Six Sigma
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Lecture No. # 03
Concepts in Quality Management III

Good afternoon, we resume our talk here, and we are still at the initial stage of this series of lectures. The one that are going to be discussing right now, we will continue with saw the tools and techniques, which are already common; and we will just what reach the we will touch six sigma; we will just make a beginning six sigma as we go in to this.

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You would remember when we started, when we stop the lecture in the previous session two we discussed how to take customer requirements? How to convert them into specification? That was something; that we could do quiet easily by asking people some questions and by asking our staff, how we are going to be solving them? So, we converted the, what is the customer, what is it that the customer wants and how are you going to be satisfying them?

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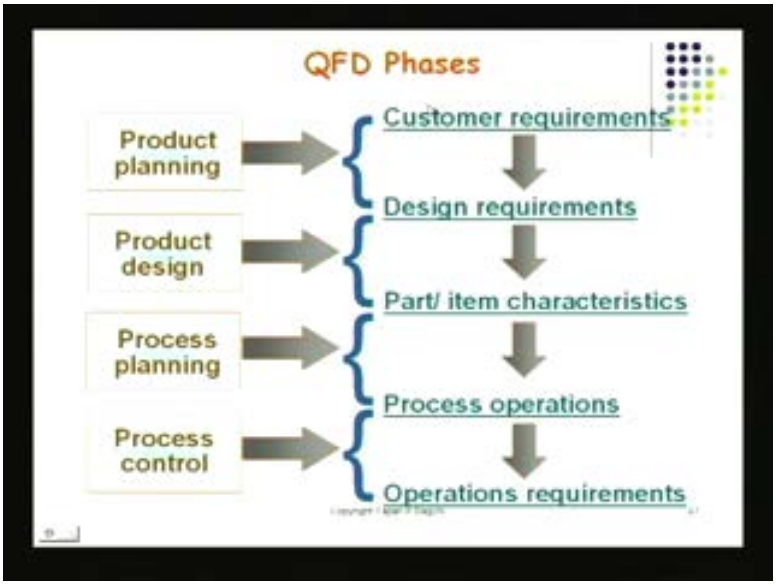

Now, the same process can continue as we go deeper into the process for example; when I am doing product planning, I would take direct requirements of the customers, and I will come up with designed requirements; that is something I could do while going through this process of doing product planning. When I come to product design, I look at design requirements, and I will come back for specification parts and the item characteristics. When I am doing the process planning, which is the private place where these parts are converted into the real process; into the real product. They of course, will be doing again one other layer of QFD and will be taking parts and input characteristic; item characteristics as the input and putting through the process planning stage will convert them into process operations.

These specifications for the process, was that is known to me that I will begin process control logic and I try to cover the operational requirements. So, starting with customer requirements I come all the way down to what I am going to be doing on the floor, that is like an at every phase. I have used QFD that is what I have done.

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Cost of mismanaging of course you know, we have already mentioned that there is going to be a lot of rework and returns of the customers, which is going to add up to our failures and loss of profit and so on.

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It is something that we like to avoid. Commitment to quality is quiet easy to detect and if you look at these points here, problems are corrected very quickly with suppliers, equipment faults are faults are put right by improved maintenance people as quickly as possible; people are well trained; partnerships are built with suppliers and also with

customers can understand both sides of the story; continuous improvement is observable. We go back to the same factory with some gap, a gap of like a month; you will see some change there and the sure for way of saying that something is something good is happening in the companies, when business begins to grow you get more orders.

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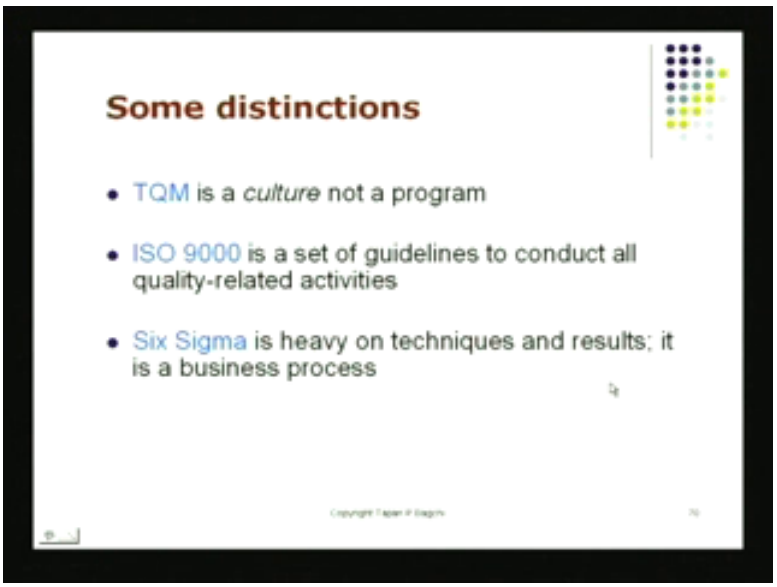

Some distinctions again; TQM as I mentioned to you it is not a program; it is a culture; it is a way of thinking. ISO 9000 is a set of guidelines, basically to impact all qualitative quality related activity, this impact you practice and put in your holds in order and all that is what is done in ISO 9000. Six sigma is a technique oriented approach; it is very heavy on techniques and results and it is a business process; it is a process that impacts your business and impacts your process and produces its better result.

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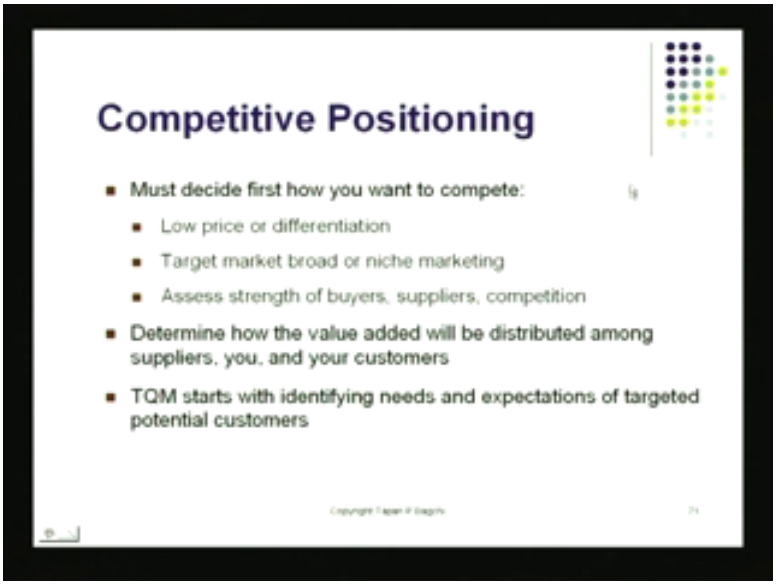

Competitive positioning: how you want to compete there are some tips giving here; do you want to be the lowest price supplier and do you want to target the market in a broad way or do you want to go after niche market and do that do that by accessing your buyers suppliers competitions output. These are different few different things that you must you write in the beginning, then you determine how you are going you are going to be adding value to this in this chain? How you are going to be doing it?

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If you just look at TQM: TQM also starts by identifying the needs and expectations of targeted potential customers and TQM does help you, in positioning your business that it does.

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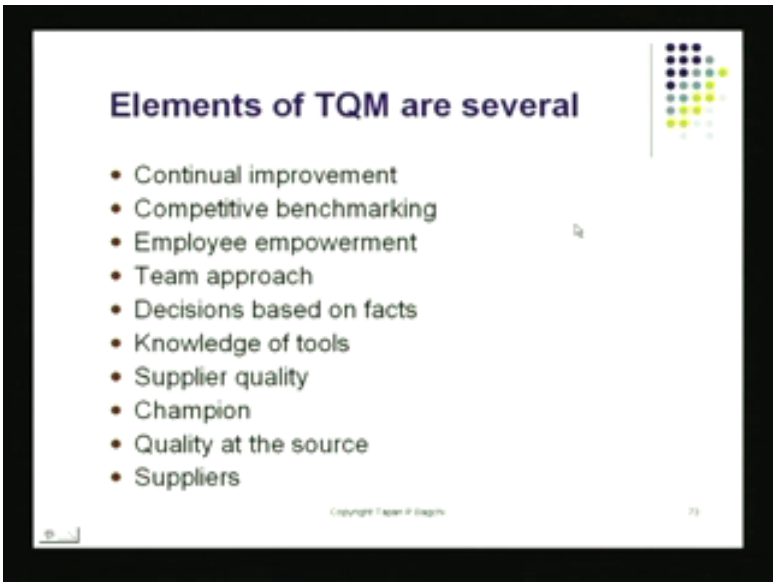

If you look at the elements TQM again, there are many different elements and you can read them; you can see what they are there is no real surprises there.

