Work System Design
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Lecture – 06
Factors Influencing Productivity

Namaskar friends, welcome to session 6 in our course on work system design, so today we are going to start our discussion for the second week and all of you are aware that this is a 30 our course in which we will have 60 sessions and the courses spread over 12 weeks. So, first week we have focused on productivity and why we are focused on productivity because we are having our target as the effective and efficient work system design.

In a work system design, our target is to design a system for doing the work in such a way that it is both beneficial for the organisation as well as beneficial for the worker also. For the worker, benefits may be in terms of good wages, in terms of safety, in terms of less fatigue, in terms of efficient and effective work procedures. So, the system we have to design, so that our raw material is converted into the final product in the most efficient and effective manner.

The company is profitable and the overall economic health of the organisation is excellent that will lead to the growth of the society and which will further lead to the improvement in the GDP of the country. So, whatever we are discussing is related to each one of us, it is related to the life of each one of us that how we can be better productive, how we can be productive, efficient and effective.

So, all our actions must be productive all our thoughts must be productive, all our; we can say works fear whatever is working around us must work in the most effective and efficient manner. So, in the previous week, we have tried to understand the concept of productivity, we have tried to differentiate productivity from performance, we have tried to differentiate productivity from efficiency, we have tried to understand that how we can measure the productivity.

We have try to understand the different measures of productivity, we have try to understand the different productivity measurement models, so we have now established a very strong foundation

about productivity and productivity measurement. Now, we will try to see that if we have to improve the productivity what all factors must be kept in mind; now, you can see and you know that what is the mathematical relationship of productivity?

If you see last class, we have seen different models of APC model, we have seen then Taylor and Davis model was there, then Craig and Harry's model was there, so in all these models if you remember and the different productivity measures that we have seen partial productivity measures, total productivity measure, total factor productivity measure and finally the multifactor productivity measure.

In each one of these theories we have seen that the output has to be related to the input, the terms, the quantities, the elements that we are using as an input may vary from one model to the other model. The output may also vary somewhere we may use the quantity as an output somewhere we may use the currency or the capital that is generated or by the operation as an output.

So, that quantities terms may vary but the basic concept remains the same that we have to see that what we are getting by putting the efforts. Efforts are our input and what we are getting is our output, so we have to relate the inputs to the output, so basically what can be the summary of productivity improvement can be that we must try to optimise, we must try to maximise our outputs in context of the various inputs that are going into making that output.

So, we have to focus on our output and the inputs in order to improve our productivity. Now, what are the various factors that we must take into account that we are going to list today, try to understand them with the; sorry, help of certain examples?

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Factors Influencing Productivity

Broadly classified in two categories :

(a) Controllable or internal factors
(b) Uncontrollable or external factors

Now, we have seen in one of the previous sessions also that the factors influencing productivity can be broadly classified into 2 categories. Now, category1 are the controllable or internal factors and the category 2 are the uncontrollable or external factors. Now, from the words that we have seen controllable, which means that the industry has a control, the organisation has a control over these factors that is they can manipulate, they can work, they can tweak, they can find tune these factors in order to improve the productivity of an organisation.

Uncontrollable means that the organisation, the industry, the company has no control over these parameters or these factors, so you cannot do much about this, so what is the need? The need is to understand the controllable or internal factors and work on these factors in order to optimise them, in order to if possible maximise their utility, so that our overall productivity of the organisation increases, improves, enhances.

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Controllable or Internal Factors

- Product factor
- Plant and equipment
- Technology
- Material and energy
- Human factors
- Work methods

So, let us try to understand that what are these controllable factors and what are the uncontrollable factors. So, controllable or internal factors you can see on your screen, you have different categories of factors; first one is the product factor, then the plant and equipment factor, technology factor, material and energy, human factors and work methods, so each one of these we will try to understand with a little bit of detail.

