Quality Design and Control
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Lecture – 10
Management of Quality- I (Contd.)

So in this the next lecture sessions on Management of Quality.

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I am going to discuss 3 important issues or aspects, which have a direct bearing on quality management as well as you know the quality of performance and quality of conformance. So, these 3 issues are 4 absolutes of quality management. So, we must know as a student as a learner, what are these 4 absolutes; that means, if you know about this absolutes you will come to know that what are the necessary conditions you have to create for quality management.

Second important issue we are going to discuss that is the quality trilogy process is it is a term coined by quality Guru, Joseph, Juran and there are you know the 3 phases in the quality improvement process and he calls it quality trilogy process. So, you should be aware of. So, this particular process and the last 1 we are going to discuss that is quality improvement principles. So, improvement is ultimate goal and there are specific principles you have to adapt you have to use for quality improvement.

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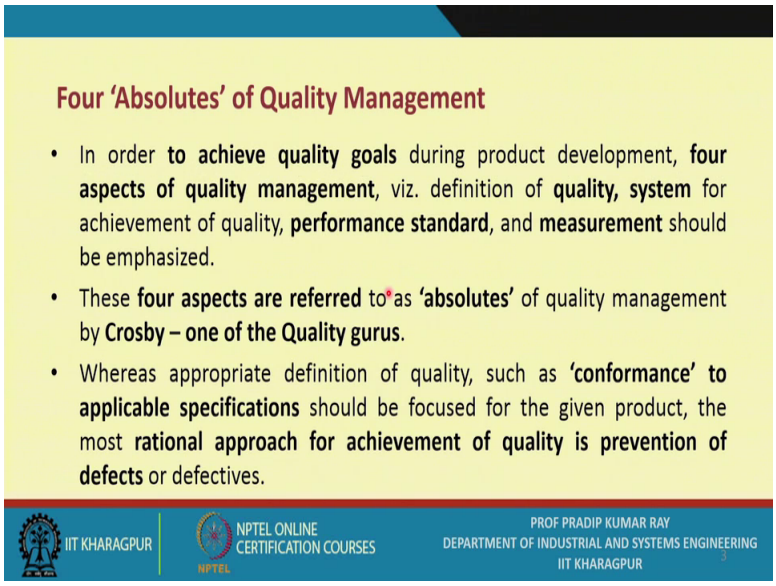

Now, let us talk about 4 absolutes of quality management; that means, these are the necessary conditions. So, in order to achieve quality goals we already aware of during product development so if you recollect you know when we discussed the product development process, whether in a you know serial engineering mode or concurrent engineering mode there are the quality related or quality related you know objectives and those are basically the part of quality dimensions you should be aware of during the product development even at the prototyping stages we should be aware of.

Now, if you look at those aspects 4 issues of quality management or 4 aspects of quality management are very very important and these 4 aspects are definition of quality which particular definition you believe in system for achievement of quality. So, that you should highlight the third 1 is the what kind of performance standards you should adopt and; that means, what is your quality goal and the measurement should be emphasizing and how do you measure quality that is very very important.

So, these are 4 the issues and they are referred to as absolute sub quality management by Crosby 1 of the quality gurus Philip Crosby across whereas, the appropriate definition of quality such as conformance to applicable specifications or the standards should be focused for the given product the most rational approach where achievement of quality is prevention of defects or defectives.

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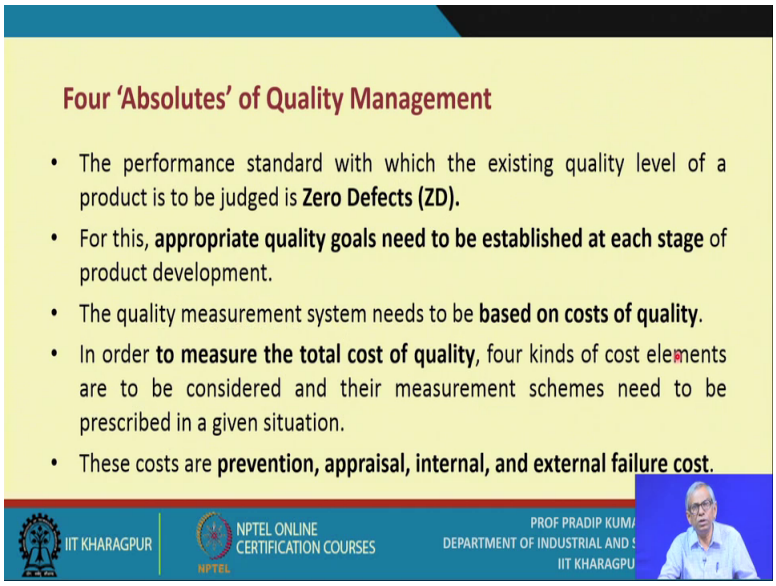

That means what we have been emphasizing all the time that instead of having a detection based quality control, why do not you adapt a prevention based quality control.

So, the performance standards with which the existing quality level of a product is to be judge is 0 defects, as I have already mentioned that that what is this the details of the 0 defects programs. So, your the goal is the 0 defects; that means, you will not allow any defects or the defects to occur in your system. So, for this appropriate quality goals needs to be established at each stage of the product development; that means, during the product design during process design and during manufacturing.

