Software Project Management

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Lecture - 51
Software Quality Management

Welcome to this lecture. In the last lecture, we had discussed about risk management and then we had started discussing about Software Quality Management. We had discussed about some very basic concepts about software quality. For example, we discussed what is a quality software. And we said that fitness of purpose is a good definition of quality for traditional products, but for software products the fitness of purpose is defined as the satisfaction of the requirements document.

But then, this is only a basic requirement for a quality product, one of the attributes of a quality software, but a software product is said to be a quality one, when it has several other desirable attributes in addition to the correctness or fitness of purpose. And we had discussed about the various attributes, quality attributes and we said that there are several quality models which define that what are the quality attributes and how to measure them given a software product.

After that we had just started discussing about the evolution of the quality systems over the years. Let us proceed from that point. We will continue with the evolution of software quality.

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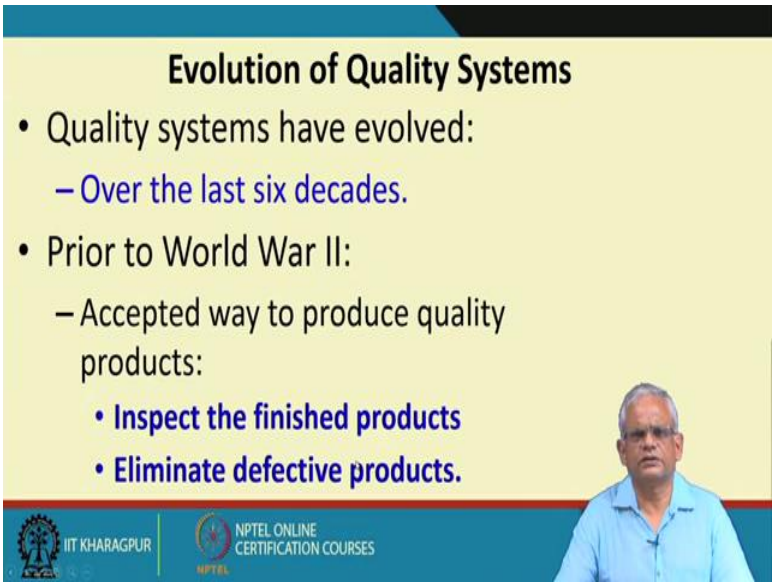

We had seen in the last lecture that before World War II. The only way quality products were produced is by testing, to test a product rigorously, identify all the bad products and eliminate the defective ones. This was the only way that quality was used in manufacturing.

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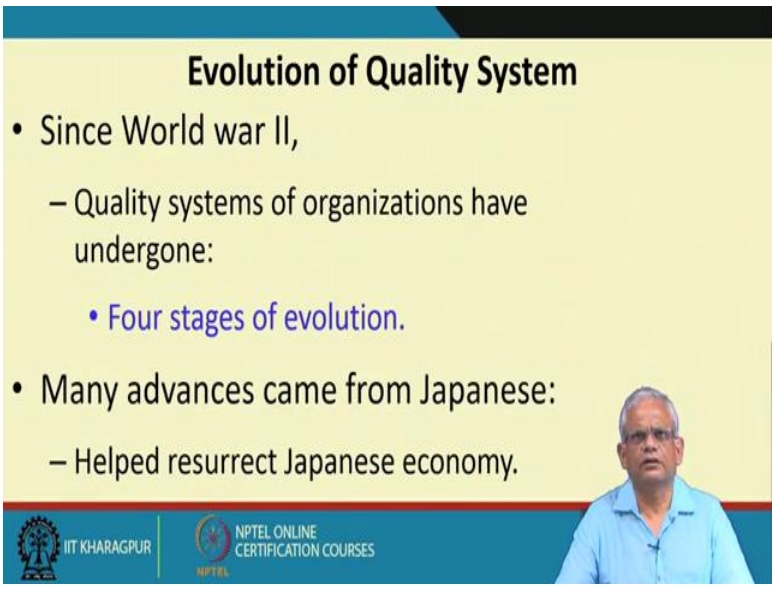

But since then, the quality systems have rapidly evolved and there are four stages of evolution and many advances originated by the Japanese.

