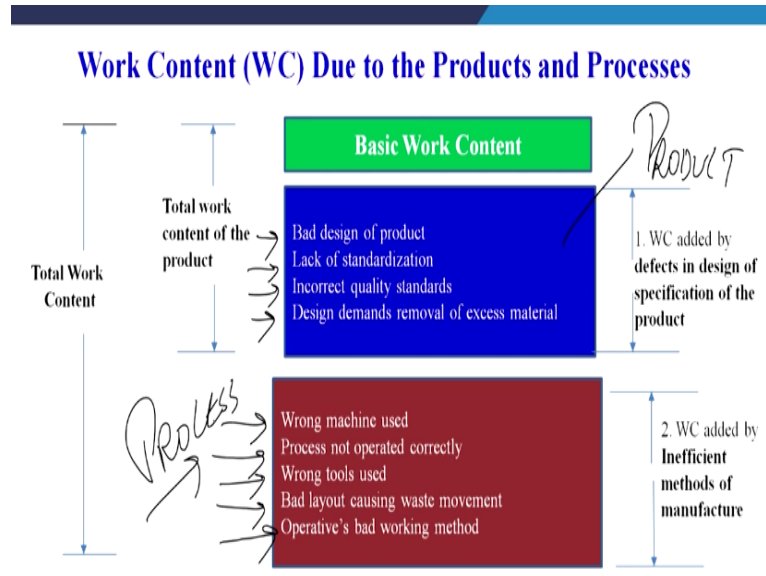


So this is showing the things slightly in a diagrammatic way. This is the basic work content. This portion is representing the basic work content of a product or an operation. This is work content added by the defects in design of the product which was the first reason for excess work content, work content added by inefficient methods of manufacture, second reason of excess work content ineffective time due to shortcomings of management.

Third reason and ineffective time within the control of workers the fourth reason. So our target is this only. Our target may be work study analyst is that whatever work is being done it must be done in its basic time only, the basic work content is our focus area and we want to eliminate all these 4 additional work content leading reasons. So these reasons we want to focus and try to eliminate this.

So that our total work content is added is our representing the basic work content only. So there is may be reasons for this and we will try to understand them and try to see that how we can have a better management, how we can have a better product policy, better methods of manufacturing in order to eliminate these reasons.

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Now we can see 1 by 1. This is the work content due to products and processes, so these are 2 important things product and processes, the other 2 is ineffective times or the excess time is due to the management and the man hours that also we will try to understand. From product point of view work content added by defects in design or specification of the product. So we can see 1 is bad design of product, lack of standardization, incorrect quality standards, design demands removal of excess material.

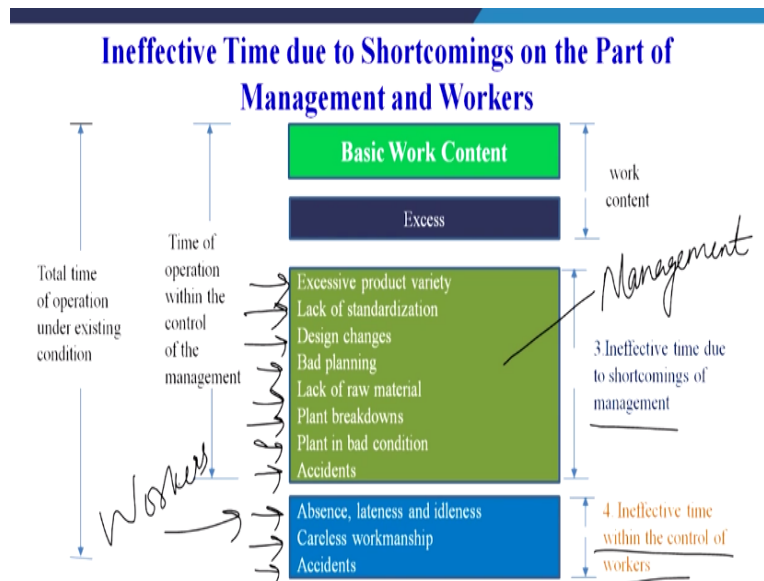
There can be more, this list is endless. Your products may fail because of n number of reasons. So here it is just highlighted 3 or 4 main points that why the product design sometime leads to additional work content, so the bad design many times standards are not followed if standards must have been followed the time automatically will reduce or there will be no excess time added because the standard procedures are being followed.