So, the quality measurement system needs to be based on cost of quality there is a concept called cost of quality; that means, in order to achieve quality in simple and plain terms it means in order to achieve quality for at a certain level, how much so the cost you are going to incur whether you are aware of these costs and whether you can measure this cost. So, that is the key issue and whenever; that means, there must be you know separate assessment for costs of quality. In order to measure the total cost of quality 4 kinds of cost elements are to be considered and you first consider this 4 types and then you have to you know the propose a measurement scheme for each one.

So, what are these 4 you know the cost elements first 1 is the prevention cost, the second is the appraisal cost, the third 1 is the internal failure cost and the fourth 1 is the external failure cost. So, I repeat prevention cost, appraisal cost, internal failure cost and external

failure cost. So, if you add all this 4 cost and you will get the total cost of quality at a given point in time.

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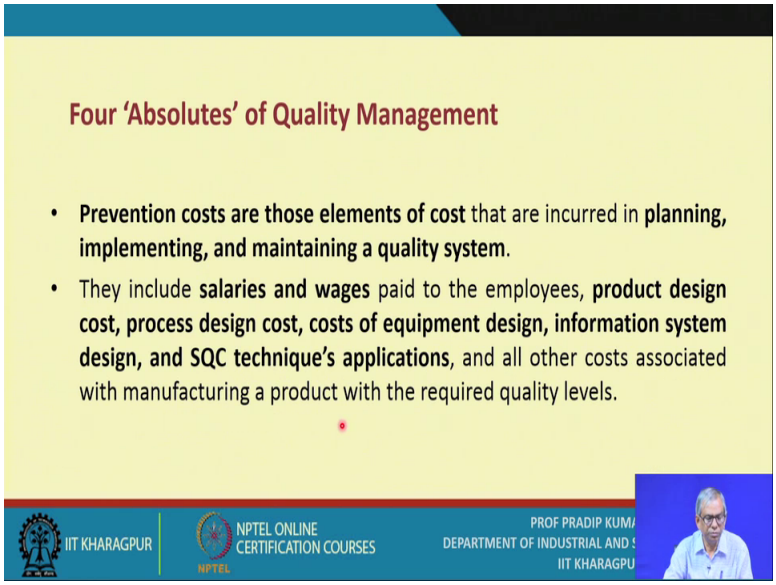

Now, what is this prevention cost now these prevention costs are those elements of costs that are incurred in planning implementing and maintaining a quality systems; obviously, anywhere you go any production system you visit there has to be a quality management systems and this quality management systems has already been implemented and for implementing this quality management systems or the quality control systems you have incurred certain costs. So, this is basically referred to as the prevention cost why it is prevention cost, because whenever you establish such a systems your basic objective is to how to prevent the occurrence of defects and defectives from the system.

So, what are this you know the cost elements what are the individual cost elements under prevention cost salaries and wages right to the employees product design cost, process design cost, cost of equipment design, information system design and whatever the exclusive techniques statistical quality control techniques you have been applying for running the quality systems in your production and all other cost associated with manufacturing a product with the required quality levels.

So, you should be you know aware of all these cost elements at a particular point in time and you also should be aware of what are the most relevant or most significant cost elements.

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What is this appraisal cost? appraisal cost are those cost elements that are associated with measuring evaluating and assessing products, components, raw materials and quality control systems in an organization to determine the degree of conformance to the specified standards; that means, even if you have you know the prevention system, but still you know you need day to day or unit to unit monitoring of the systems.

So, for monitoring and controlling the systems on day to day basis or moment to moment basis; obviously, you are incurring certain costs. So, essentially the approach will cost referred to the activities carried out for maintaining the systems for monitoring and controlling the system.

Different types of inspection costs and cost of calibrating and maintaining measuring instruments and equipment are included in this cost category. So, this is very very vital these costs are basically associated with managing the outcome of a manufacturing systems; that means, what is your actual performance is it you must know and for that you must have a system for monitoring and controlling the systems, so that at any given point in time during a period of time, you will be able to assess the performance.

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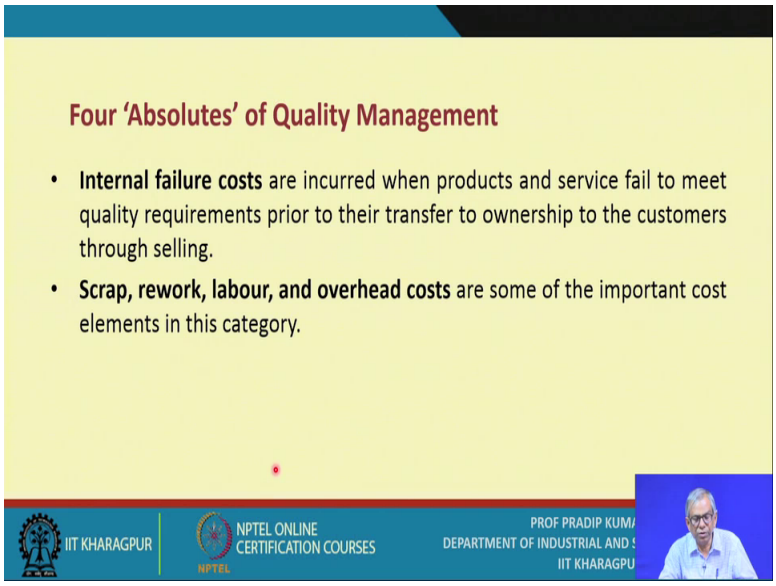

So, this way you look at your quality management systems, what are the internal failure costs? Now these costs are incurred when products and service fail to meet quality requirements prior to their transfer to owner ship to the customers through selling. Now it just cannot be in a majority of the cases you will find; obviously, it is there is a probability; however, small the probability is that you will be making mistakes. During your you know when you carry out several during the activities you carry out during the production systems.