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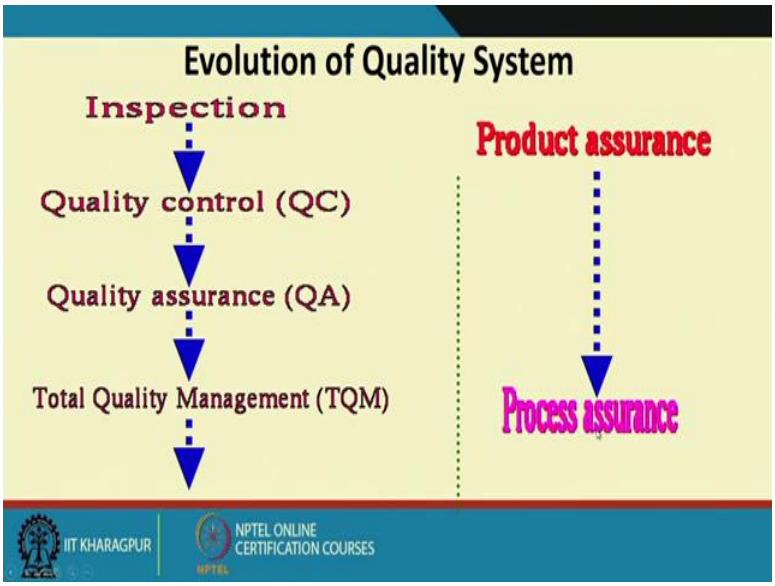

The initial inspection and testing was superseded by quality control. We will see what is quality control and statistical quality control and later the quality assurance techniques evolved. And since then the total quality management techniques evolved and still we are further developments in this area. As you can see that there are various stages of growth of quality because the customers are becoming quality conscious and it is very important for an organization to produce quality products.

And the manager has a very important role in an organization producing quality software. If we look at the different developments that have occurred here from inspection to total quality management, we will see that initially there was too much of emphasis on the product, the product was tested thoroughly, but later we will see that we do not really look at the product much we look more at the process.

The basic assumption is that the process if it is good it is bound to produce quality products. We need not look at the product and reject the bad products that need not be the emphasis, the emphasis should be on having a good process. Over the time that the quality systems have evolved the emphasis has shifted from product assurance to process assurance.

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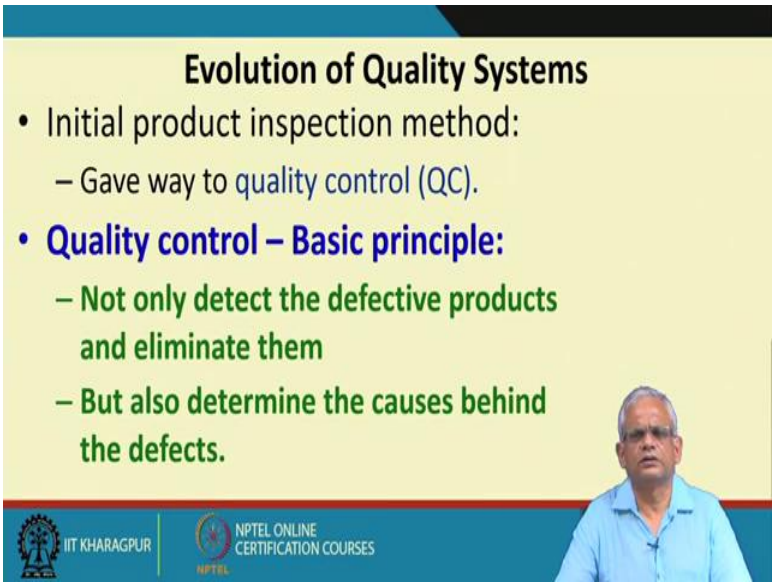

The initial technique deployed for quality was testing and inspection and later the quality control technique or QC started appearing. The basic principles of the quality control is that not only test the manufactured products detect and eliminate the bad products, but also determine what causes the defects. That is look at the process of manufacturing.

If it is the case that the rejection rate is high for a nuts and bolt manufacturer, just check that what is causing this defect, is it that the temperature at which it is done is really expanding the cost and the cost is not tolerant to the temperature and that is causing the defect, then use a different cost. So, the quality control principle, as you can see that gradual shift is there to the process, yes do the testing, inspection and testing.

That is still there it is one of the basic techniques even in the modern quality system testing is there, eliminate the defect product, but also look at the process; why the defective products have arise in the first place. This form the basic quality control principles, but then we had the statistical quality control.