Whenever you go for a nonstandard may be part or a component it will require additional processing and may lead to the excess or additional time. So lack of standardization, incorrect quality standards may be 1 reason and design demands, removal of excess material. So all these points have to be taken into account. These are reasons leading to excess work content. Then from the manufacturing point of view, wrong machine used you can see.

The machine selection is not proper, process not operated correctly. You have selected the right machine, but your type of work or operational things are not proper or the process is not operated in the manner it must be operated, tools are not correctly selected, bad layout causing waste, wastage of movement, operative's bad working method. So a person is not following the standard procedure, what is the standard procedure? That we will try to understand when we do the method study. So these are the 2.

This is from the product point of view. This one is from the process point of view, what are the issues, and this one is from the process point of view, what are the issues involved. So from product and process point of view we have seen if the design is not proper or if the process that we are following for producing the product is not proper, wrong tools are used, wrong machines are selected, it will definitely lead to the excess work content. Our focus is on the basic work content only. What are the other 2 reasons, the management?

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Ineffective time due to shortcomings of the management. Then excessive product you are writing, the management has to decide how much product variety they want to offer to their customer. So if there is lot of variety may lead to excess time, lack of standardization again design changes, bad planning, lack of raw materials sometimes may lead to excessive, the machines are there they are idle, no raw material is available.

Plant is in bad condition, plant breakdowns, accidents due to non adherence of the safety norms in the organization. So the management policies also sometime may lead to the additional work content which can be easily eliminated, easily avoided by following the right industrial management policies. We cannot discuss each and every point, the major point to emphasize is that there are 4 major issues or 4 major areas where we address.

We will be able to save the excess time that is leading to additional work content and the last 1 in this series, 3 we have already seen. In the previous slide we have seen products, issues related to product, we have issues related to process or manufacturing, the third is the issues related to management and the fourth one is the issues related to the man. So in-effective time within the control of the workers we will try to may be absence, lateness and idleness, careless workmanship, and accidents because of wrong methods of operation.

Or maybe because of carelessness or because of not following the standard operating procedure. So we have seen from the management point of view also there are issues which can be addressed which lead to additional work content and from the workers point of view also there are issues which must be addressed. Now what can be very quickly we will try to see, just few guidelines if we follow those guidelines very easily we will be able to reduce the excess work content.

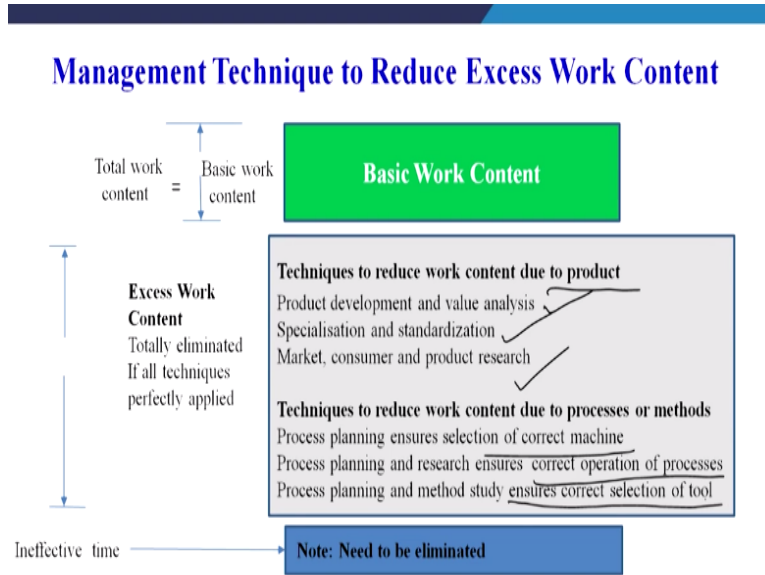
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Techniques to Reduce Work Content

- Techniques to reduce work content due to product
- Techniques to reduce work content due to processes or methods
- Techniques to reduce ineffective time due to management
- Techniques to reduce ineffective time within control of the workers

Now techniques to reduce the additional work content or to reduce the excess work content we can see techniques to reduce the work content due to product, so first focus can be product, second can be processes, third can be management, fourth can be workers so which we have already understood.

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Now techniques to reduce the work content due to product. What we can do, lack of standardization or the problems so we can follow the standards, so specialization and standardization, market consumer and product research, product development, and value analysis, or value engineering. So if you follow the standard techniques of product design and analysis product design and development.