So, during production so; obviously, you know you must be aware of such cost elements referred to as a internal failure cost; that means, within the manufacturing systems such failures may occur. So, examples are basically the scrap rework Labour and overhead costs are some with a some and these are referred to as the important cost elements in this category internal failure cost now what are the external failure costs.

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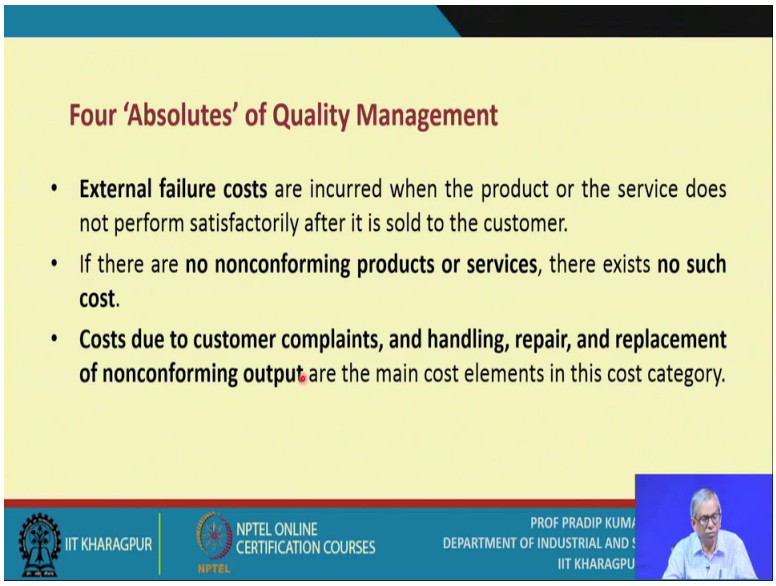

Now, these costs are incurred when the product or the service does not perform satisfactorily after it is sold to the customer; that means, it is in the domain of quality of performance.

If there are no nonconforming products or services there exist no such cost that is the point to be noted is it and cost due to customer compliance and handling repair and replacement of non-conforming output are the main cost elements in these cost category, particular you know when we deal with a industrial products. So, you should be you know aware of the external failure costs.

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And in many cases if you do not control these external failure costs; obviously, you know if you do not have any mechanisms to control the external failure cost your quality of performance will be extremely poor.

Now, the next important aspect of the quality in management I am going to discuss that is the quality trilogy process, you know whenever you produce a new product now this is there is a process there is a process of creating a new product and these process is referred to as a iterative process is it and while you create such a process you believe that the quality levels of the product are subject to changes or modifications over time is it. So, nothing is static; that means, to the set of you know or say the level of quality must change tomorrow and it is constantly changing and 1 reason is that the design of a new product can never become matured, there is constantly you know the design the new kinds of designs are constantly evolving as a technology changes.

So, obviously, the change is these changes may be dependent on changes in process design and manufacturing. So, what a so in this context the quality improvement process assumes importance because of it is impact on product development. So, as per Juran 1 of the quality gurus these quality improvement process consist of 3 interacting phases there are 3 phases I have already mentioned.

So, that is why it is called the quality trilogy process first 1 is the quality planning then you go for quality control against a given specifications or the standards and then when

you can achieve this standards you think of improving the quality level further and so you are entering into the third phase that is called the quality improvement phase. So, your 3 phase is quality planning, quality control and quality improvement.

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Now, let us talk about the other aspects of this Quality Trilogy.

Now, this quality trilogy process starts with the quality planning at various levels of an organization each of which has a distinct goal. So, upper management level planning is term strategic quality management this is the another term we frequently come across we use; that means, whatever the quality related activities at the upper the upper management is supposed to do these are referred to as the strategic quality management is coming under the planning is planning activities, for quality at the upper management level at a termed as strategic quality management. What quality goals are established at this level and a structure approach is selected in which management chooses a plan of action and allocates resources to achieve the goal.