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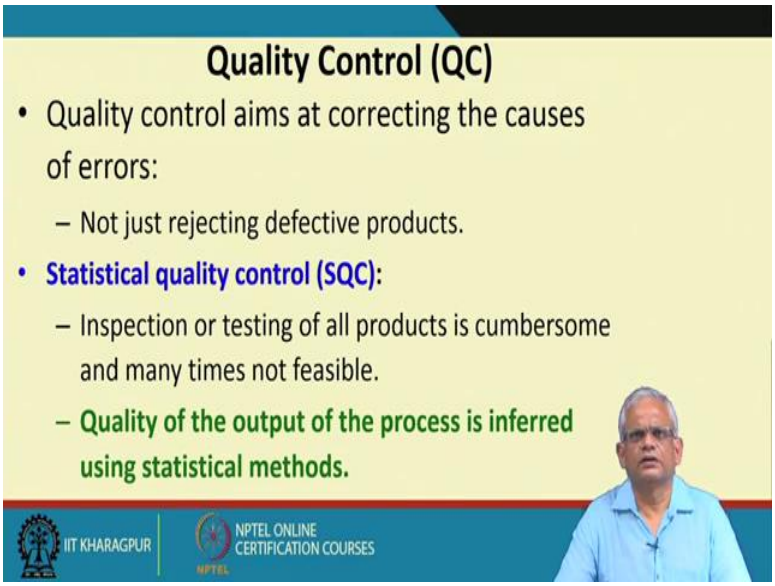

The quality control not only in targets to reject the defective products, but also aims at correcting the causes of the manufacturing process that was resulting in the defecting products and slowly the quality control techniques evolved into statistical quality control SQC, where the idea is that, many times testing each and every product is difficult, can we use statistical techniques to make inferences about the quality of the product and also make variations to the process and check whether the quality is improving or not.

So, the statistical quality control techniques, essentially use statistics to make inference about the quality of the output produced, the quality of the process that is produced and then make changes to the process and see whether the quality is improving.

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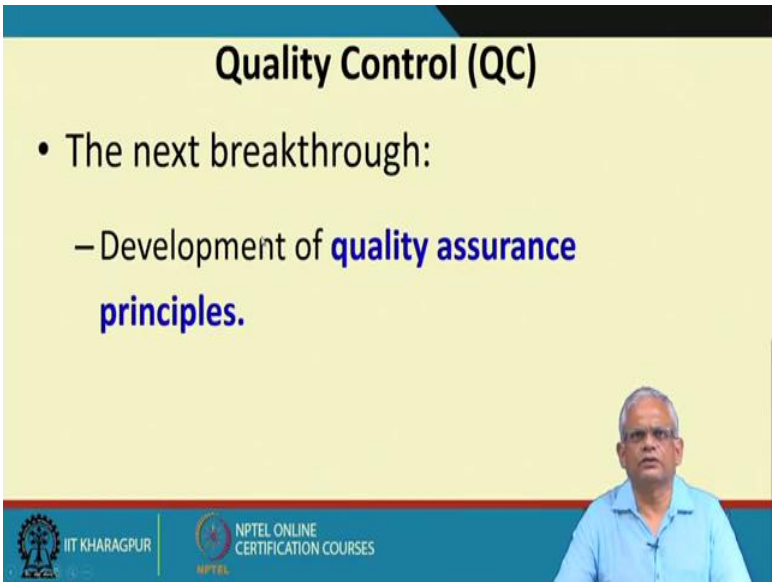

And after quality control the next breakthrough was quality assurance.