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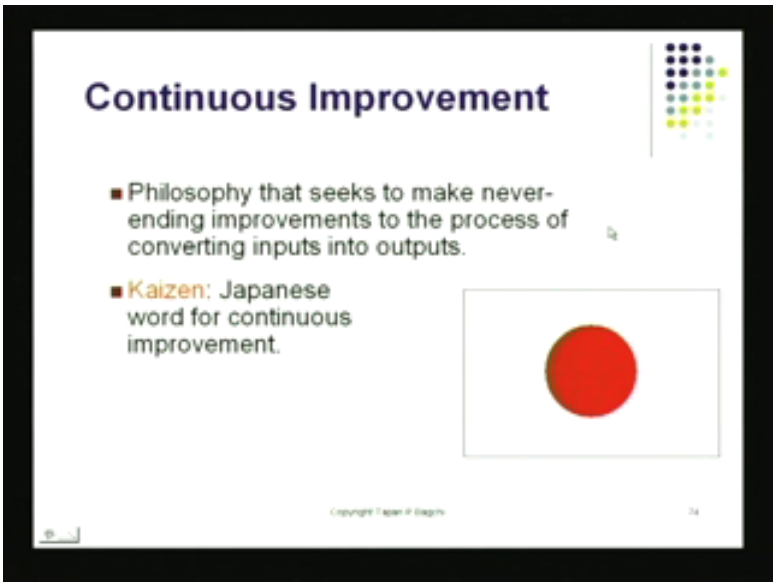

This theme of continuous improvement, this is very important for this Japanese. They would do the same thing again and again, and every time they do it they come up with a

slight improvement they come up with slight improvement they not like or looking for a breakthrough or waiting for a breakthrough, which is the western style. The eastern style or the Japanese style is to try to do certain improvement everyday to the extent possible make an impact on your process.

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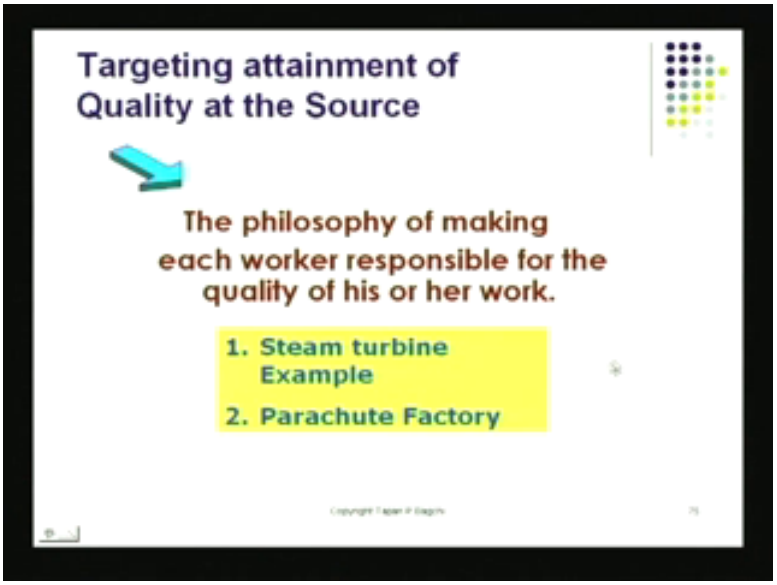

The philosophy of making each worker responsible for the quality of work that is also very, very important.

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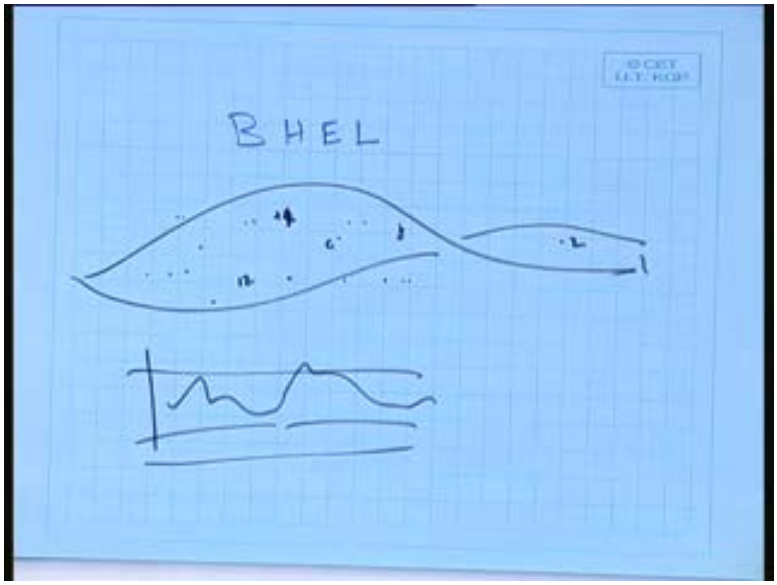

Let me give you the example of couple of cases, which I was involved there is an organization called BHEL. It is a very, very famous company and the letters stands for: Bharat Heavy Electricals limited. What is their business? They produce or supply equipment; they produce the turbines; the stream turbines or the hydro turbines. They also produce the generators and eventually they produce total facilities that can produce 250 mega watts of power or 500 mega watts of power. These are world scale generators of power they are in this business. The example is as follows I go around and give talks on quality and in various different places. One of those occasions has invited to go to BHEL and in a town called Haridwar.

It is a very, very pretty place and the Ganges, Russian running down from the mountains and it is just reaching the planes and the water speed is very, very fast and on the shores of the river there. That there is just huge plant, the BHEL plant for the fabric all these different turbines and so and so forth. Now, I was there to give a talk and after some gap I had some time I had I had about an hour and I wanted to walk around, and I asked people could I go to the shop floor? Lower hold behind in the few minutes, I was in the shop floor and they had these different machines and all kinds of machining was going on and different things were going on welding and you know machining and grinding and so on, all that was taking place at these work stations.

I found a gentlemen, he was about thirty-five and I walk up to him; and I look at him and he kind of looks likes is he really knows what he is going on seems to have seem to have good experience in his hand in his hand. He had a turbine plate he had a turbine plate in his hands which had been forced by other system. Now, he was doing the grinding on it he was trying to make sure he gave it the shape because it had to be Aerodynamic and so on to make sure it function pretty well. It was able to convert the steams energy the pressure into rotation and with that the shaft is going to rotate and so on, all that would happen, if the blades are ok. He was grinding these individual blades; he was machining them then that was something that he was doing one blade after the other.

So, it take one blade, he would do the job and then he would something, you would some it make some measurements; he write something down; then he would pick up the next blade and he would do the same thing do again some grinding and So on, then he would make some very particular; very specific measurements then take a look at it make some corrections and again he would make some measurements and so on.

While he was doing that he was writing down the lot of stuff. So, I found him writing down in a measurement A B C D and he is measuring these things. There was a picture there was a picture of turbine blade and the blade was somehow like this. He would make these measurements at various spots and write down some numbers like say twelve fourteen or twelve and eight and six and two there and so on. he was doing this as he was preparing these blades; he had that picture there and writing these and I kind of you know a bit to tease him and I bit to find out really what is going on, I asked him in Hindi we call such people us tad [FL] what the hell are you doing I did not say hell off course. I said what a heaven are you doing and he said well I am making turbine blades and it is a very important part that goes into a huge turbine.

Now, what we have to make sure is that the turbines are made properly? That means the blades have to be made properly. So, my job is to produce these blades and I said well, I see that; I see got this diagram and he make and he is making these measurement then he writing certain things down; he was filling up some charts its look like; he had some charts there and he was doing this kind of stuff; he was doing that as the blades were coming out and I said sir please tell me why are you bothered about these preparing the chart and so on… so forth. Your job is to basically fabricate that that turbine blade. So, basically you will be very worried about the turbine blade.

