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

Lecture - 02
Introduction and Concept of Productivity

Namashkar friends. Welcome to session 2 in our course on work system design. As you are well aware in session 1, we have seen that we are going to have a 30-hour long course or 60 sessions of half an hour each on this course on work system design. We have seen that what are the various modules or various chapters or various units that we are going to cover in this course and the first and foremost unit that is most important is the unit on productivity.

We must try to understand the importance of productivity because it is going to give us a quantitative measure of comparing our performance. We would like to see that how we are doing currently and what measures we must take to improve our productivity. There are certain misconceptions about productivity. There are various words which are used as synonyms to productivity.

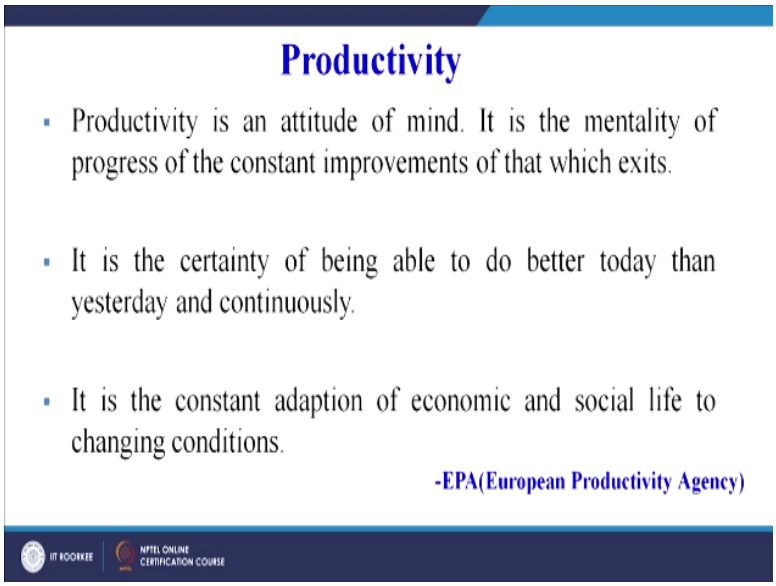
So what is the difference between these 2 words or these 3 words that we must know and we must know that how we can increase the productivity, we must know that what are the reasons for low productivity in an organization, so with this background we will start our discussion on productivity. So today's session is introduction and concept of productivity. We will just try to understand the word productivity that what do we mean by this word productivity.

And then we will see in our subsequent sessions that what are the reasons for low productivity, we will try to understand that how we can improve the productivity and we will also try to do some case studies, numerical problems and try to understand that productivity is an important we can say measure which will indicate or which is a good indicator of the economic well-being of an organization or it gives us an idea about the economic health of an organization or a company.

So we must try to understand the concept of productivity and in today's session we are not going to solve too many problems related to productivity, we are just going to try, we are just

going to understand the concept of productivity and prior to going for the productivity definition we will try to understand that what various authors or various agencies have given for productivity or what definition has been given for productivity.

(Refer Slide Time: 03:10)



Now we can see on your slide the first thing, productivity is an attitude of mind. It is the mentality of progress of the constant improvements of that what exists. So the important point is that what exists so that is what we are trying to understand today on your screen, you can see that productivity is an attitude of mind so maybe what we see that what I am doing today, what is my productivity for the day that is today's day.

Tomorrow I must try to be more productive, so it must be a constant endeavor of an individual to be more productive every passing day. Similarly, for an organization also productivity is very, very important. Each organization must strive to improve, increase its productivity the way they are going to progress in their business domain. So that is an important point that must always be the thirst area, the focus area of every organization.

So that must always be the target of each and every person, each and every individual, each and every unit, each and every department of an organization to always strive for improving the productivity of a system or improving the productivity of an organization. So it is the mentality, it is the way of thinking, it is the thought process of progress always we must strive to do the best of constant improvements of what which exists.