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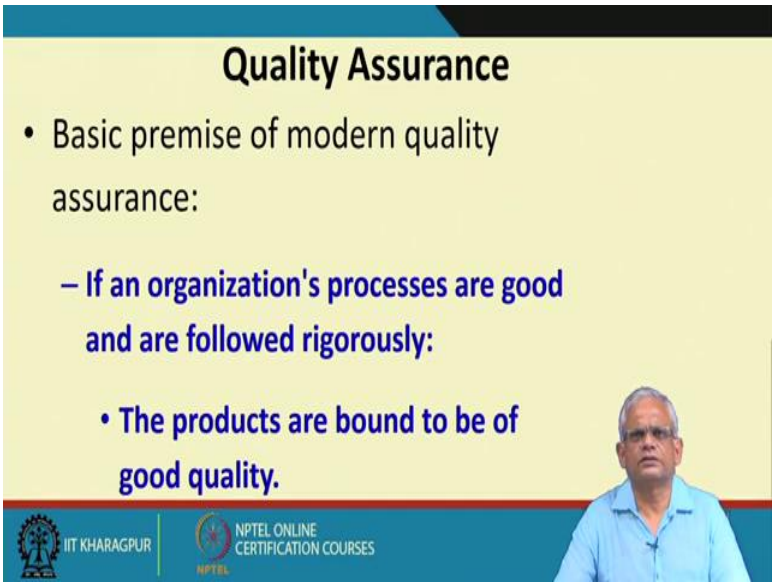

The main assumption in quality assurance is that to produce quality product, looking at the finished product and then doing testing is not that important. The major focus of the quality team should be on the process. If a good process is in place good products are bound to result, if an organizations manufacturing process is good and is followed rigorously then the products are bound to be of good quality. Just looking at the products rejecting bad products is not a good way of ensuring quality.

Rather the team, the quality team needs to concentrate on having a good process and then seeing that the process is followed rigorously. In that case we the products are bound to be good.

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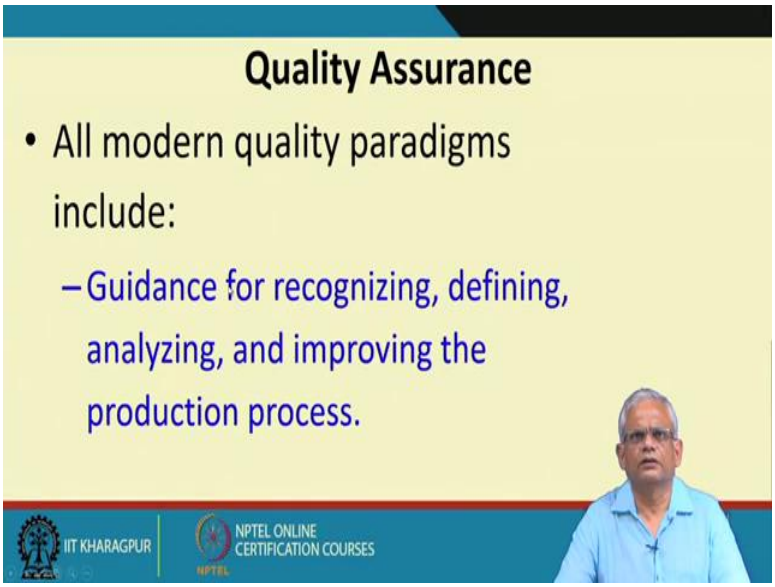

The modern quality paradigms are based on the quality assurance principles and we will see that there is guidance for recognizing, defining, analysing and improving the product process. So, see the shift from the product to the process. The quality assurance techniques have shifted from just testing based techniques to recognizing, defining, analysing and improving the production process.

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And even that further evolved into the total quality management principles. This was the next step of evolution. Here make process measurements that is how effective is the process. Is it producing good products? Is it efficient? And other desirable characteristics of the process, how effective is the process and then make changes to the process, so that the process improves and the focus here is continuous process improvement through process measurements.

We need to have metrics collected about the process and then see where there are problems and then change the process itself and process continually improves.

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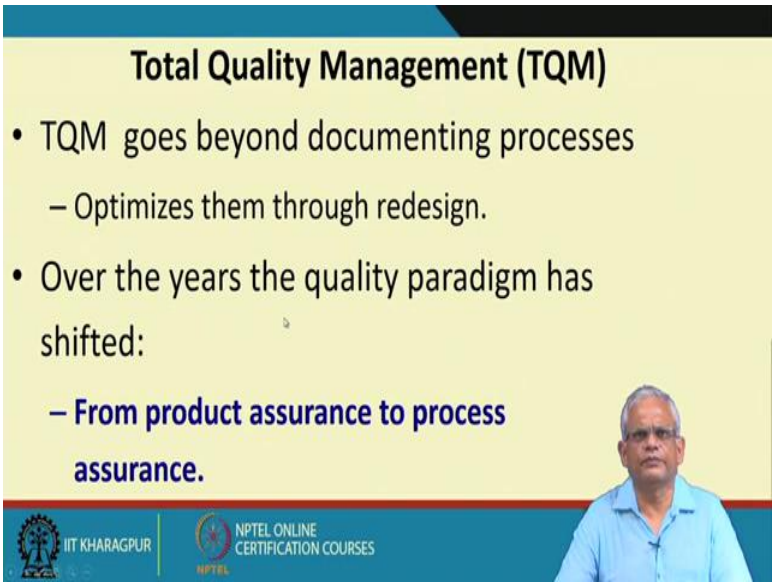