Why is it that you are writing all these numbers do on making all these measurement? What is the use of all this? You are a machinist, you got so, many years of experience twelve to thirteen years of experience you should be focusing on machining, and this seems like clerical work, why are you doing this? This is the philosophy of making each worker responsible. What he is doing? Let me tell me show you what happened; let me tell you what happened he really; he gave me a very stunned look, then he asked me sir do you might telling me who you are? I got a little shaken up; I said well you know I am a teacher and I have been brought here to give some talks and so on and I had some time.

So, I came down to the floor found you are doing interesting things. So, I want to check with you a little bit, but I am still very curious you know why are we bothered about all these writing all these numbers down and plotting this charts why are you concerned with that.

Sir, let me tell you something it is just turbine blade that I am making if the dimensions are not right at the right places. Suppose this turbine blade malfunctions in the big turbine, where it is put in they are like fifty, sixty such blades they will put around a hub and then the turbine when the steam comes, it will start rotating and suppose it is not balanced; suppose something is wrong with it the turbine may basically fail and; that means, the generator that is connected with it with the big shock it is also going to fail; that means, it is not going to be generating power anymore; that means, whichever power station is using this and through the electric grid.

Suppose it supplies power to Delhi. In Delhi, you got this parliament and everything else, market place and factories on outside Delhi they are going to shut down. So, because of my poor work it is very possible that Delhi is going to collapse or Delhi is going to have a power out for; may be six hours, ten hours or god knows, how long? That is the reason, I have to do this job right; I have to make this measurement these are looked at by an engineer; he is going to make sure in the evening after he goes through all this charts things are acceptable as far as business is concerned things are acceptable to me.

You know I honestly was more than impressed, I could not believe that this man knew the value of his work; he knew it to the point; he knew exactly the impact of, he is not doing the job right and its impact you know, some hundreds of miles away on Delhi or perhaps some other place he knew that very, very clearly .This is one example.

Let me show you the let me talk about the other example, a parachute factory. This parachute factory is also located in the north and there of course, we have a different kind of story to tell you. Again like I visited BHEL, I went to this parachute factory. This factory produce parachutes and these parachutes were used by these amateurs, you know the people whose hobby is to fly parachute. Jump of some cleft and float around. These parachutes are fabricated in this parachute factory and I walk up to a particular place a work station their again because my talk was over; I had some time to float around. I went down to t him shop floor and I found they had what look like a bunch of tailors.

Tailors means they were you know they are cutting up sheets of plastic and sheets of silk and sheets of cloth they are stitching them stitching them here, stitching them there. They are doing this; there was one gentleman, their one gentleman he was actually cutting the cloth; he had a template in front of him and he was cutting this cloth. First of all, I should

tell you in the north India; there are not many places where people use parachutes. it is all used either in the hills which is really up north or they had done in the south some places again, where there are recreation facilities and people you know they take a jump either from an airplane or from a hill and float around and they had some fun that way.

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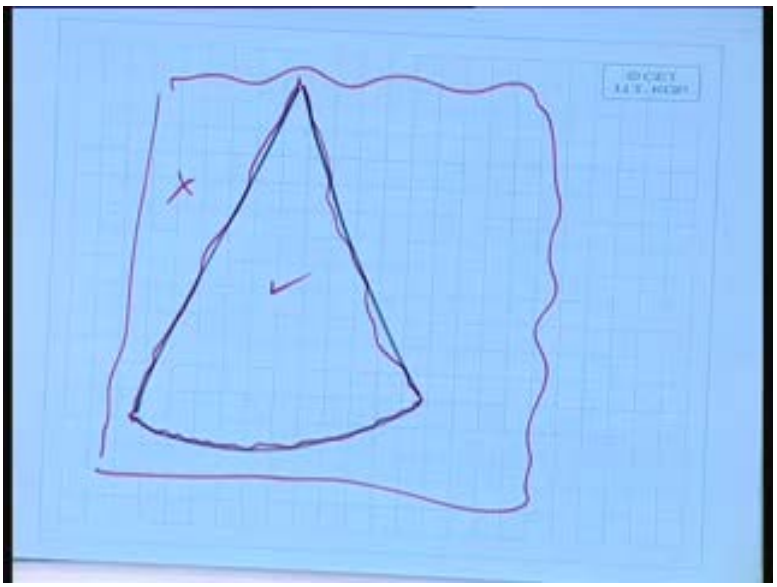

Around the area where this factory was located there were no parachutes jumpers. Here, I walk up to this gentlemen and he is got this huge sheet of cloth laid out in front of him; he had this template also laid out in front of him and yes the template was there like this and he would spread the cloth on the top this; the cloth would be spread then you take a Scissor and you start cutting, cutting, cutting, cutting, cutting and it cut, cut, cut, cut, cut and cut, cut, cut. He discard this part and it keep the cloth this he would fold up; it stack them up some place then I asked him what do you do now. So, well you know I am not concerned with that I basically produce these triangles and I shift the over to the next department they have a box and I go and pile them up in that box and then they do something with it.

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I said, sir what is it that is actually happening here what are you trying to do? And he said well in my language it is called [FL] we are making [FL] we are producing [FL] [FL] are kind of the collegial word for a parachute that is got a circular shape and it is got can apian. There strings and of course, the man who is jumping he is hanging were the

parachute; he is got some strings attached with his body to the parachute to the there. This man is job was to prepare these triangular sheets and these were stitched up and the canopy will be prepared. I asked him, sir, “have you seen someone jump of an airplane?; have you actually seen the [FL] open up?; have you actually seen it yourself?” and he said no sir I have never seen say what about may be some other place have you actually you know that [FL] are used by. He say yeah, yeah I know I know they are used by people and I have heard they are used by young people they kind of you know they have some fun and they do this and what about you have you actually if you.

You are telling me you are never really seen a real parachute open up and the man floating down; you never seen that yourself right. He said, “No sir, just think of this person, who is doing this his sensitivity toward the user”; he is no idea who the user is or what he does how he jumps?; how the parachute opens up?; I am sure he is probably curious, but he had never had that opportunity to interface with a person like that well this was not so bad.

Let me tell you, what happened after this after this little visit to the shop floor I then occasion to have some tea with some people these were the supervisors and these were graduates; they were graduate engineers who were the supervisors of these people they in charge of various shops somebody was in charge of the belt department; somebody was in charge of cutting department; somebody in charge of something else and somebody in charge of stitching and. So on.

These guys they were supervisors they were at much high level than these people there and they are having tea with me we are sitting around the table and they are chatting about various things life in the factory; life in this. The general manager was also there he happen to be there and I again I just wanted to ask the same question I actually asked gentlemen you been here a for few years three four five years you are probably waiting for promotions. So, you can go on to better jobs and bigger jobs.

Tell me, “Have you actually seen someone jump of an airplane? Have you actually seen your parachutes utilized by somebody?”This is the city in the north again in the planes. So, again there is no real local; no opportunity to watch these parachutes float around in the in the sky. There is no such opportunity there. None of these people had been exposed to that, they had been exposed to a site where they could see a fellow jump of a

cleft for a parachute with a parachute and the parachute open up; slowly come down to the ground they had not seen themselves. They are engineers; they are they are supervisors.

There was one person who says yes, “Sir, I have seen a fellow jump of a parachute”. I said well, how is it? How is it that you have experienced this? So, different from these people they also seem to be looking about the same. They cannot be much younger to you how is it that you know about parachute he said sir I was originally I was selected by the air force, but then for some reason I got hurt somewhere. So, I was asked to go into civil end duty. So, I have been assigned to this factory and work here. This was the only person who had physically seen a parachute. A parachute in use, unless you have seen, how the user is going to be using this object. Suppose I am the producer of this object if I never have been exposed to the person; I have never come face to face with the person who is the real user. Do you really think I will be a top job in producing this?

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So, the contrasting pictures of this the first one is the turbine where the man knew fully about the consequences of his work other consequences of doing a poor job there and the fellow who was cutting these you know pieces of cloth in a parachute factory this fellow had no idea at all as far as the end user was concerned. So, would he be sensitive this is something that is very, very important and this is what you saying making each worker responsible for the quality of his or her work that will not come by pounding on his head it will not come pounding on his head by some just some philosophy. It will come only with a direct face to face contact.