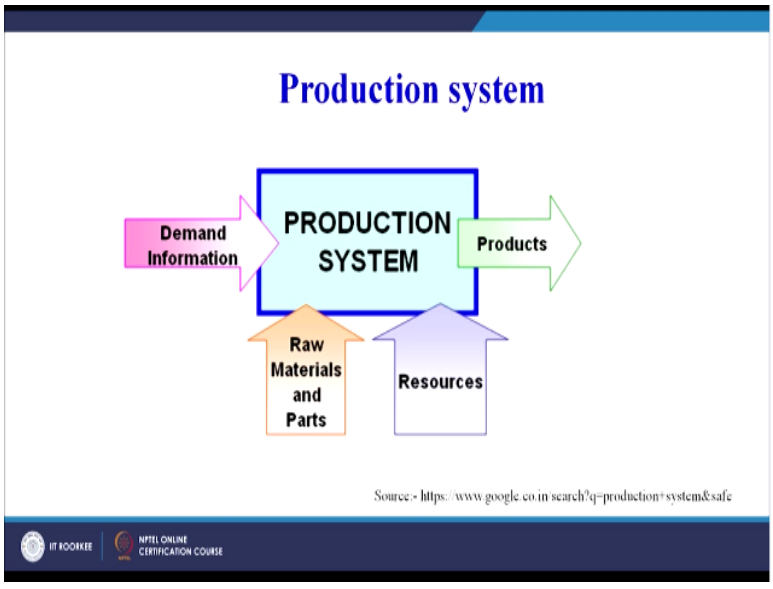
So whatever is the current scenario, whatever is the present status, there must always be a target to improve the condition, improve the situation of what exits today, tomorrow the system must be better, the individuals must be better, the organization must be better and that will lead to the growth of the country also, it will lead to the increase in the per capita income also, it will lead to the increase in the standard of living of the individuals of the country.

So overall if we think that we have to be more productive, we are not only maybe improving ourselves or we are not only going to be much better individuals but the country as a whole will progress. So that is the basic concept with which we must look at the word productivity, so it is not about an individual, it is about a country and if everybody becomes productive; very, very efficient; very, very effective the overall progress of the country will definitely take place.

So we must inculcate this thinking process about being productive in our day-to-day life. So it is the certainty of being able to do better today than yesterday and continuously. So this is what is coming out from the first definition only that we must strive to be better today than yesterday and continuously strive to be better day after day, week after week, month after month and year after year.

It is the constant adaptation of economic and social life to changing conditions, so we need to adapt to the new changes. So this is just we can say philosophical view point of looking at the word productivity.

(Refer Slide Time: 06:43)



Now on your screen you can see that what is a production system. In a production system, there is a demand information and this demand information is taken as an input and then the production system which is the physical system which maybe having different manufacturing processes will convert the raw materials that is the input into the final products. So we have an input in the form of materials, men, machines, equipment, consultants, there are different types of inputs.

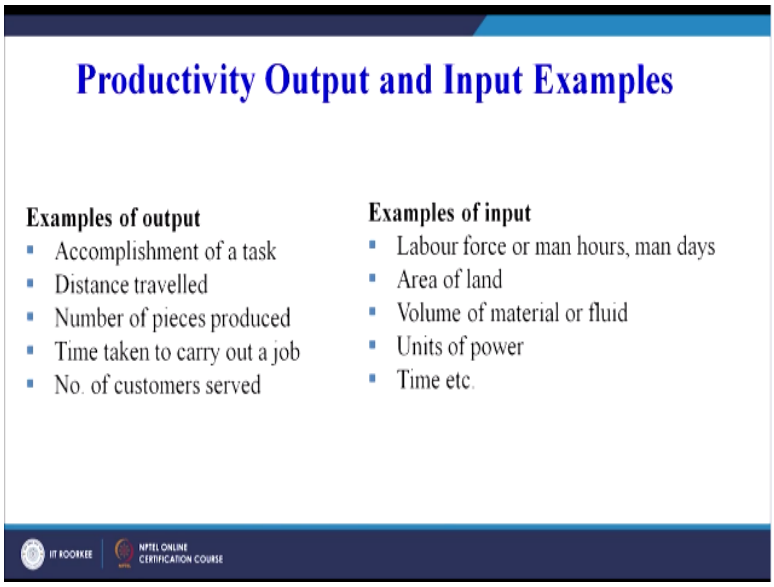
Now the manufacturing system will convert this into a final product. For example, just to explain a wooden chair. So the wooden chair is made up of wood and then there is a carpenter who has worked on that wood to convert it into a product which is a chair which is used by the customers. So the production system has certain inputs. Then, there is a transformation process.