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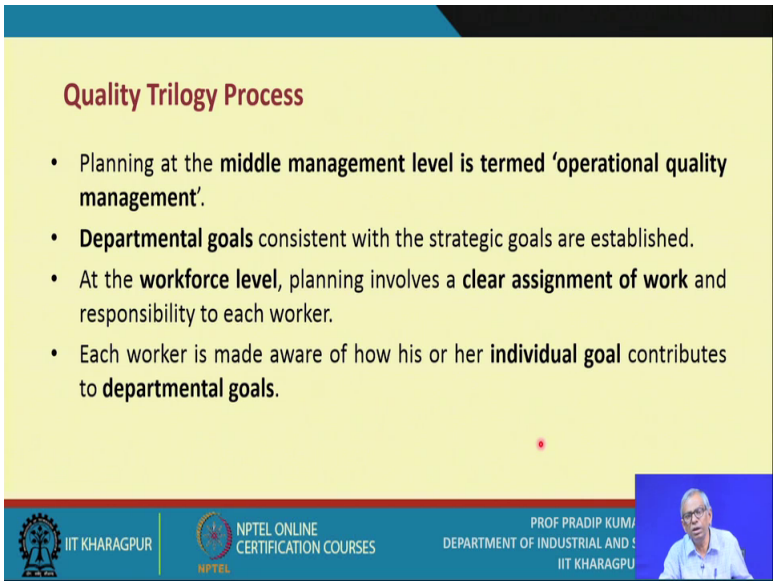

So, this is essentially you know certain strategic actions you have to take planning at the middle management level is termed operational quality management and departmental goals consistent with the strategic goals are established. So, you must set the company goal and then the department wise you have to set your goals related to quality and then you go to the operations level at the workforce level planning involves clear assignment of work and responsibility to each worker each worker is made aware of how his or her individual goal contributes to departmental goals.

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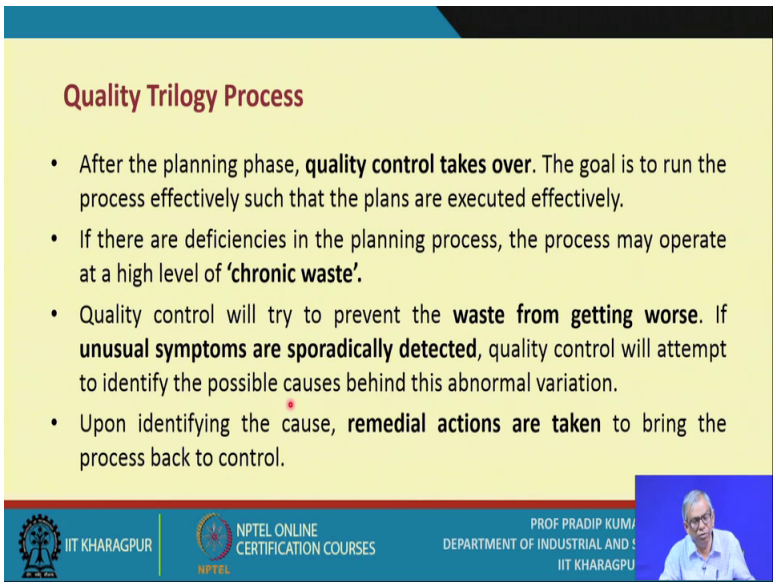

Now, at this point I want to just mention 1 point that whenever you deal with the quality aspects you need to use several kinds of tools and techniques and approaches and so; obviously, we have certain tools and techniques which we use as the strategic level, at the middle management level, we use another set of you know the quality related tools and techniques and absolutely when you go to the shop floor level easy to (Refer Time: 15:55) at the work level or workforce level you need to use some other you know kinds of tools and techniques exclusively designed for dealing with the shop floor related problems on quality.

So, at the planning phase quality control after the planning phase the quality control takes over. So, the planning is very very important once the quality planning is over now you go for quality control. So, here the goal is to run the process effectively such the plans are executed effectively this is well known. So, if there are deficiencies in the planning process the process may operate at a high level of chronic waste; that means, suppose you find that the materials quality is not of good quality and you find that you cannot change the that the materials called whatever may be the reasons.

So, it may be treated as the chronic waste, quality control will try to prevent the waste from getting worse if usual symptoms are sporadically detected quality control will attempt to identify the possible causes behind these abnormal variation; that means, there could be some abnormal certain variation you have to allow and this is the part of the system, but if you find the abnormal variation; that means, there are some specific causes those are referred to as the assignable causes.

So, your control systems should be such that you are able to identify it is assignable cause, upon identifying this cause remedial actions are taken to bring the process back to control.

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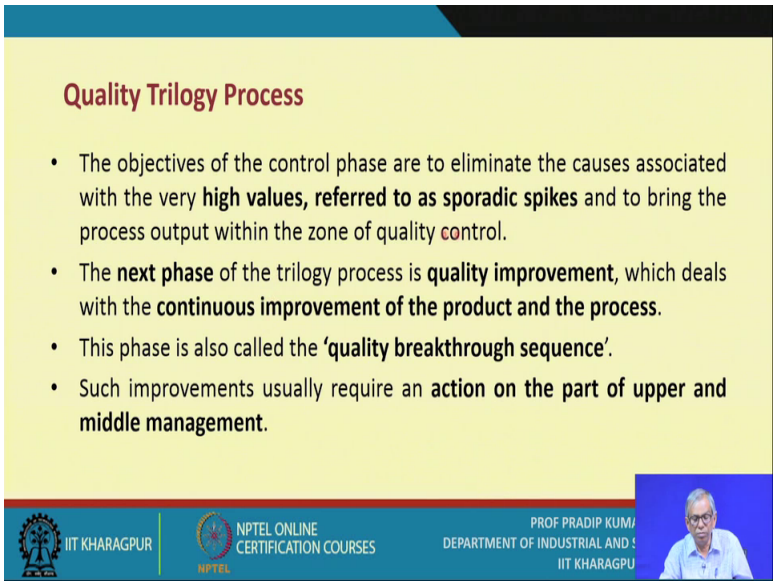

So, this you know abnormal variations sometimes they refer to as or they are shown as the sporadic spikes and so you have to be of all this 1 as the process a process is continuing and a process is running. So, you may have several occasions where you get abnormal variations.