So, you need things like the QFD and so on. To come in direct contact with the user unless you do that you just will never have that sensitivity. The ladies when they serve you the food what do they do they watch your face what they have produced how do you like it your face will tell them without even saying oh food is outstanding food is knockout bla bla these thing they will watch your face. Some gentlemen, who is preserved this special wine that he is brought from France for you; he is got that bottle there; he pulls out that bottle; he lay’s it.

He shows of you know look at this you know shuttle some wine, there this I have kept; I was waiting for your visit and now that you are there. Now, when he pours it out and

gives it you in a little goblet and he starts sipping what does he do? he watching your face and there he is coming in direct contact face to face, contact with the user and he gets signals from it. He probably finds out well this Indian guy, who is from the east he loves fish, but probably he does not like my wine. Probably next time, I should not be serving him this; I should be serving him something else this is something this is the sensitivity that you require. This comes only, when you got face to face contact with it.

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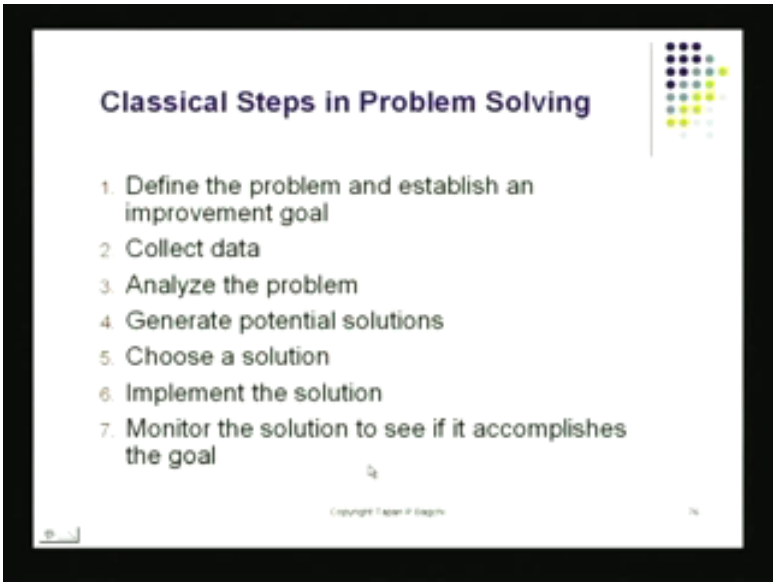

No matter what you do in terms of your logic philosophy and everything else. You cannot forget the customers; you cannot expect to win if you forget the customer that is very, very important. There are obviously, some classical ways to solve problems and you got the definition of the problem; you collect data; you analyze things and you do, you generate potential solutions; you choose a solution then, you implement the solution and solve. These are classical problem solving steps.

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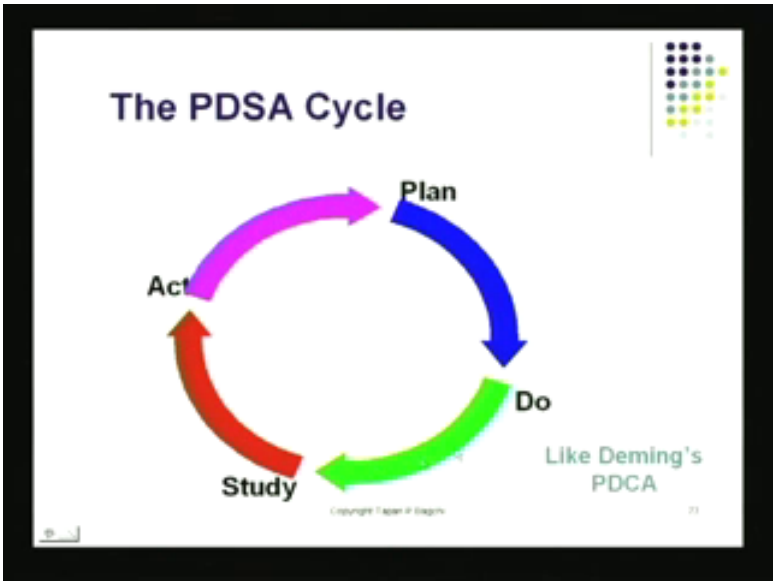

This is somewhat different, from what basically Deming ended of saying. Deming said, you plan what you are going to do some criteria action you are going to take you carry it out; you look at the effect and then you act which is like take the next step to come around this is his PDCA cycle. This plan do, study or check and act PDSA or PDCA cycle. This was given by Advert Deming; he gave this.

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Process improvement; obviously, would could proceed this way and lot of processes they are basically work that work that by this way.

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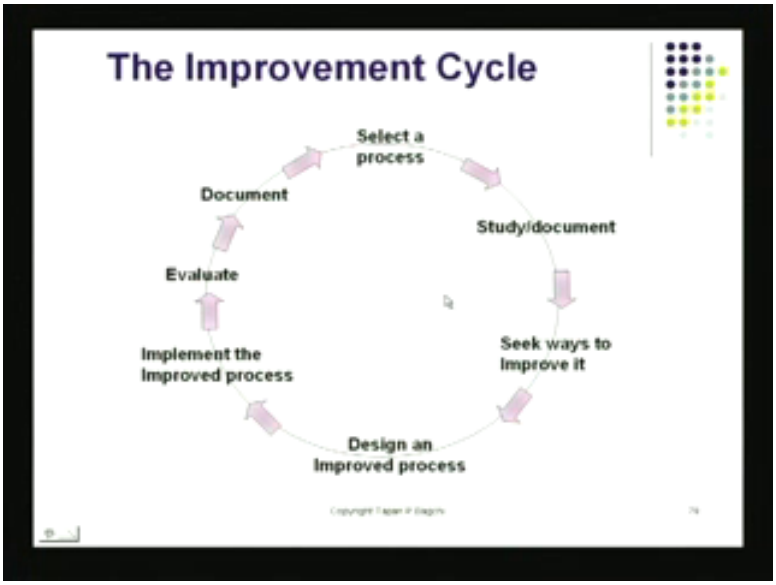

In fact, there are more powerful methods so; refinements have been produced of this PDCA cycle. This is one example and they can pause the tape; they can pause your screen and you can look at these scenes and you can read them as you are there not very different from, we saw in PDCA except some refinements have been done.

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But six sigma provides you a much more powerful framework and that framework is spelled DMAIC.

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I am going get into a little bit to give you little glimpse of how six sigma is different. But before that let me just remind you; six sigma does not throw away; TQM six sigma builds on TQM. So, we will catch glimpse of a some of the tools of TQM, if you have not use them believe me, try to use them; try to use some of these TQM tools and you will find how useful they are just this morning there was an occasion one student came to me, and he told me, “sir, teachers are late coming to the class just think of this problem”.

This kid is highly conscious; he is really strongly motivated to learn and he comes to the class and he finds that teacher is not there; he is trying to get into the building and he is finding that the class could not be started because of right at different things. I said this is something that I would like to analyze; I would like to understand then him. I we went to an empty class and I do a cause and effect diagram and I am going to give an example of that.

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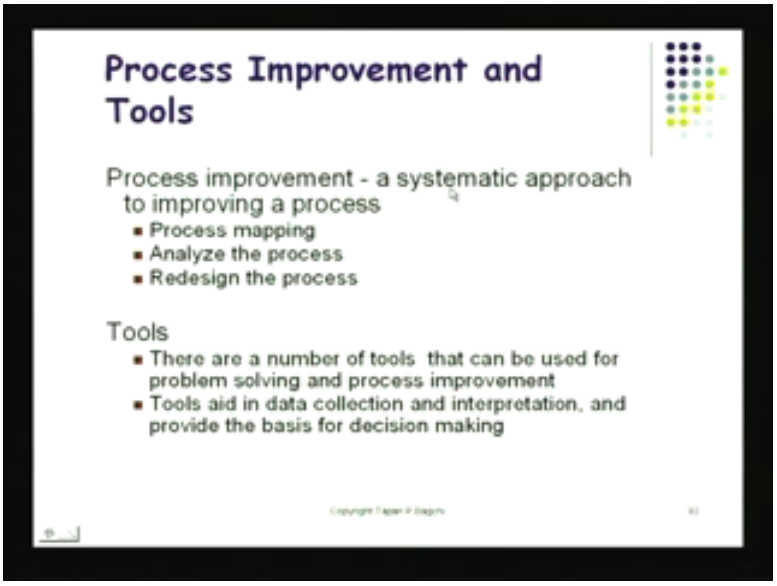

I will go there gradually. So, we will call that process improvement. So, we are going to be looking at some process improvement tools there are number of tools available as I get into point, I am going to pause for a minute and; I am going to bring up the issue of teacher's coming late to the class how did we tackle that.