For example, the wood working in case our example where a carpenter works on the wood using various tools and machines and converts it into a chair. So we have the product in case of our example is a chair. Then, we have raw materials, human resources, economic resources, all kinds of resources are the inputs. So this is a basic understanding of any given production system.

Now productivity basically is that we will try to understand it in context of the inputs that we are putting into the system. As you can see here, in a typical production system what are the various inputs going, the demand information is going in, the raw material input is going in, the various parts of assemblies input is going in then the various resources which can be labour, which can be money, which can be infrastructural resources, so different resources are going as a input.

Now what is coming out from the system, the coming out or the output from the system are the products. So we need to understand this in terms of the inputs and the outputs and then we will be able to understand the concept of productivity in a much better manner.

(Refer Slide Time: 09:00)



You can see the productivity output and input examples. So examples of output are accomplishment of a task, suppose I have been given a task to complete maybe to prepare a time table for department of mechanical and industrial engineering, so it is a task given to me. So if I am able to accomplish this task before the start of the semester very easily we can say that this is the output given by Inderdeep Singh.

Similarly, the distance travelled, number of pieces produced maybe in the morning you tell a person who is stitching shirts that you have to stich 50 shirts today and in the evening while going home he counts the number of shirts that he has stitched and it is more than 50, we will say that this is an example of his output for the whole day. This tailor has stitched 50 shirts today, time taken to carry out a job, it can also be an output, number of customers served.

For example, on any fast food center the customer care executive on the board may be if he takes 200 orders in his shift, so we can say 200 is the output or 200 customers served is the output of this individual who was at the front desk. So these are the examples of the outputs, there can be other examples also but just to give you an idea. Now what are the inputs to any system?

Inputs can be labour force or man hours, for example the person was on the front desk for 8 hours, so 8 hours is the input, how many customers he has served in this 8 hours, for example he has served 200 customers in 8 hours, so the output is 200 customers that is the number of customers served and the input is the 8 hours that he has spent on the front desk. Similarly,

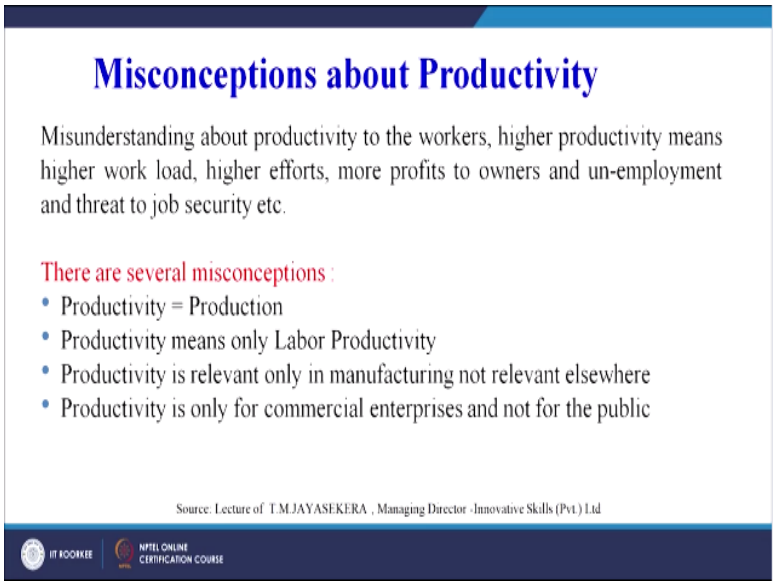
sometimes in case of shopping malls we say that this much of square feet of area is used for display of the various item, so area of land is also sometimes an input.

Then, the volume of material or fluid used, then the units of power maybe in case of an industry suppose we are producing 500 cars in a week, so the kind of input that we are giving in terms of the power which can be specifically the electrical power that we are giving. So we can say that amount of electrical energy used to make these 500 cars is this much, so that is kind of one of the input and the output is the number of cars produced.