So, as soon as you get the abnormal variation you have to take a you know the control measures. So, that the causes are causes are known and causes are eliminated and the process is brought back to say control. So, now, once you can achieve this the a control systems consistently, next stage you go for improving the quality level. So, the next phase of the trilogy process is quality improvement which deals with the continuous improvement of the product and the process this phase is also called the quality break, through sequence such improvements usually require an action on the part of the upper and middle management.

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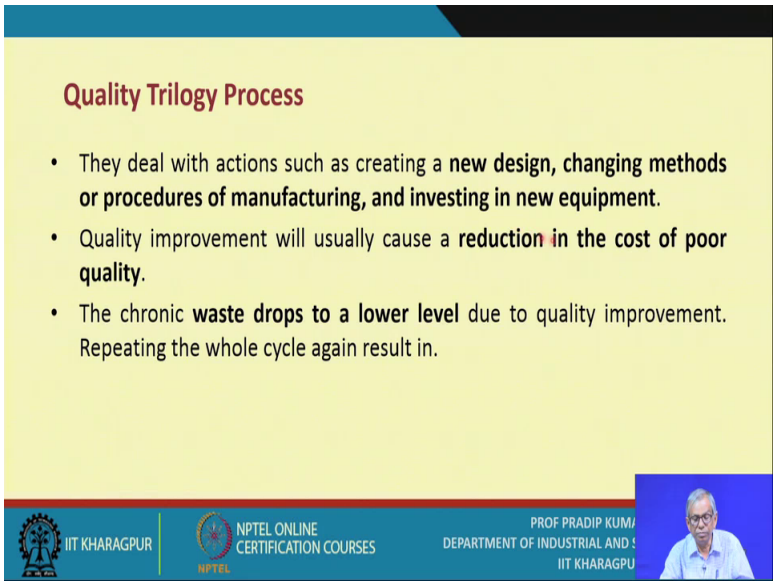

So, you what you need to do you go for new design changing methods or procedures of manufacturing and investment in new equipment. So, the several ways you can adapt this philosophy the quality improvement philosophy and if you go for quality improvement also; obviously, it will have a bearing on the cost of over quality. So, it is expected that through quality improvement effort a condition in which the reduction in the cost of poor quality is reached, the chronic waste drops to a lower level due to quality improvement repeating the whole cycle again result in ok.

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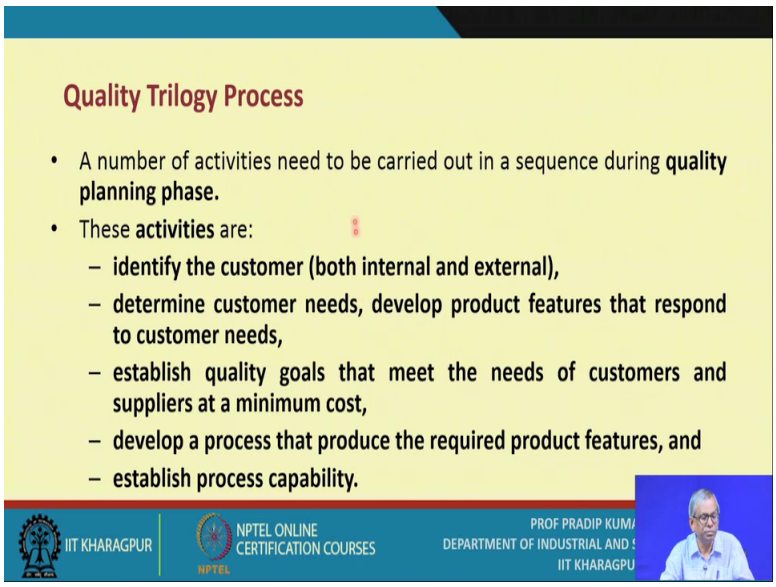

So, a number of activities need to be carried out in sequence during quality planning phase. So, these are the important activities identifying the customer needs establishing quality goals, develop a process then establish process capabilities this point we will discuss later on the process capability; process capability is actually ability to produce as for the specifications ability of a process to produce as for the specifications this is an important aspect in the quality systems and we should constantly monitor this one.

So, you must establish the system in the planning phase with which you can develop the process capability systems and you can measure the quality of the process capability during the production or the during the running phase of the production systems.