So, this is the total quality management principle. Here it is not just documenting a good process, but then here the emphasis is to as the projects run to collect statistics, the metrics regarding the process performance and find the bottlenecks in the process and optimize them through this redesign. But one thing is clear that over the years the quality paradigm has shifted from product assurance to process assurance.

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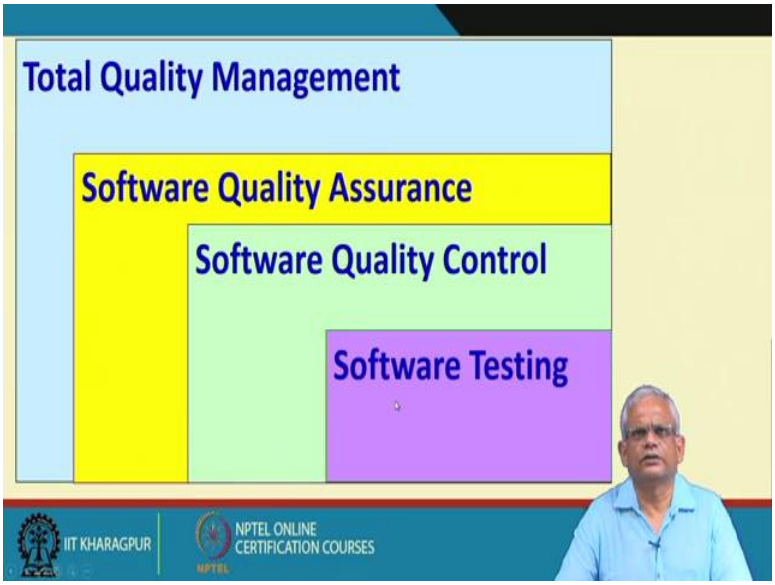

Initially software testing was the primary means of manufacturing good quality products. It is the basic technique, it is still there, but then we have the we had the quality control

as the next development. It incorporated software testing no doubt, but then the defective products were analysed to identify what was the problem in the process that was resulting in the bad products and modify the process. That is the software quality control.

In software quality assurance, the basic premise is do not focus on the product testing, focus on having a good process, document the process and then follow it rigorously, then the product is bound to be good. That was the next development you can see the shift from testing to testing is a smaller activity and analysing the process the shift to process here and then finally here software quality assurance have a good process, good products are bound to follow.

And then the next step of development is total quality management where not only have a documented process to start with a good documented process, but through process measurements continuously improve the process. So, this diagram emphasizes that software testing is still there, it is part of it is a smaller part now. There are many other things that happen.

For example in software quality control, we not only do the testing and inspection, but also we look at the defects analyse the defect and find out why the defects are arising software quality assurance these things are still there, but then we also have documented process. And total quality management we have processed measurements, find out the bottlenecks and continuously change the process.

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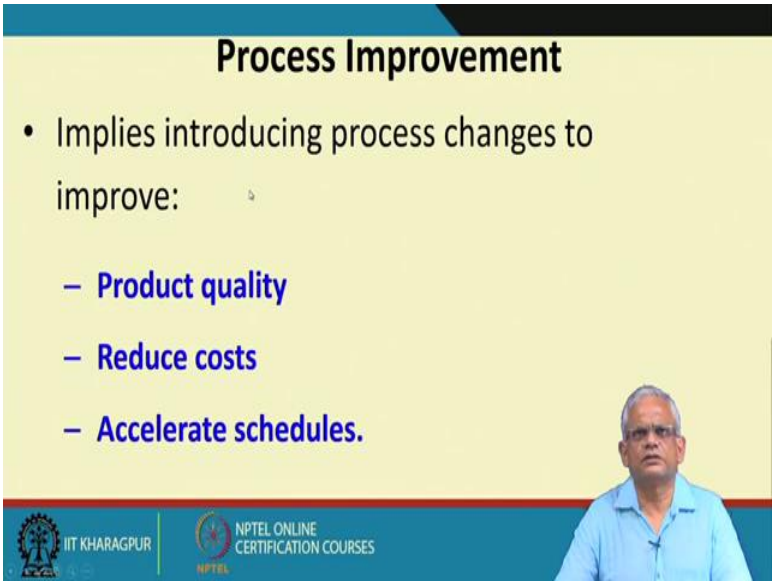