Then, the time can also be an input as we have seen in the very first example of input that is labour force or man hours. So these are the 2 you can say important things to understand or the important words to understand because both of these will combine together to give us an idea about productivity. So we have seen that there is a production system, there are inputs to the production system, there are outputs from the production system and the production system converts the inputs into the tangible outputs.

And what can be the examples of outputs and inputs that we have already seen in this slide.

(Refer Slide Time: 12:19)



Now let us take another important point that is the misconceptions about the word productivity that we will try to maybe address in our 2 weeks of discussion on this topic of productivity. So we will try to address all the misconceptions that do exist in the minds of engineers and managers related to the word productivity. Now misunderstanding about

productivity to the workers, higher productivity means higher workload, higher efforts, more profits to owners and unemployment and threat to the job security.

So so many things have been said and each word can be explained in much, much detail but there are misconceptions that if the company says or tells the individuals to be more productive, it means that they will have to work even harder. To some extent that may be true but then the hard work will lead to more productivity and the productivity will lead to more profits for the organization.

And more profits will lead to the sharing of the profits with the workers and the workers automatically will get benefitted. So many times we are able to not understand the right meaning of productivity. Now productivity is that whatever input we are giving. Now for example I have seen many people. We are studying for an examination, most of the learners maybe students only, maybe some of you maybe executives.

So most of the time when we see that we are giving certain input in terms of our time for the preparation of the exam so more or less we see that if I have studied for 4 hours I say that I have studied for 4 hours this much marks I have secured. The other person may have studied for maybe 3 hours but he has also secured equal marks. So that means that the person who has studied who has given 3 hours of input if he has also got the similar marks then we can say that person input is 3 hours, output is same.

So he is more productive and in our case my case I have given 4 hours of input and output is similar to the other person I will say that I am less productive. Many times, I may realize that for these 4 hours when I was preparing for the examination, I may not be serious for half of that time, I may be checking my mobile phone, may be randomly then I may be in between looking at the news that are coming on the television.

So although in calculation I have given 4 hours as my input but in real sense I have not devoted 4 hours for the preparation. So when we tend to improve the productivity we try to understand that when 4 hours of study means 4 hours of study, we are not going to waste any time out of these 4 hours. So then maybe our output or our productivity will be better than the person who has given 3 hours.

Although, this may not be a very good example, the marks that we score depends on n number of other parameters but as this is related to the teaching learning process I have just tried to take this example and try to explain that what is the target when we say that we try to eliminate the non-value added activities in our input. So if we add all non-value added activities also into our input and input is getting converted into output.

So more input less output means we are less productive, less input more output means we are more productive. So misunderstanding about this concept that the higher productivity means higher work load, this is not exactly true. It means that we may work for the same duration only but now we are working with much more efficiency and much more effectiveness and we are trying to reduce the non-value added time that we were unnecessarily spending but that was getting added as an input to our overall productivity calculations.

So we need to do smart efforts and then we will definitely be able to improve our productivity. Now there are several misconceptions, we will try to understand I have highlighted it with red color productivity=production. We will try to address that what is the difference between the 2, productivity means only labour productivity, no we can have a single factor productivity, we can have a multifactor productivity. Now in labor productivity we will have input only in terms of labor.

But in case of multifactor productivity, we can have different types of inputs and the output can be the number of products that we are producing so we will try to understand the single factor and multifactor productivity in due course of time of our sessions. Now productivity is relevant only in manufacturing and is not relevant elsewhere. So this is also a misconception. Productivity is a universal concept.