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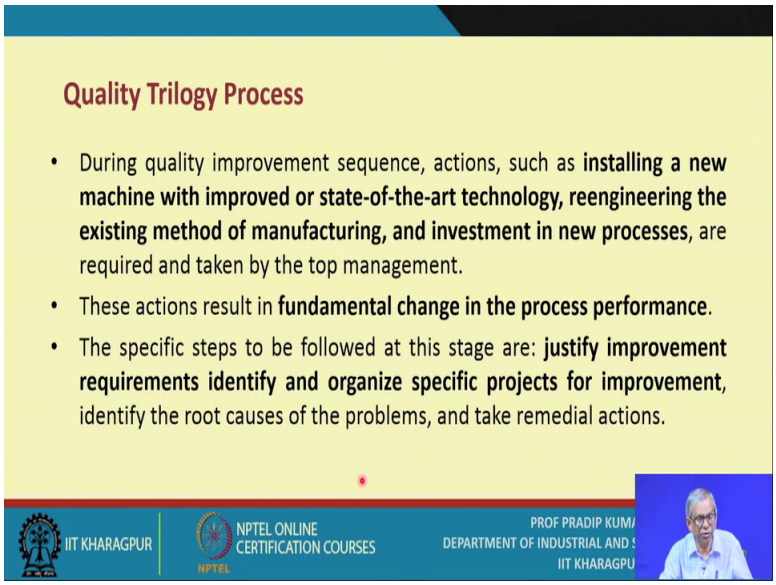

So, installing a new machine which improves a state of that technology reengineering these distinct method of manufacturing and investment a new processes these are the responsibilities. In fact, in many a time what you will find that the quality improvement effort leads to essentially a quality improvement project so in case so you need you know the investment in new processes in a new technologies.

And also and with this what you what you call for you call for fundamental change in the process performance; that means, a drastic or say radical change in the in the in the performance of the quality in the in the quality performance or in the performance of the system is possible only through adapting quality improvement say actions. The specific steps to be followed at this stage are justify improvement requirements identify and

organize specific projects for improvement this point I have already mentioned, that means for such cases for quality improvement; that means, a new projects are to be taken up.

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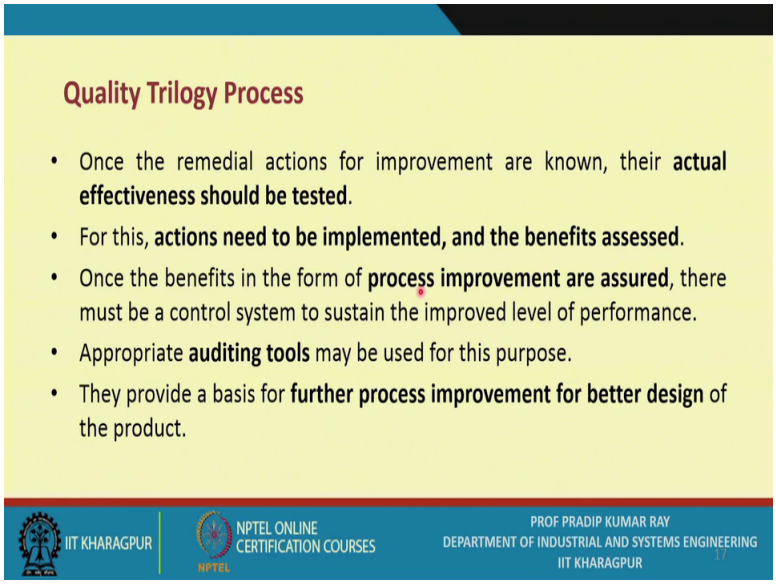

Once the remedial actions for improvement are known their actual effectiveness will be tested actions needs to be implemented and the benefits assessed once the benefits in the form of process improvement are assured there must be a control system to sustain the improved level of performance is it. So, first what you do you go for quality planning? So, as per the plan you establish your quality systems and you check whether you can you can maintain that quality system or not as per the given standards 1 once you achieve this condition consistently, then you go 1 step further you go for quality improvement; that means, the standards you must change and the how to adapt the new standards or the improved standard. So, that is basically a part of the quality effort

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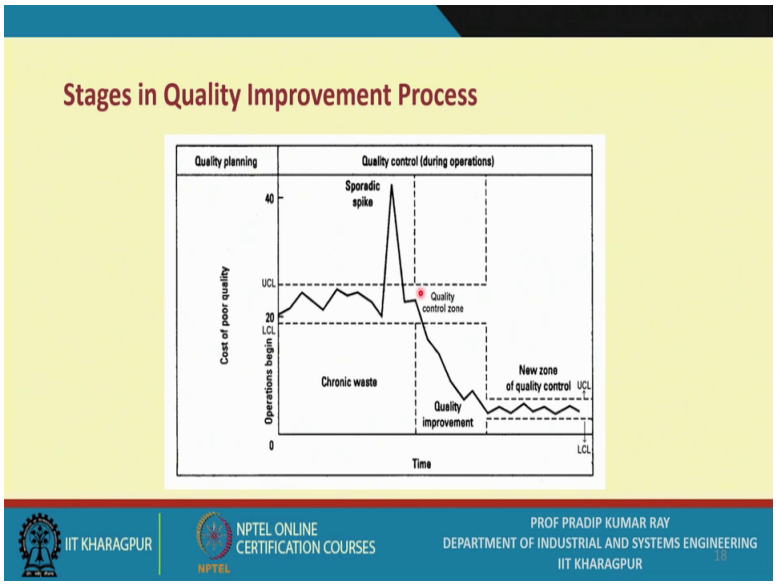

So, further so continuous improvement is our goal and so this quality improvement process believes in the philosophy of continuous improvement. So, we always say that even if the quality is best also can be bettered. So, you have this the pictorial representations of the quality trilogy process, you have cost of poor quality at the quality planning then you go for quality control during operation that is this phase is it. So, this is the chronic waste on which you do not have any control and this is the sporadic spike; that means, abnormal variation you get and then what you do you go for quality improvement project and with this variations the level was around this at this level around 20 and now with the quality improvement effort what you do you reduce it from the basic level the average, you know the changes from say around say 25 to say 5 is it ok.