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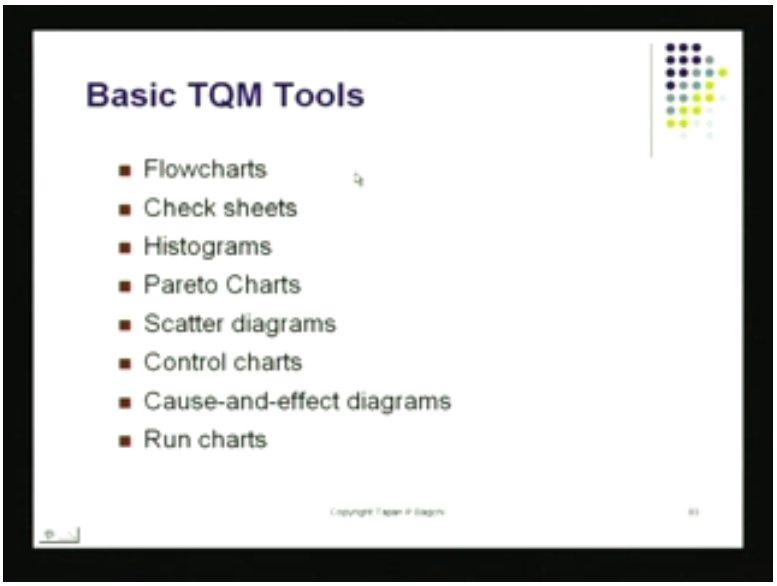

The basic TQM tools include Flowcharts, Check sheets, Histograms, Pareto charts, Scatter diagrams, Control charts, Cause and effect diagrams and Run charts. They are probably listing more than seven tools here because some of these are quiet similar.

What we have to remember is that each has a specific purpose. For example, the control charts is used to control a process. The run chart is basically, the run chart not probably marked here. The run chart is used basically to keep track, how many run chart is right of the bottom here to keep track of how many items produced are out of specification. So, control charts have a different function, they try to help you control a process to keep accuracy in control and to keep precession in control two objectives. What does the run chart do? It just tries to make sure your production is within specification that is what the run chart will do.

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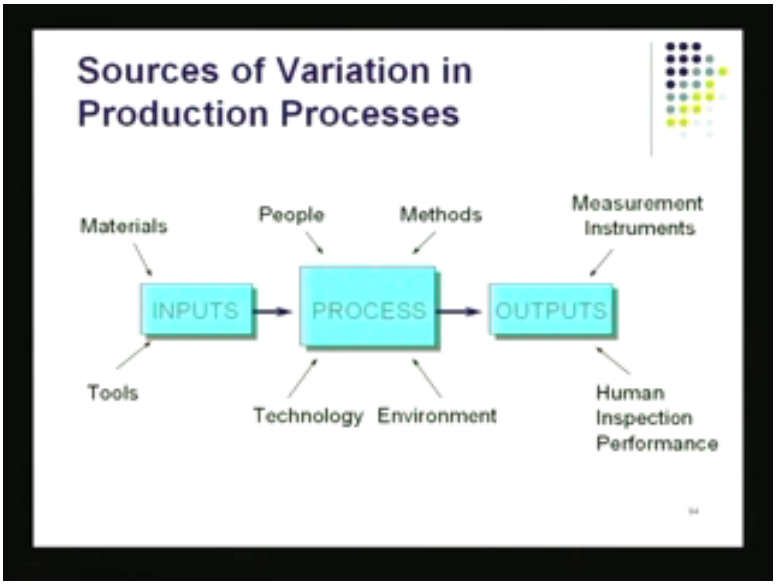

There are different applications. So, process is there, there is input going on and all these different factors they might be impacting your process.

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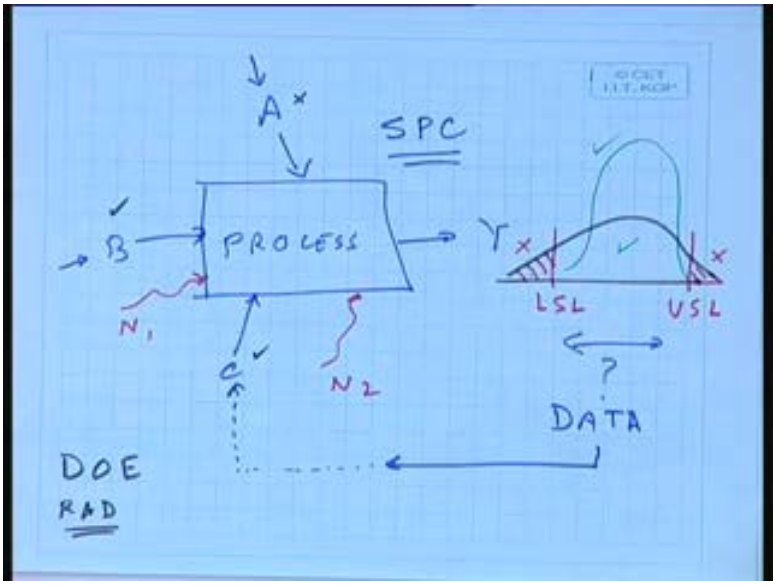

Your sources of Variation; Variation something that we do not like for example, we saw our friendly chart which was like this one and with the black distribution; we saw lots of Variation that people would not like and somehow we got it to the green distribution; that has smaller Variation. This is something customers would also like because everything is fitting within these spec limits. This is how does this Variation occur. It occurs because of all these different factors, they are not always in control all these different factors that are not always in control that is why we end up variation.

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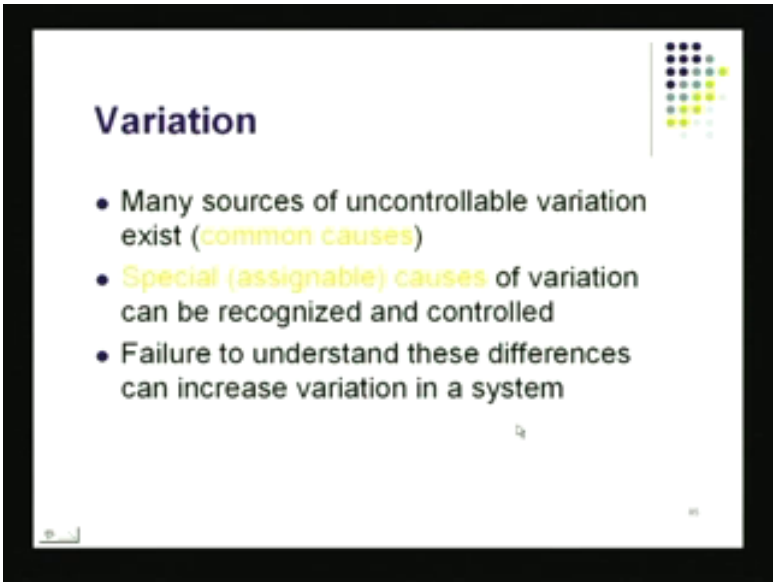

So, Variation is something that nobody likes Variation and in particular Qualitation people or quality managers. They should literally go mad; when they see Variation they should go mad and they should try to fix it.