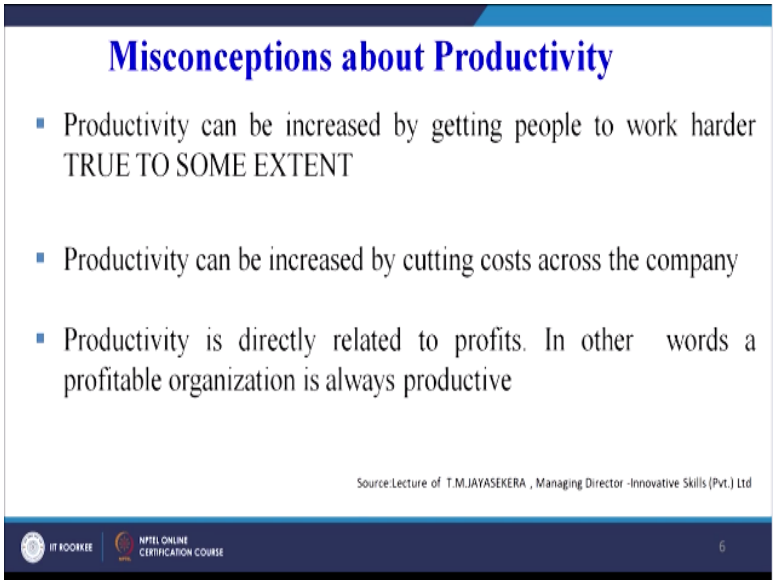
I can even be more productive in utilizing my time maybe if I am in office for eight hours in a day maybe tomorrow I may try to become more productive by trying to utilize my time in a best possible manner. So I am not manufacturing anything or I am not into manufacturing industry but still I can adapt the principles of productivity and/or measure my productivity.

And try to be more productive in the next days as we have seen in the first slide that it has to be a constant endeavor of each and every individual to be more productive in each passing day, each passing week, each passing year, so productivity is only for commercial enterprises

and not for the public, no it is this word is for each and every individual, each and every person of our country, each and every one of us must try to utilize our time in the best possible manner.

So I am talking about the productivity of time but this productivity can be in productivity of resources, whatever resources we have at our disposal we must try to make best use of those resources then it will lead to our development, development of our society as well as development of our country. So this word is not only related to manufacturing, this is related to each one of us, it is related to our society, it is related to our country.

(Refer Slide Time: 19:08)



Now there are other misconceptions, productivity can be increased by getting people to work harder, this may be true to some extent but this is not quite true in the absolute sense as I have already explained in today's discussion. Productivity can be increased by cutting costs across the country.

No, no we cannot because cost is one input that is going but by cutting the cost we may be compromising on the performance, we maybe compromising on the quality of what we are delivering to our customers or the quality of services that we are offering to our customers. So that may even some times lead to the compromise of the profits that we are making, so cost cutting across the country may not lead to I am saying may in many cases it is absolutely true that it will never lead to increase in productivity.

But in one or 2 of cases it may initially for some time lead to. Mathematically, in calculations we can show that if we reduce our input by this much, output remaining same our productivity has increased but in long run may not be a very good option. So productivity is directly related to profits, in other words a profitable organization is always productive. This is also not true in most of the cases.

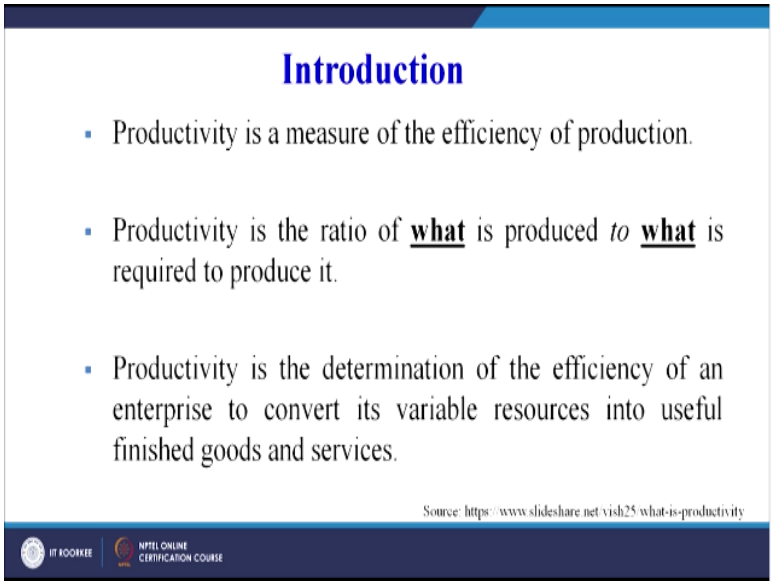
So it is not important that whether you are making profit or not, it is important that how you are converting your inputs into your output. So initially you may be having profit because you have a monopolistic type of product or you have a product which is not being developed any other organization or technology is not available with other companies. So you may be making profit but you may not be productive.