The modern quality systems emphasize on process improvement and here the changes are made to the process to improve the product quality, reduce costs and accelerate the schedules. We find where are the process bottlenecks which are causing the product quality to be poorer, resulting in higher cost, delays and so on and fine tune the process to improve the product quality, reduce cost and accelerate the schedule.

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One thing that is well accepted now is that a good process is required to produce good product. But we must remember that given a process a manufacturing plant, product manufacturing plant can run the process again and again and each time good quality products will come out, no doubt about that for traditional manufacturing.

Let us say we look at a iron manufacturing company it consumes iron ore and other raw materials produce good quality of iron may be flat sheets or rods. And once the plant has been set up and process is followed like getting good quality raw material and so on, it will keep on continuing to produce good quality products once the process has been set up. But for software development and other design activities, we cannot say that we set up a good process and always good products will come out there are other factors.

For example, let us say the complexity of the problem. The process that we heard worked well and good quality products came out for accounting software. But let us say we are doing something very different in a telecom domain and maybe we cannot replicate that

process to have a good product in telecom. And also, the capability of the designers this is the important fact, important factor in producing good quality.

Even though the process is there, but then if the designers and coders are inherently not good, the product cannot be good. So, just making this point here that for traditional products having a good process is enough to have good quality products, but for software development having a good process is only part of the story, there are other factors which affect the quality.

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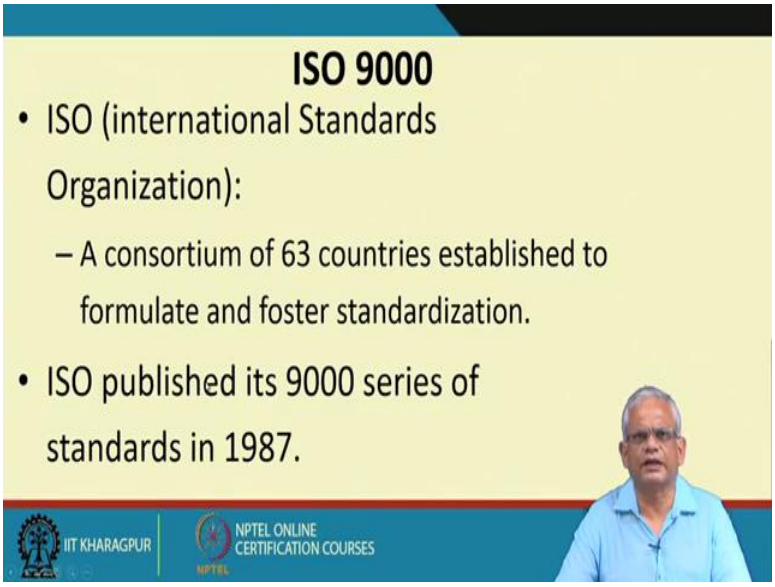

One of the early standards in quality is the ISO 9000 series of standards. ISO stands for International Standards Organization it is a consortium of a large number of countries established to formulate and foster standardization. The ISO 9000 series of the quality standards were published quite some time back in 1987. These are basically sets of documents which are guidelines for the process.

They do not really look at the product, it is not a product specific, it is based on the process. And ISO 9000 came up with three documents, the ISO 9001 standard, 9002 standard and ISO 9003 standard.