And take into account concepts like design for manufacturing, design for assembly, design for quality, design for safety, design for manufacturing and assembly, automatically our product design will be good. We can follow concepts of value engineering, we can follow concepts of quality function deployment, there are standard approaches for designing the product. So if we follow the standard approach for product design our additional time spent for making the product will be saved.

So we will only focus on the basic work content which is the theoretical time required to produce 1 unit of output. So the excess time we can control if we are able to design the product in the

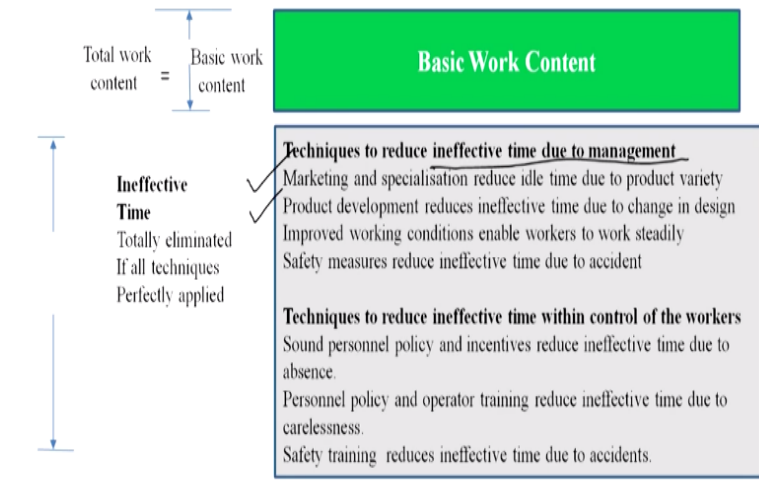
most efficient and effective manner. Then the second is related to the process. So from process point of view, process planning ensures selection of correct machine because we have seen that in the selection of incorrect machines.

Selection of incorrect tools may lead to additional time for manufacture or may lead to excess work content for any job. So if we choose the correct machine using the process planning, then you use the correct operation of processes. If we process planning and method study ensures correct selection of tools so if the tools, sequence of operations processes machines are selected properly our additional time will be saved.

Then 2 things we have already done product design we have to focus on processes we have to focus on, then the management policies also we have to take into account.

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Management Techniques to Reduce Ineffective Time



Then from the management point of view techniques to reduce ineffective time due to management we can focus on marketing and specialization, reduce ideal time due to product variety. Now many times we have seen from management decides to satisfy each and every customer via providing lot of variety which sometimes lead to additional work content. So if they do proper marketing analysis, proper target marketing and try to understand.

That who the customers are going to be very easily they can reduce the idle time by identifying that what is the product variety they have to focus on. Product development reduces ineffective time due to change in design, so product design and development they can focus on, improved working condition enable workers to work steadily, no accidents will be caused. Safety measure reduce ineffective time due to accidents.

So we can see that management policies effective and efficient management policies will definitely reduce the excess work content, then from the workers point of view if we see sound personal policy and incentives reduce ineffective time due to absence, so may be if the worker is enjoying going to the industry or the work place definitely the absence and lateness will be reduced. How the company can ensure that the worker enjoys coming to the company.

They can give certain incentives may be the working environment may be provided which is enjoyable for the worker, he enjoys the way he is doing his work for example these days' children enjoy going to school why that because school provides learning along with playing, so they learn and play together. Similarly, for the worker also, they work and enjoy together, so automatically they will enjoy coming to the organization.

Personal policy and operational training reduces ineffective time due to carelessness. So carelessness can be avoided by proper training of the worker. Safety training reduces ineffective time due to accidents. So we have try to understand that total work content is made up of basic work content which is the ideal time in terms of man hour or machine hour which is required to accomplish the work and there is practically the additional excess time.

Or excess work content which is due to primarily 4 reasons related to the product, related to the processes, related to the management and related to the worker. So we have seen that what can be the problem areas in these 4 fields or these 4 specific points or factors and what can be some of the key remedies for eliminating or reducing or avoiding the excess work content. So we have tried to list the 4 ideas or 4 areas where the excess work content is there and try to find out the remedies for these 4 areas.

What are these 4 areas that is the issues related to the product, issues related to the processes that are used to make the product, issues related to the management policies and issues related to the workers who are actually performing the work on the shop floor. So with this we conclude our session and in the next session our target will be to identify tools and techniques which are used to conduct any work study in an organization. Thank you.