But in many cases we will see that initial profitability may later on lead to the losses also if you do not check the kind of inputs that you are giving to your system and the outputs that you are producing. So productivity is an important concept. So initially we may be profitable but in a long run we may be at loss if we do not focus our attention on this word productivity.

So this is the basic misconceptions about productivity but we will try to address each of these concerns with logical discussion with certain examples and we will try to be a better individual with our knowledge base of productivity at the end of our 2 weeks of discussion on productivity. Now let us see that I think in between I have tried to explain the word productivity.

But now we will systematically try to understand the word productivity. I think by now all learners must have understood that this has something to do between the inputs and the outputs. Now we will try to define the word productivity.

(Refer Slide Time: 22:14)



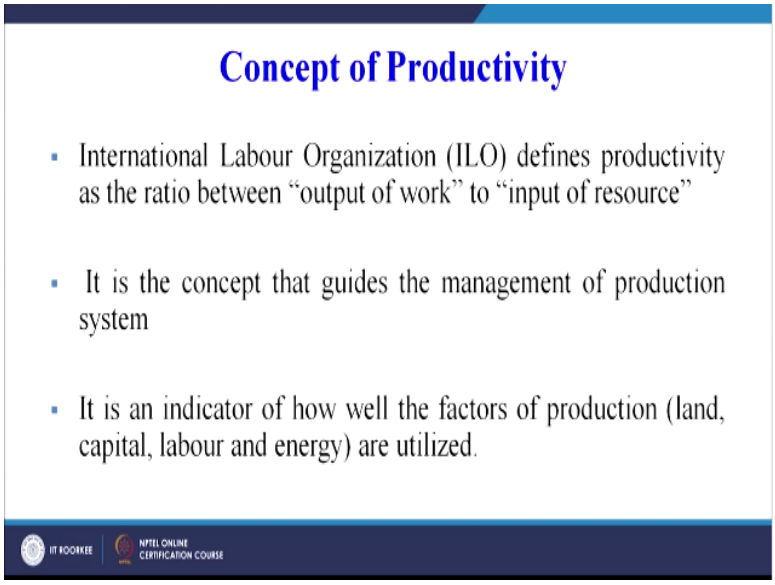
Now productivity is a measure of the efficiency of production. Now maybe if possible time permits I will definitely love to explain the difference that is given in the various books or maybe on different websites regarding the difference between productivity and the word efficiency but here we say productivity is a measure of efficiency of production that means in our production system we are giving some inputs and we are producing some outputs.

So this will give us a ratio of the outputs to the inputs. So productivity is the ratio of what is produced that is what are the products that we are producing, 2 what is required to produce it, so what is require to produce it are the various inputs maybe the raw material, the machines, the equipments, the tools, the money required, all these are the inputs and the output is our final product or the number of products that we are producing.

So productivity is the ratio of what is produced to what is required to produce it. Now productivity is a determination of the efficiency of an enterprise to convert its variable resources into useful finished goods and services. I think it is maybe slight more detailed version of the definition that is given in point 2 in our slide so it is a determination of efficiency of an enterprise.

So productivity will in case may be as I have told indicate the efficiency of an organization that how beautifully, how well, how intelligently an organization is converting its resources into the products. So that is basically going to be given us by this term productivity.

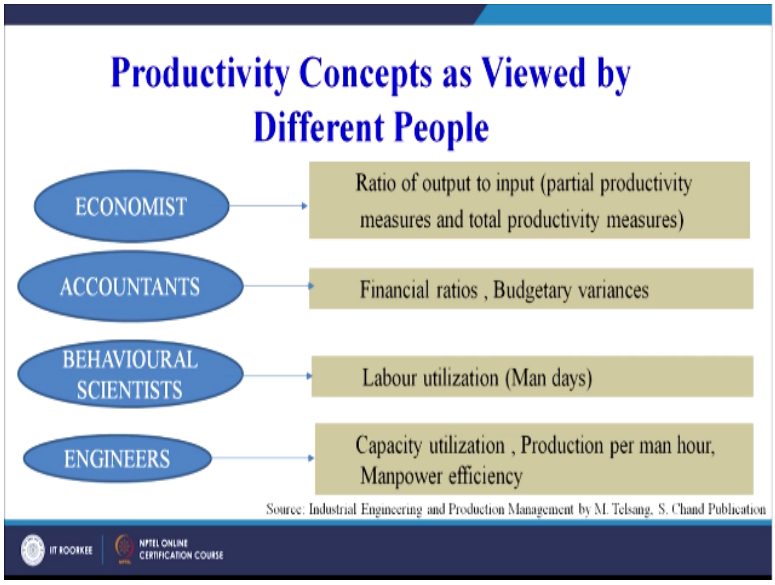
(Refer Slide Time: 24:13)