Because our topic is quite exhaustive that is work system design and the time that we have is 30 hours only, so within 30 hours we have to summarise, we have to study, we have to understand, we have to discuss, we have to may be deliberate on a number of other parameters also, or the number of other topics also. So, quickly we will try to understand that what are these parameters and how we can work on these parameters to improve the productivity of any organisation.

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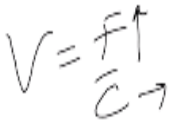
Product Factor

- The extent to which product meets output requirements.
- Product is judged by its usefulness.
- Cost benefit factor can be enhanced by increasing the benefit at the same cost or by reducing cost for the same benefit.



So, first one is the product factor, I have already read all the factors for you, now let us see the product factor. The extent to which product meets the output requirements; output requirements can be the customer requirement, so we have to see that whatever product our company is manufacturing rather it is really required in the market or so for product that we are manufacturing, we need to do a detailed exhaustive marketing analysis.

We try to understand that who are going to be the customers, who are going to use this product, what is their education level, what is their economic strata, where do they lie in the economic may be levels of the society, so we have to do all kinds of marketing research in order to find out that what product we are producing, whether it is going to be useful or whether it is going to be needful for the persons or for the customers or not.

So, the extent to which the product meets the output requirements, this is one factor as in context of the product, then product is judged by its usefulness. In our course, if you remember we have done a course on product design and development also and there we had a discussion on value engineering also in our course which is currently running on operations management, we have discussed product design and development again as one of the important topics.

And there also we have emphasised on value engineering, so product is judged by its usefulness and that usefulness I can relate as judged by its functions and as per the definition of value

engineering we say that the maximum value is achieved, when the desired function is met reliably at the minimum possible cost. So, we have to see that the product is satisfying the desired function reliably at minimum cost.

So, if our product is able to deliver the function for which the customer has bought this product reliability that is over a period of time and the cost he has to expand on procuring this product is also less than the product will be useful for the customer. Then the cost benefit factor can be enhanced by increasing the benefit at the same cost or by reducing the cost for the same benefit. If you remember we have seen that the value of the product is related to the function.

It is providing to; if you remember the cost of the product, so we have seen that usually we say value is equal to function by cost, so this third point highlights that our usefulness or the cost benefit factor is enhanced if we keep the cost constant and try to improve the benefits or the functions of the product or we try to keep the benefits constant and try to reduce the cost of the product, I must add another thing here we can increase the benefits.

And we can also increase the cost also but the overall change must be the increase or improvement in the value of the product, so the cost benefit analysis from the product point of view is very, very important that we must address as an organisation in order to be profitable as well as productive.

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Controllable or Internal Factors

- Product factor
- Plant and equipment
- Technology
- Material and energy
- Human factors
- Work methods

Then, the second factor which is most important is the plant and the equipment, now as we know that we must ensure the optimal utilisation of all our facilities.

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Plant and Equipment

- Play a prominent role in enhancing the productivity.
- Increased availability of plant through proper maintenance and reduction of idle time increases the productivity.
- Productivity can be increased by paying proper attention to utilization, age, modernisation, cost, investment etc.

So, let us see what we need to understand in case of plant and equipment because that is also one of the important inputs that go into the productivity measurement models. So, these play a prominent role in enhancing the productivity, increased availability of plant through proper maintenance and reduction of idle time increases the productivity. So, as I have already said that we must focus on the optimal utilisation of our resources in terms of plant and equipment.

If all of our machines are up and running, we are doing proper maintenance, total proper preventive maintenance of our machines, the machines will give us the better output, better output means that our productivity will be higher. So, we must try to minimise or reduce the idle times of our machines and equipment also, productivity can be increased by paying proper attention to utilisation, age, modernisation, cost and investment.

So, we have to focus on all the sub factors also, the major factor is plant and equipment, so within plant and equipment we must see that what is the age of a particular machine, when we need to replace this machine, what type of preventive maintenance procedures must be followed for this particular machine, then we can also see that what are the technological advancements in the field.