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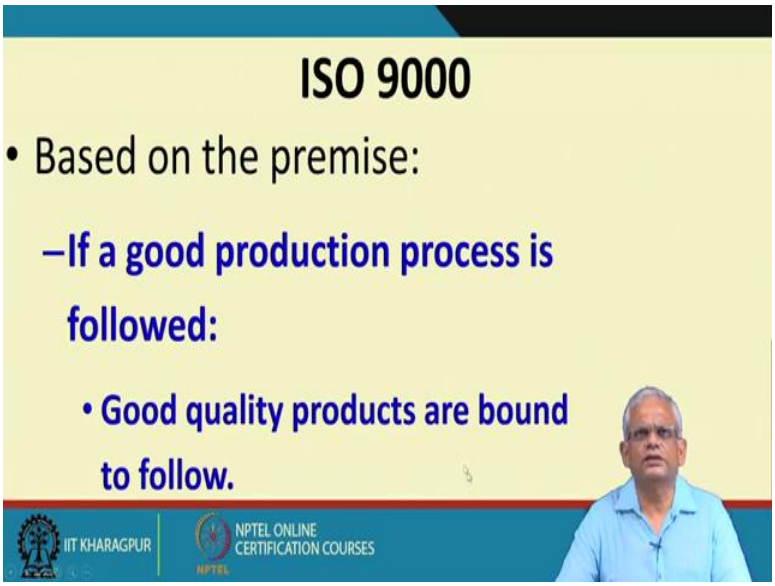

The ISO 9000 is based on the quality assurance principles that if a good production process is followed good quality products are bound to follow, you can see that this is essentially the quality assurance principle and ISO 9000 is based on the quality assurance model.

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Now, let us see what is the difference between ISO 9001, 2 and 3. ISO 9001 is applicable to organizations engaged in design, development, production and servicing of goods. So, here for the manufacturing there is initial design and the design is used for development

and then production and then servicing. And therefore, this is the right standard for software development organizations because they do these requirements design, develop, test and service.

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But there are the other standards 9002, it is applicable to organizations who do not do the product design, but are involved in production and servicing. For example that there is a consultant organization who designed the plant. The company here did not design the plant, there is a consultant organization which designed the plant and once the plant was set up and the process was there then it just continued producing goods and then servicing.

So, here the plant and the process is purchased and the company only manufactures. And the 9002 series of standards is applicable to such organizations and of course, it is not applicable to software development organizations because here the development organization does requirements design, coding, testing, everything. It is not that it just gets the design and code and just keeps on manufacturing.

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ISO 9003 standard, this is another document that was produced by ISO it is applicable to organizations which do only inspection and testing of products.

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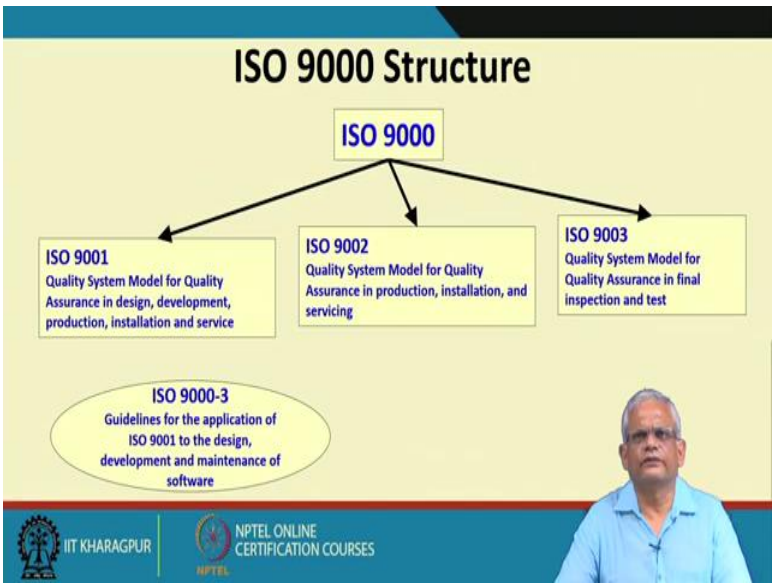

This is just pictorially represented here that 9001 here, the applicable to organizations which do design, development, production, installation and service and software companies come under 9001, but then 9002 and 9003 standards are applicable to 9002 is applicable to those who do production installation and servicing whereas, 9003 is only those who do the inspection and test.

But 9001 is a very generic standard applicable to many types of industries, those who produce design and produce goods but then software is different. Here there is no raw material that is consumed. Even as the software is being developed its not visible, only when the software is finally, running you can see it.

And therefore, software needs a very different interpretation of the guidelines given in the ISO 9001 document and this was felt because it became very difficult to apply the clauses of 9001 to the software industry. And ISO later came up with a new document called as ISO 9000 part 3, which provides the guidelines for software design development and maintenance. This was specific to the software.