Now the international labour organization defines the productivity as the ratio between the output of work to the input of resource. So it is basically we can say to summarize output to input or the ratio of the output that we are producing to the input that we are giving to the system. It is the concept that guides the management of production system. It is an indicator of how well the factors of production that is land, capital, labour and energy are utilized to convert the raw materials into the final product.

I think so many different definitions we are trying to understand single line definition but the summary of the matter is that it is the ratio of the output to the input. Now output may be different types as we have seen in the previous slides and the inputs also can be different and in this slide also you can see there are different types of inputs like land, capital, labour and energy are the few examples of the inputs.

(Refer Slide Time: 25:24)

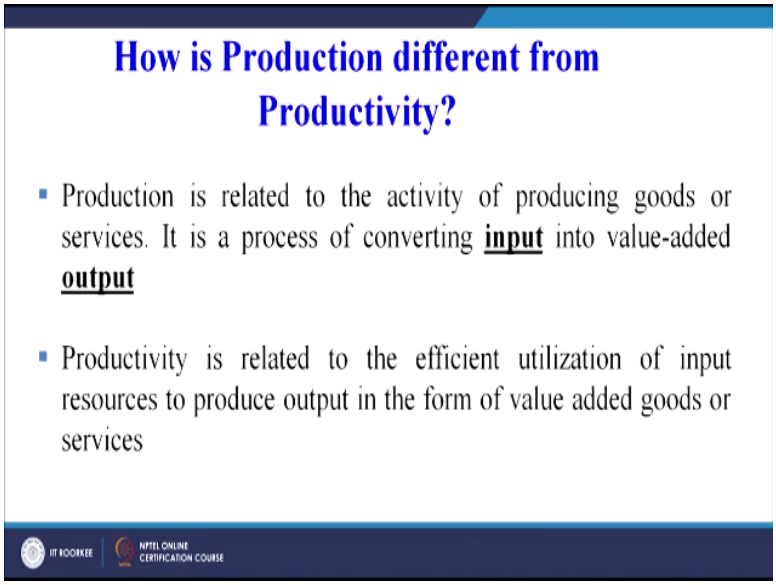


Now different people view productivity in a different manner, so let us see an economist will say that it is the ratio of the output to input partial productivity measures and total productivity measures. So in major cases we will see it is the ratio of output to input for an economist. We will try to see what is the partial productivity measures and total productivity measures in our subsequent session.

For accountants, it can be financial ratios, budgetary variances. For behavioral scientist, it may be labour utilization or man days, for engineers it can be the capacity utilization, production per man hour, manpower efficiency. So production per man hour it can be one parameter for defining the concept of productivity. So we can see the different people will have different ways of looking at this word productivity.

But majorly it will be that how well our inputs are getting converted into our outputs. Now first misconception was the difference between the word production and the productivity. Now production is related to the activity of producing goods or services.

(Refer Slide Time: 26:35)



It is a process of converting input into value-added output. For example, you can say maybe many of the listeners or the learners of this course may not be engineers so what we can say if we are cooking or suppose we are preparing tea, so preparation of tea what we are doing we are putting all the ingredients for example milk or water and then we add tea leaves and then sugar.