So, technology is another factor which we are considering separately but the technological enhancement in terms of plant and equipment also is very, very important must be taken care of, so we can see that if we are able to optimally utilise the machines and equipment available with us, they will definitely influence the productivity of an organisation. The third factor is; as I have already told technological enhancements is very, very important, so technology must be taken into account.

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So, we can say from technology point of view, we can see what is the size and capacity of our plant, how we can increase the capacity of our plant by spending a little extra amount of money by changing the technology or by adopting a better technology may be simple example that we can take is that in case of a manually operated lathe machine, if you go for a CNC lathe may be little bit of input may increase.

But it will be offset by the productivity enhancements that we can achieve using the lathe machine, so that is you can say the size and the capacity of the plant we can work upon by changing the technology, then timely supply and quality of inputs, the quality of inputs can be checked by doing the onsite inspection and for inspection, we can use the latest technological measures techniques for an assessing and checking the quality of the inputs that we are getting.

Then timely supply can be ensured using the concept of information technology, we can you; we can have dedicated lines of information sharing with our vendors using the concept of technology and then which can help us in the timely supply of our raw materials, then production planning and control and operations management can help us to improve the productivity of our organisation.

We can have optimal utilisation of our resources using the technology as we want to produce the right quantity in right quality at right time at right cost using the concept of production planning and control, so 4 things we can very easily manage, if we apply the principles of production planning and control and these 4 things are the right quality, right quantity, right time and at right cost or competitive cost.

So the principles of PPC can help us with a meeting these objectives and then we can be profitable as well as productive, then repairs and maintenance can be done using the technological updates or we can have a regular you can say, update regarding which machines require maintenance at what particular time, so for a human being it may become difficult to remember or to keep a track of all these things.

But using technology, using systems, using computers we can read tag that this particular machine has to be stopped today or there can be buzzers which can give us an indication of this machine must not be operated today and all these things as we have seen in the previous slide that is plant and equipment, so our plant and equipment is an important parameter and technology can help us to keep our plant up and running.

And if both are working in unison, the overall productivity will definitely improve that means that if you use technology for keeping our plant up and running, this is definitely going to help us in improving the productivity of an organisation. Then the last point here is we can use technology for efficient material handling, so there are different materials handling systems, we have these (()) (16:31) which we call as the automated guided vehicles.

We have conveyor belts, conveyor lines, so there are different technological advancements in the fission material handling systems which can help us to improve the productivity of our organisation. So, till now we have considered 3 important points, we must focus as an organisation of on our products whether our product is liked by our customers or not, then we must focus on the plant and equipment, we must focus on the technological advancements.

And then what else we must focus on; we must focus on the materials that are going into our product because in most of the productivity measurement models, we have seen that material is an important input parameter as well as the energy that is expanded for converting the raw materials into the final product.

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Material and Energy

- Selection of quality material and right material
- Control of wastage and scrap
- Effective stock control
- Development of sources of supply
- Optimum energy utilisation and energy savings

So, you can see from materials point of view, we need to be very, very cautious regarding the selection of quality materials and the right materials, then we must try to control the wastage and scrap that has been produced in the organisation, we must have an effective, inventory and stock control systems in place which will help us to minimise the wastage and optimally utilise the materials which are available with us.

Then, we must also develop different sources of supply of material, we are not dependent on a particular vendor only, so we can have alternate vendor is depending upon the requirement, we can choose a specific vendor for a specific order. Similarly, the energy utilisation must also be optimum and we must focus on energy savings, there is a lot of focus these days on saving the energy, energy audits are done by various organisations to see that whether they are optimally utilising the energy sources or not.

So, from the material point of view, there are topics that we have already covered in operations management, we have seen APC analysis, VED analysis, economic order quantity, production quantity models, so there is a baby theory available which can be put into practice for efficiently utilising the materials that we are using within the organisation. So, if we focus on proper utilisation of material, proper ordering, proper handling of the materials within the organisation, it will definitely lead to the improvement in the productivity of an organisation.