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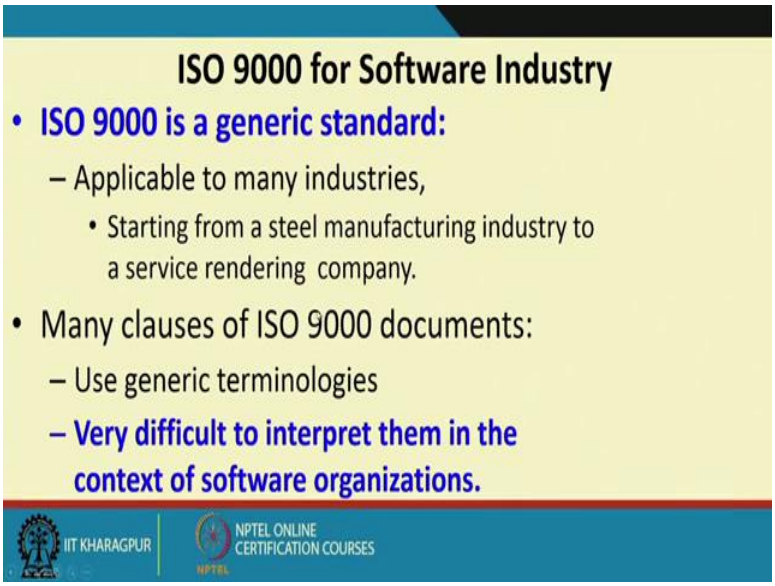

We must understand that ISO 9000 is applicable to a wide variety of industry. It is a generic standard starting from steel manufacturing to service industry and so on. And ISO 9000 documents are written using generic terminologies which are difficult to interpret for software organizations and therefore, ISO came up with a new document which is ISO 9000 part 3 which provide interpretation of the ISO 9001 for the software industry.

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The software industry is very different from the other industries.

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For example, during software development the only raw material consumed is data, if we can think of some raw material which is basically the data or inputs. Whereas, the other types of development, manufacturing and development they consume lot of raw material. For example, iron ore, coal, limestone and so on. And therefore, many of the clauses of the 9001 pertains to raw material controller, input controller and that is not applicable to software industry. These clauses are not relevant for software organization.

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And therefore, ISO came up with a new document applicable to the software industry. It recognized that there is a radical difference between software and other product and came up with a new document which is ISO 9000 part 3, few years later the original is, original documents were published in 1987 and the ISO 9000 part 3 came up in 1991.

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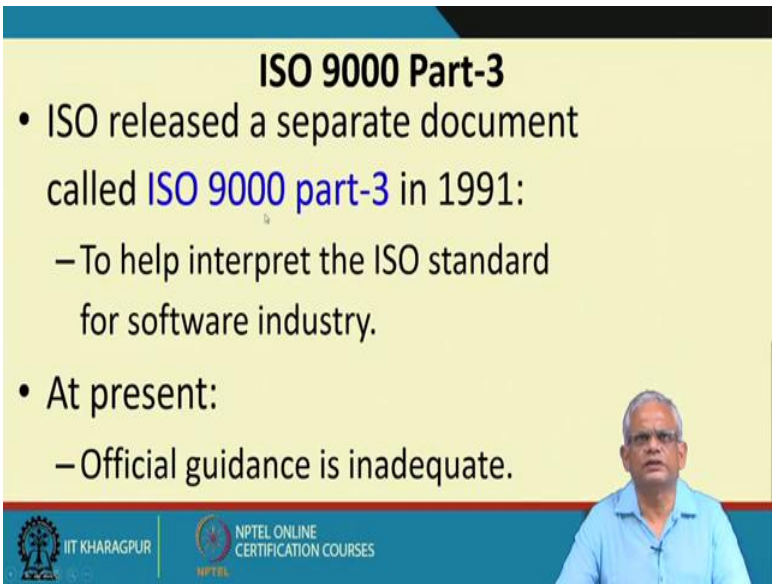

It helped to interpret the ISO standard for software industry, but still the official guidance is inadequate and it is interpreted by various consultants.

We will stop here. Almost at the end of the time and we will briefly look at what is the requirement for ISO 9001 for the software industry, what areas it emphasizes and what is the model that it proposes. And then the subsequently we will look at the software engineering institute, capability maturity model. We will stop now.

Thank you.