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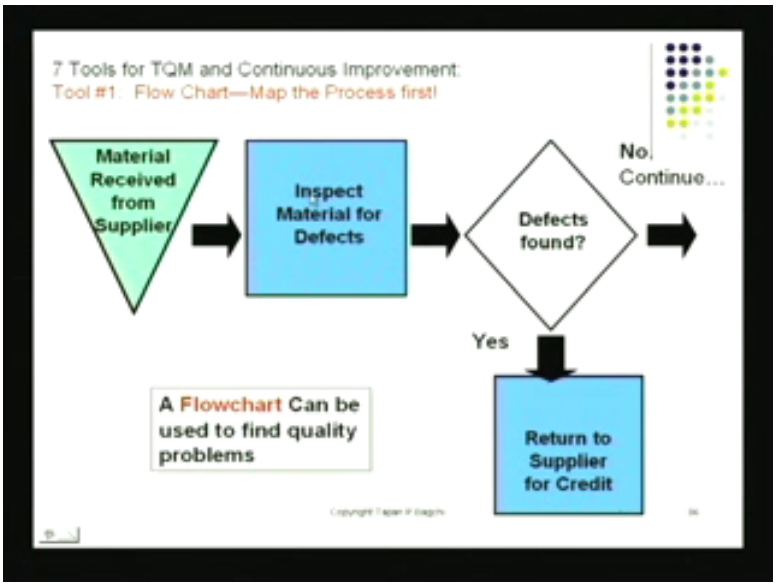

What are some of the tools, one way is to try to flowchart the process? Go from the beginning to the end trace, the process and try to locate those sports where quality seems to be out of fact out of control then you focus there and you would try to take some steps before that try to make sure again the process comes within control.

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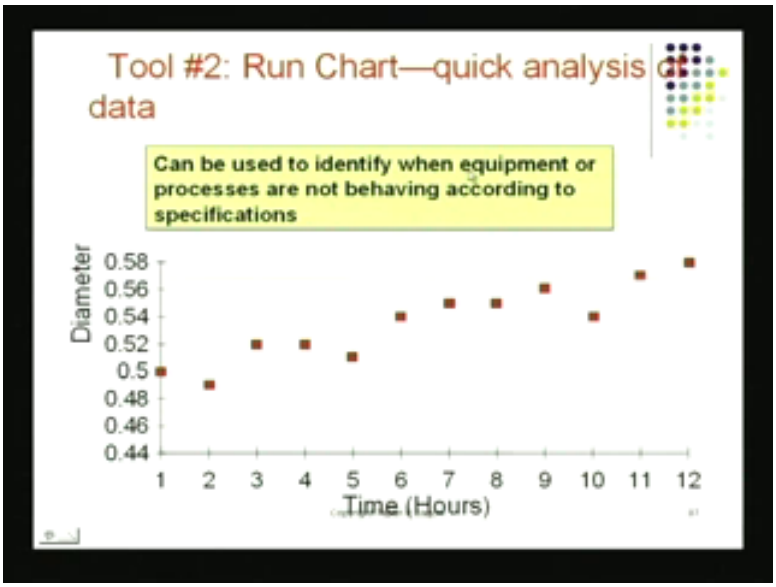

There is a run chart of course, and I have given you the result of it and it can be used to identify when equipmental process. They are not behaving according to specifications. This is really it has got spec limits here not control limits it has got spec limits here that is how it is trying to do.

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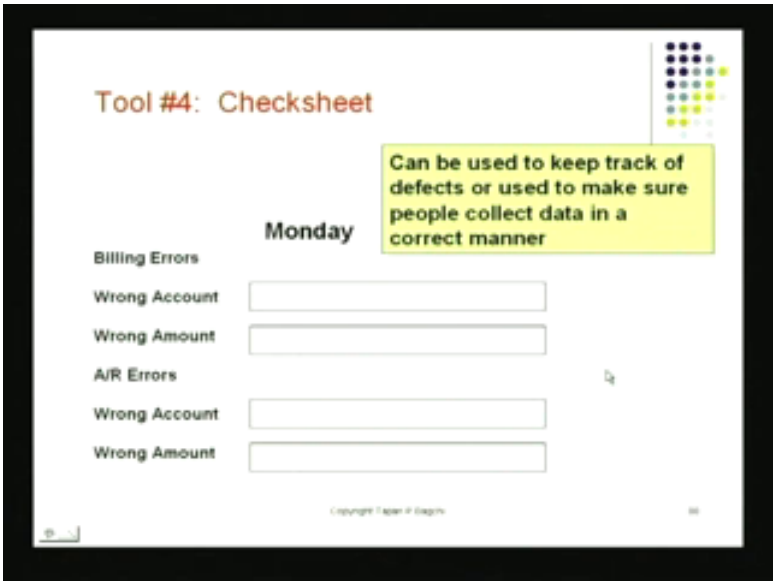

Then off course, you have this little data correction chart called the checklist; these are all TQM tools

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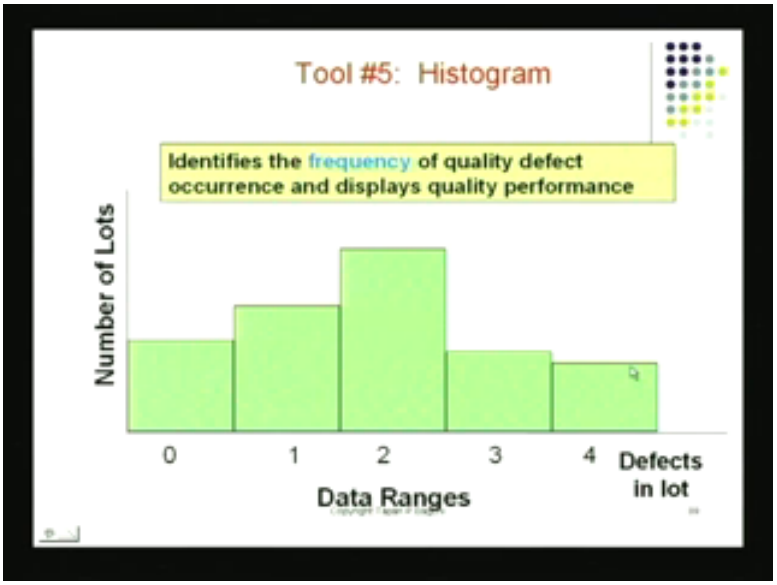

You got something called the histogram, which gives you the picture of the history of production and if on top of this. Suppose, I able to super impose specification limits then I can find out you know what are parts that are out of spec and which are the parts, what is the fraction of parts that is within specification that is something that, I could do very easily with the histogram.

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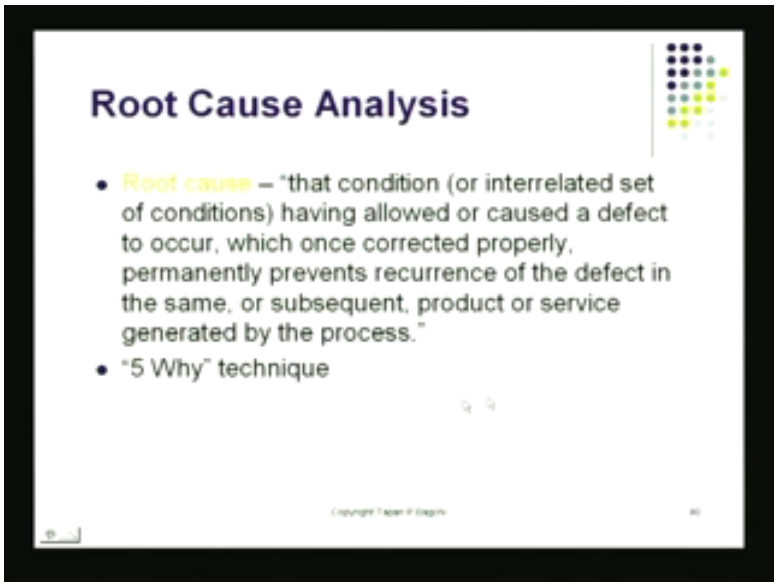

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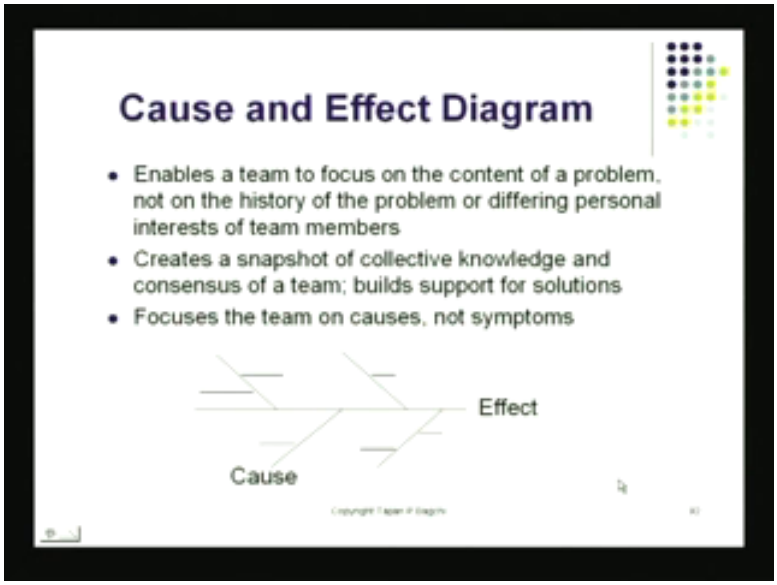

When it comes to root cause analysis: the best tool for that is the Cause and Effect diagram. The Cause and Effect diagram is the Effect taken on the right hand side and the

various causes; initially, they are developed by doing speculation you do not try to solve the problem directly with the cause and effect diagram, but first you try to speculate what are the different causes that might have cause this and I am going to go back that teacher coming late to the class problem in just a couple of minutes.