The next point are the human factors which I consider as the most important factor for any organisation or which ensures the success of any organisation mostly I tell that the organisations are not run by machines and equipment, the organisations are made successful by dedicated people by people who want to work for an organisation, so the organisation are successful by the people or made successful by the people not by the machines and equipment.

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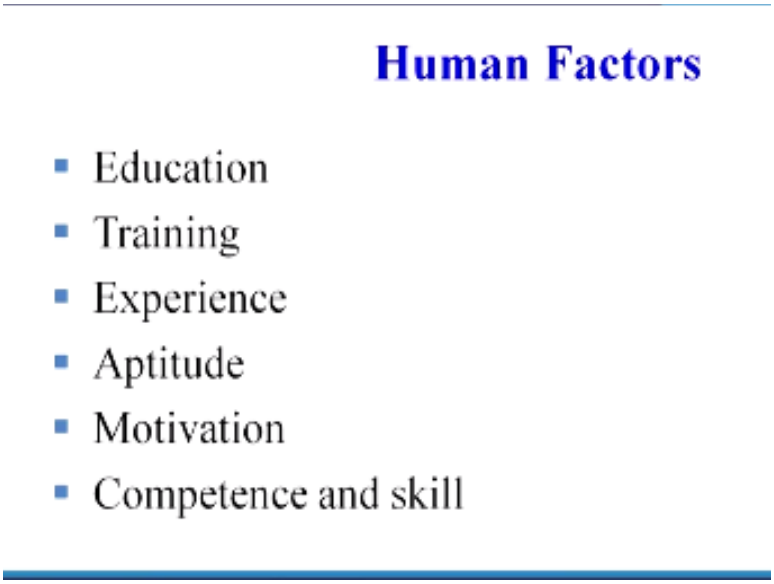

So, the human factor is very, very, very, very important for the; from the productivity point of view, so from human factors point of view, we can have different parameters like education of the workers or the skill enhancement of the workers, then training may be time to time timely may be training must be given to the workers, experience must be utilised, aptitude training can also be done.

Then, motivation which is the most important parameter, the employees must be motivated to work hard, then competence and skill, all in all may be to summarise that we must have a dedicated workforce, which want to put their heart and soul for the organisation, they are related to the organisation, they are part of the family of the organisation and if the organisation also keeps them hale and hearty or may be in good state of mind.

They can always be an important resource for any organisation, they can definitely make the organisation productive, so humans resource basically we can say 3 important things can be

considered here. First one is the skill that training the education and all things related to their technical development, the second can be the behavioural aspect where they must be in high morale and motivated.

And the third can be the economic or the bonus or the benefits or the wages, so training, wages and the behavioural aspects can definitely help any organisation to develop their human resource in a way that they lead to profitability and then thereby leading to the productivity of an organisation and the next thing that is the last thing for today that we have are the work methods. So, these are all the controllable parameters.

Then, we will see the uncontrollable which are beyond the control but when we want to increase the productivity, we can only focus on what is within our grasp, what is within our control, whatever is out of control we have no choice in that case but from the controllable point of view, the last one are the work methods and our course is focused on work methods only, so work system design can help us to improve the productivity of the organisation.

And here we will try to focus on the work study, we will see work study which will further be classified as a method study and the time study, then the industrial engineering techniques are there which can help us to improve the productivity of an organisation, training.