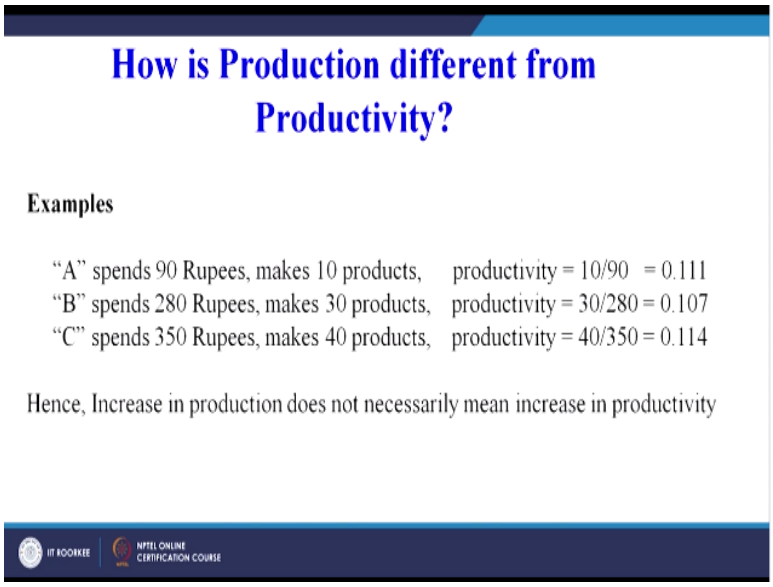
So then we cook it or may be boil it and then we drink it, so that is the process of production. So word we are using the inputs and converting it into the tea so that is the case of production but now when we talk of productivity, in case of productivity we will see that how much quantity of milk we have put in the tea, how much water we have put in the tea, how much tea leaves, how much sugar and then we will see how many cups of tea we have been able to produce.

So when we have quantified each and every input and maybe quantified it in terms of money and then we see the output of number of cups that we are producing also in terms of money then we will say that this much input we have produced, this much output and then the ratio will give us the productivity. So productivity is related to the efficient utilization of input resources to produce output in the form of value-added goods or services.

So I think the example of tea, the process of making the tea will be production but how well the inputs have been converted into the outputs will be giving us the measure of productivity. So this is just we are trying to address misconception that there is difference between the

word production and the word productivity. Now how is production different from productivity?

(Refer Slide Time: 28:32)



May be this may be my last slide for the day, so the examples are A spends 90 rupees and makes 10 products, now what is the input here? The input is the money that the person is spending, 90 rupees spent that is input 10 products made that is the output. Now productivity is 10/90, so 10 products is the output so output/input that is 90, so we get 0.111 as productivity.

B spends 280 rupees and makes 30 products, so here the production has increased. If you see initially we were producing 10 products, now we are producing 30 products but what is the input, input is 280 rupees so the output is 30, input is 280, so we get productivity of 0.107. Similarly, a person see, spends 350 rupees and makes 40 products so the production is still further improving from 10 to 30 then to 40 so what is the productivity, 40 is our output and 350 is our input.

So the productivity is 0.114. So from this slide we can see the production is increasing, the production was earlier 10 products, then it increased to 30 products and then it increased to 40 products. So the production has improved continuously but the productivity has not increased. So we can say that the increase in production may not always lead to increase in productivity.

So it may sometimes lead to decrease in productivity also because it is taking into account the inputs that are being used for converting into the products. So hence increasing the production does not necessarily mean that there is going to be an increase in productivity. So we must be very, very careful when we use the word this production and productivity. Many cases, many organizations I have seen, people will focus on production.

That we must increase our production, we must focus on the areas which are non-value added and we must try to improve the production capacity of our organization but that will not lead to increase in the productivity of the organization until and unless we address the inputs that are being used for converting the material into the final product.

So we must focus on the production but the increase in the numbers, increase in the quantity of things produced or the products produced does not unilaterally will give us an idea about the economic health of an organization. If we say that company is producing more number of products, we cannot say that it is a very, very efficient and productive organization until and unless we try to relate it with the inputs.

If we modify our statement and we say that this much input the company is giving this much output, then we can say that with similar input no other company is able to produce that much output. Then, we can say yes this company is very, very productive because with minimum input they are giving the maximum output. So I think in today's session, we have been able to understand the basic concept of the word productivity.

Also we have understood the difference between the words production and the productivity and try to understand that increased production or the volume of production or the number of products produced does not necessarily means increase in productivity. Thank you.