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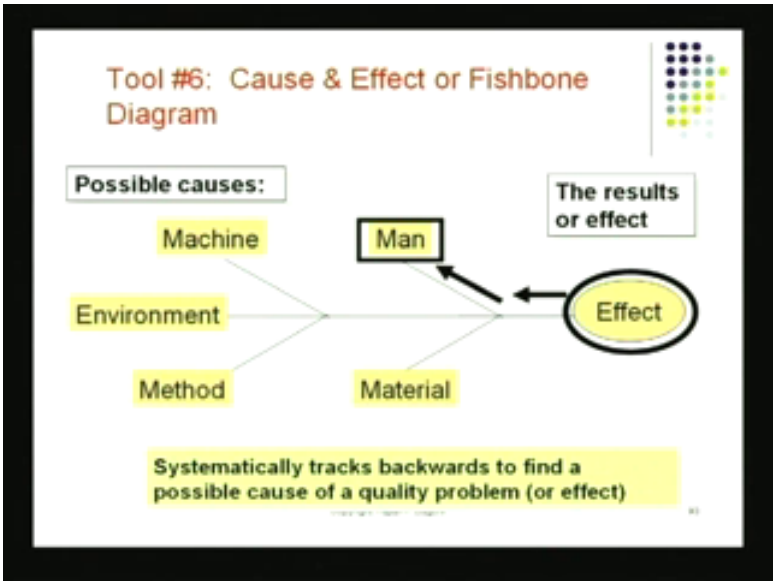

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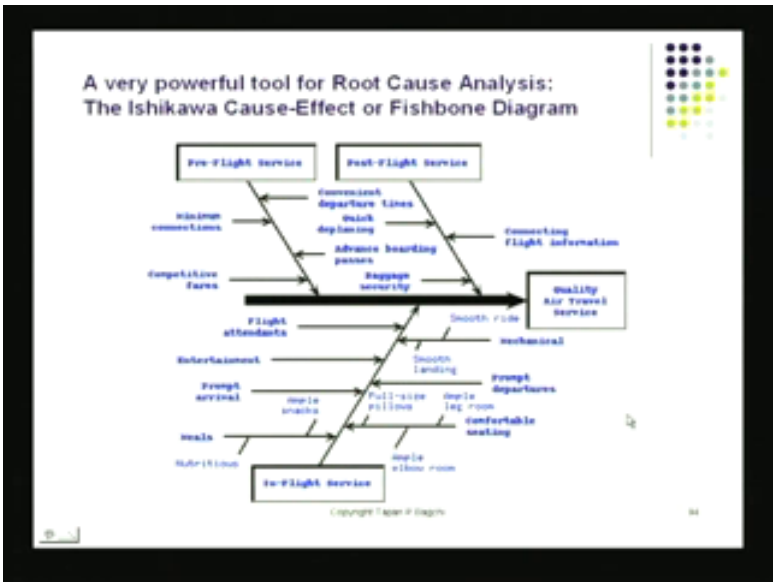

Let’s take a look at one finished cause and effect diagram: this is like one that is under construction and this is the one that is been completed. So, it has got many more details

let me tell you now, what happened in that class teacher coming to the class situation. We went to this empty class room and we wrote down the effect to the right.

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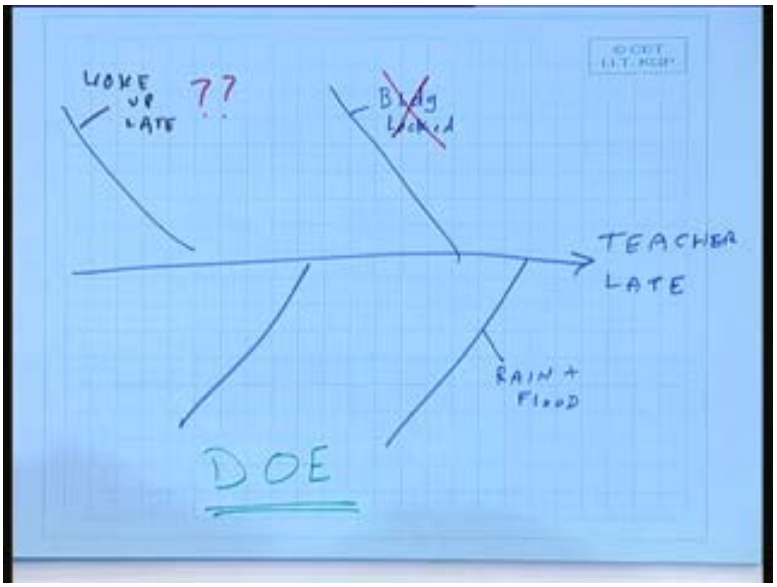

we said teacher comes late to the class and I do the fin of the fish teacher late and this could be caused by variety of different things and the student of course, did not want to be kind of put on to the spot he did not want to be come up with the factors himself; he knew many factors, but he dint want because I was a teacher I am a teacher he dint want to sound like offensive. So, he held back a little bit then I had to provoke him a little bit and I had to provoke him a little bit. So, I started out by saying well the teacher late ,may be because the building is locked, could this happen he said sir yes; what about rain and flood could that also prevent this teacher to come rain and flood he said yes; then he started saying, what about other factors is it possible that he woke up late. So, he woke up late alarm did not go off and I acknowledge that and he we when turn around like this and believe we found the reason that were really strange for example, indeed the building was locked and the phone was not working and so on…

Would you believe that the teacher did not know the time of the class, because when we called up the teacher, he said well some students called I dint really know the right time of the class and I said till it is confirmed that the time is right; how could I start the class? Because may be other people missing the class. So, I did not do the class.

So, this is like how you do slowly what we call root cause analysis. Then you start removing them. For example, if we found that the gate keeper the fellow does not show up on time. The fellow is suppose to open the gate open the doors his does not show up on time the class is suppose to start at seven thirty am in IIT Kharagpur. This is our routine and suppose the man with the key does not show up till after eight perhaps means that is his routine, but he does not quiet know that once he opens a door only then people can get in.

So, that had to be fixed. So, this problem had to be fixed by. In fact, telling him what the time was foe opening the thing rain and flood you could not do probably much about, but perhaps the access to the building could be controlled. If there is a huge paddle there probably one could not walk trough that basically this is how you do it what about waking up if this is something where the teacher had to change his habits. Let it be known to him, but would you really start beating him up will; you really start calling this teacher will you really start sending e mails; what you have to count is how frequently?

How often does this happen? If it happens like once a year twice a year that is ok, everybody understand, but is this happening like three times in a week? Then of course, something is wrong may be he is going to bed too late. maybe he is pleased the student his student keeping him up keeping him up in his office, till may be one o clock or two o clock of course, he is going to be late coming up and this I have personally experienced this things sometimes where students really stay with you for a later of you know till very late hours and of course, you are then kind of wonder you know what should I do/ shall I ask him to go? Or should I just complete this discussion? it becomes kind of a dilemma.

So, in any case the issue is this if we have to find the root cause for an issue that is there a quality problem that is there you got to be able to construct this initially this is done on speculative bases. You see in this chart that is the finish chart on the screen. Here, this is a finish chart then you start examining them. This is only one use of this control chart or of this fishbone diagram the other use is if you got definitive factors. Here factors A,B,C,D, these are control variables if these are factors, that you can control you could take them high you could set them at the middle or you could push them down to the low setting you will have to find out what is the right setting for this and the technique for doing that.