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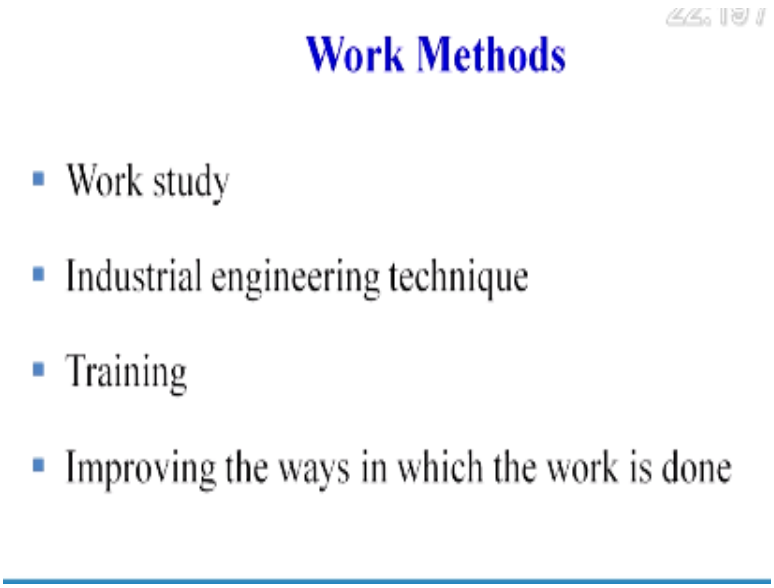

And lastly, improving the ways in which the work is being done, which we will cover exhaustively when we will discuss the methods study part, we will see the operation charts, flow diagrams, man machine charge, so all these theoretical tools or all these graphical tools will help us to improve the way we are doing the work or the way the work is being done within the organisation.

So, the work methods the way the work is being done in the organisation is also very, very important and our focus will be on that and this is the work methods is that you can say the target of our course, we want to improve the way the work is being done.

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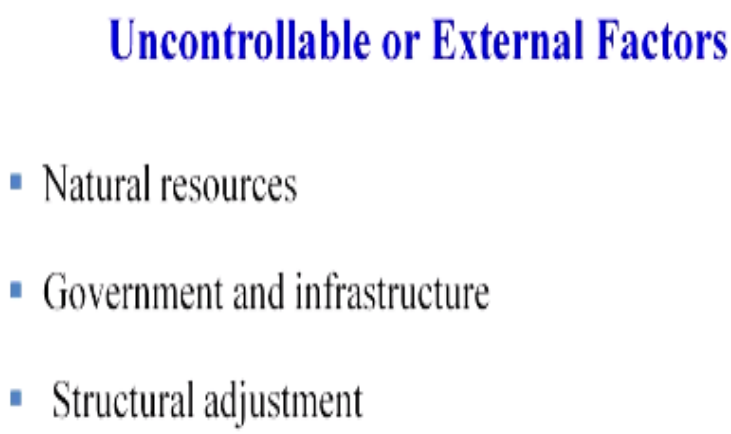

Then, the uncontrollable or external factors quickly we will go through the natural resources, government and infrastructure support available from the government, then the structural adjustment.

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Natural Resources

- Manpower
- Land
- Raw material

Quickly, we will see natural resources are like man power, land and raw material, we see that is the raw material is not available, good quality raw material is not available, productivity cannot be enhanced.

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Government and Infrastructure

- Government policies and programmes
- Practices of government agencies, transport and communication power
- Fiscal policies (interest rates , taxes)

Government and infrastructure, government policies and programs, practices of government agencies, transport and communication which the government has to ensure for any organisation, then the fiscal policies like interest, rates and taxes, so basically all these are beyond the control of the organisation.

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Structural Adjustment

- Economic changes
- Social changes

Now, the last are the structural adjustments like an economic change, sometimes we have economic boom, sometimes we have economic depression, now those are beyond the control of an organisation but organisation must keep itself ready the processes, the procedures and the policies of the organisation within the organisation must be robust to adjust to these type of economic changes.

And then the social changes are also something which is beyond the control of any organisation, so with this, I think we will conclude the today's session, today was the first session of week 2 and we have focused on the various factors that influence the productivity of an organisation, these can be classified into 2; controllable and uncontrollable. Controllable factors are like product, plants and equipment, work methods, the human resource all these are maybe in the controllable factors.

And uncontrollable are government policies, the natural resources and the structural adjustments, so all these are the uncontrollable parameters. In our next session, we will try to understand other finer intricacies of productivity measurement and we will see that how we can try to improve the productivity, what are the causes of low productivity and finally in this week, we will conclude by calculating or using the mathematical tools for calculating different types of problems related to productivity measurement. Thank you.