So, may be from 20 to it reduce to 5. So, the new zone of quality control; that means, what we say that this was your the level and this is the variability at the initial stage, with the quality improvement effort what you do; that means, the level comes down and as well as the variation across that change the new level also is reduced is it.

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So, this is your goal now what are the principles of quality improvement now I want to highlight related to quality improvement a few or a set of principles which you need to adapt or you need to follow.

So, what are these principles? So, let me highlight certain points like since the time application of quality control an improvement tools and techniques in the organization started formally in the beginning of the twentieth century this point already we have highlighted. The concepts of quality control have evolved in to a comprehensive one; that means, it has become a total system now it is almost a hundred year old concept it started in 1920s.

And so this quality control focuses on a few important aspects that have become highly relevant in product development in recent times is it. So, what are these aspects improvement in quality or performance in products and processes? So, you should look into both; that means, the quality of the product and the quality of the process and what we have achieved; that means, improvement in quality and if this quality is equated with the performance, the main dimension of quality, systematic implementation of a new design of a product, through continuously controlling process quality.

So, this is also possible as I have mentioned that the product quality is very much dependent on the process quality. So, if you want to implement a new design for a product you have neither alternative, but to improve the process quality is it ok.

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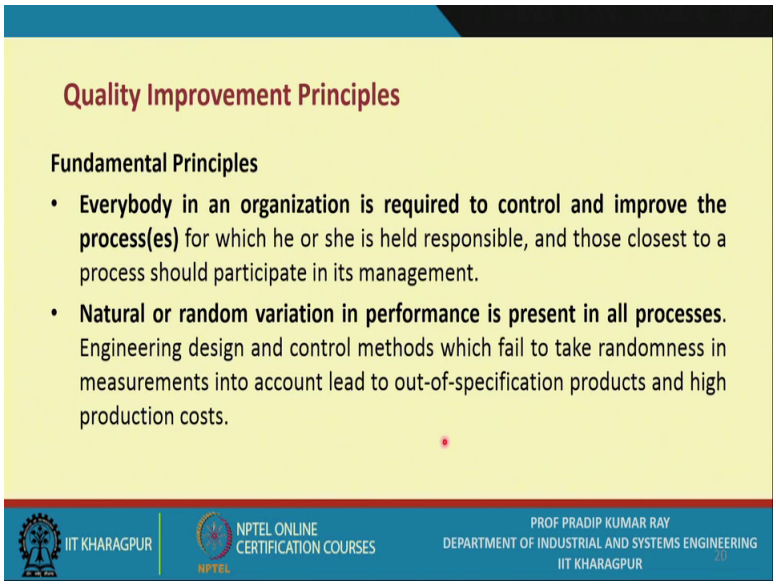

So, that is the point you understood. So, what are the fundamental principles there are certain fundamental principles number 1, everybody in an organization is required to control and improve the processes. For which he or she is held responsible and those closest to a process should participate in it is management this is very very important whether you are directly or indirectly related to the main process or not ok.

So, you are supposed to carry out certain activities while you carry out these activities production or nonproduction direct or indirect you must look into the quality aspects of this of these activities which you are required to perform. Natural or random variation in performance is present in all processes; that means, there will be always variations even if you install the most sophisticated, you know the process at your shop floor you will find that you just cannot get the same values all the time it is just not possible is it or like say you can you just produce identical units of the same product you cannot ok.

So, this is natural or random variation is a must and say engineering design and control methods which fail to take randomness in measurements into account lead to out of specification products and high production cost. So, this is obvious.

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Now, all organization the next important principle is all organization must give top priority to fulfillment of customer requirements and in today's market customers demand highly reliable and low cost quality products as I have already mentioned that the quality should a improve or increase continuously, if not continuously at least continually. Whereas, the cost to produce that quality should continually reduce or decrease over the time period with respect to the same quality characteristics with respect to the same part with respect to the same product ok.

So, this is a really a challenging assignment and use of the state of the art hard technology may not result in increased market share for the product. So, this is to be looked into; that means, whenever you produce the quality the quality at what cost; that means, at what price that is very very important before a new one quality product is sold to the customers that is the next principle experimentation of product performance under different conditions is a must.

And usually you know well known companies and the dealing with you know world renowned the products is it established products very very you know the good quality products they have been except for products they are designing they are producing with excellent quality, what they do actually you know during the prototypes stage prototyping. So, they carry out lot of experiments they take long time in the getting a perfect or acceptable product design.

So, all sorts of you know the experimentations you have to do under varied conditions and then you say that out of the results you get though experimentation what is the best possible the product design. So, experimental design is the valid and most sought after tool in the process of product development.

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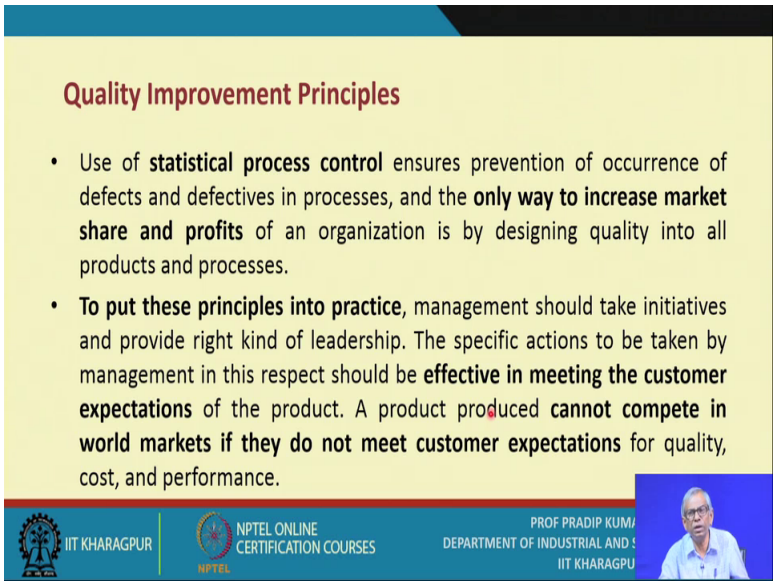

In fact, in many cases when you opt for you know the quality improvement experimental design you have to adapt otherwise you cannot go for quality improvement in the products.

Use of statistical process control that you have to do ensures prevention of occurrences of defects and defectives in their process and the only way to increase market share and profits of an organization by designing quality into all products and processes; that means, again we are emphasizing on the importance of quality engineering practices to prove these principles into practice management should take initiatives and provide right kind of leadership the specific actions to be taken by management in this respect should be effective in meeting the customers' expectations of the product a product, produced cannot compete in world markets if they do not meet customer expectations for quality cost and performance.

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So, the main actions required management must reevaluate the way in which the design products and processes this is very very important that is why radically new and innovative ways of designing and developing the products becomes the hallmark of any progressive management. So, this is point number 1 processes must be standardized measured and evaluated this is 1 third 1 is the statically designed experiments need to be used.

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This point I have already mentioned and every employee in an organization should be thoroughly trained to be able to work in a group for this they should be skilled enough to form team these approach, ensures a vibration vibrant and effective quality improvement program that is focused on designing quality performance into products and processes.

So, these are the 4 actions steps these 4 action steps are essential for.

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Designing quality for maintaining quality.

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And for improving quality.

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So, I think that most of the important principles related to quality improvement we have highlighted. So, they are certain principles related to implementation like the improvement effort should be directed to existing process that is the first, second one is the characteristics of the process and the products that are required to be measured and monitored, should be identified and cost possible causes of process variability should be known and listed.

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This is an important exercise later on when we will take up you know the actual you know the quality improvement exercises or the problems we will highlight this part. And so any you know the problems we deal with related to quality control ultimately, you know we must know what are the possible cause of process variability and a comprehensive plan to implement changes in the process based on the results of experiments conducted should be prepared.

So, the implementation plan is a very important step. So, like say there could certain suggestions for quality improvement, how to implement them over a specific, within a time frame that should be considered.

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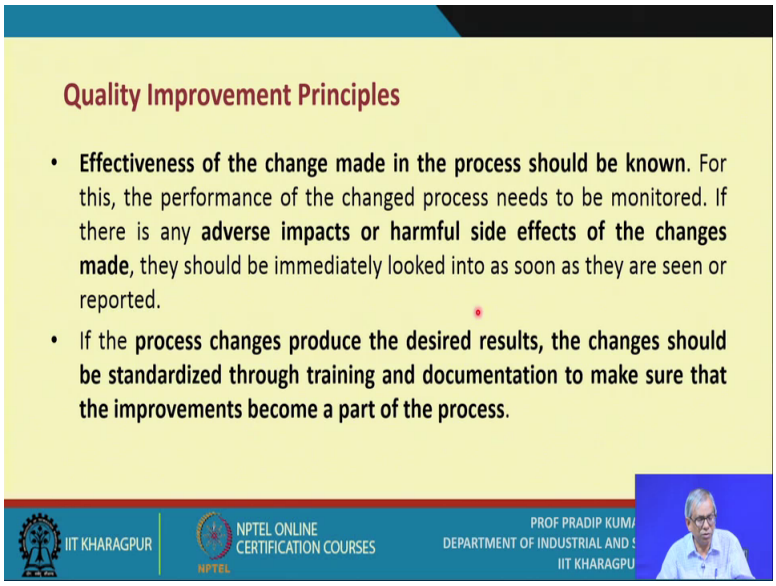

So, effectiveness of the change made in the process should be known. So, this way you know the we carry out the several sorts of you know the exercises and we have to collect data and the data to be properly to be analyzed and if the process changes produce the desired results the changes should be standardized through training and documentation to make sure that the improvements become a part of the process.

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So, this is the management responsibility and the process performance needs to be reviewed at periodic intervals. So, this you cannot avoid. So, in order to check whether

you have a you are you are creating a system which will be sustainable in the long term. So, the constant the monitoring and control is a must.

So, we have covered almost all the important principles related to management of quality and more specifically we have highlighted those principles, which are relevant during the product development process; that means, during the product design during process design and during manufacturing.