Can you tell me, what that technique is I think some of you would remember it is DOE design of experiments a design of experiment is also the is right at the core of six sigma. So, it tells out that the cause and effect diagram is the beginning of the six sigma project. I have done it personally nobody gave me the factors nobody told me Professor Mr. Bagchi here are the factors and just please play with those factors. I had to make sure that none of the important factors were left out of the list, for that I had to get back to the cause and effect diagram. I really had to get down to this had to make sure all the important factors are captured, then we would you know construct the matrix and start doing all experiments.

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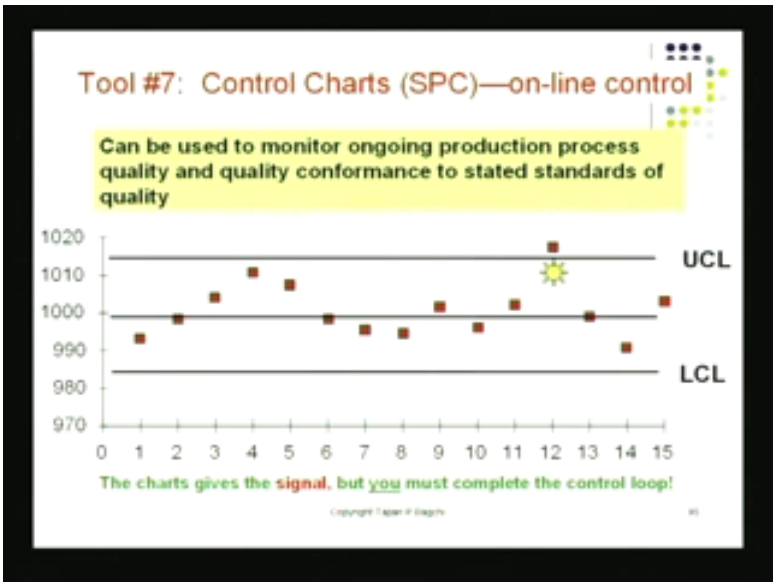

So, it is a very, very important tool. I just cannot tell you, how important some of these tools are even in a large project like six sigma project then of course, you got SPC and SPC comes along not exactly at your start of your six sigma project, but in the control stage DMAIC. So, at the C point when you want to stabilize the process and you want to keep it that way use SPC to monitor the process.

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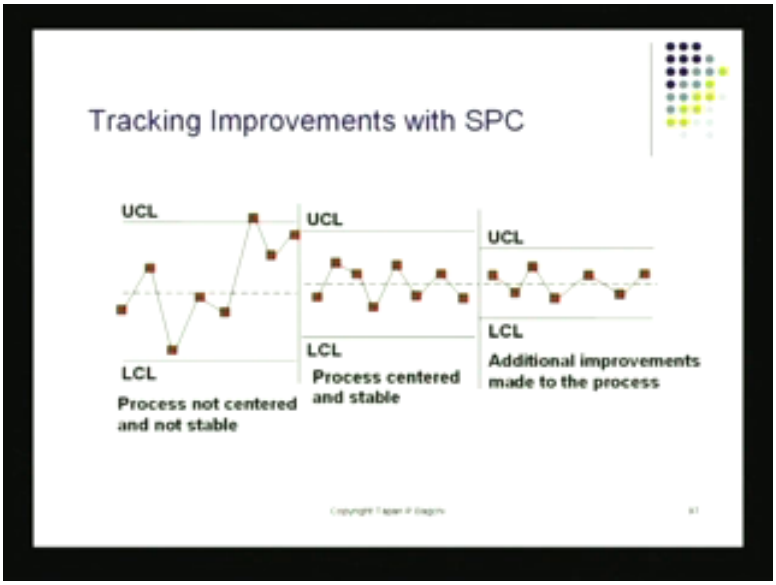

What is the result for doing all this? If we start with the process look at the look at the distribution on the left hand side, its wide; that means; perhaps my product is probably out of specification occasionally. I should just remind you that here, I got control limits, I do not have spec limits, because what I am plotting here is some variable like X bar or R which are really statistical in nature these are not individual measurement. Then of course, after some work after; some troubleshooting, I am able to narrow down the variability. So, variability is maximum at this end its medium here and its narrowest here hopefully more customers more customers are going to be satisfied at this level this is something.

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I have got to remember this is like one tool how do I get ideas where the best way to get ideas is by Brainstorming and there are those rules. If you have any doubt pick up some books that discuss Brainstorming and look through the chapter or go on internet and type Brainstorming and just see what comes out you will get many, many people who are writing on this Brainstorming.

You will find many articles on it perhaps, even white papers and you just read them it is not that difficult to basically learn about it is somewhat difficult to control yourself when you are in Brainstorming situation because we tend to speak up and we tend to control others quality circles is the same way interviewing is like another way to generate ideas Benchmark is a great way and the Japanese pheasant 5W2H that is like an another method, what you could do that.

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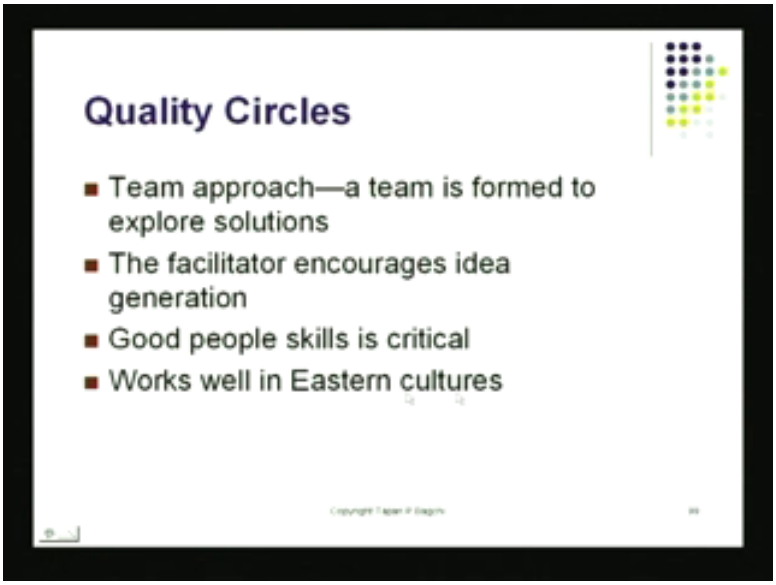

Quality circles, I am just going to be you know basically displaying these are screen saved for you is a slides here quality circle is a team approach of course, it is made up volunteers and. So, on and it works very well on unfortunately in the eastern cultures it does not work so well in the west, because tend to be more people tend to be more individualistic that is why does not seem to work there.

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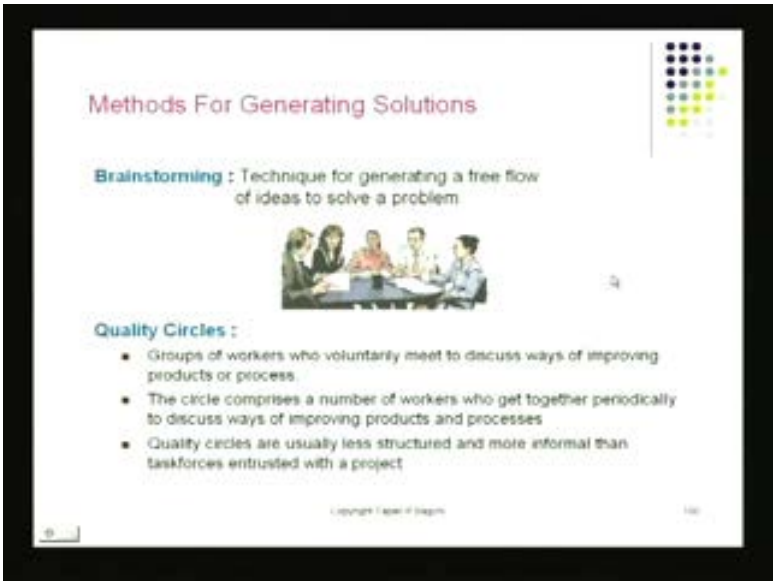

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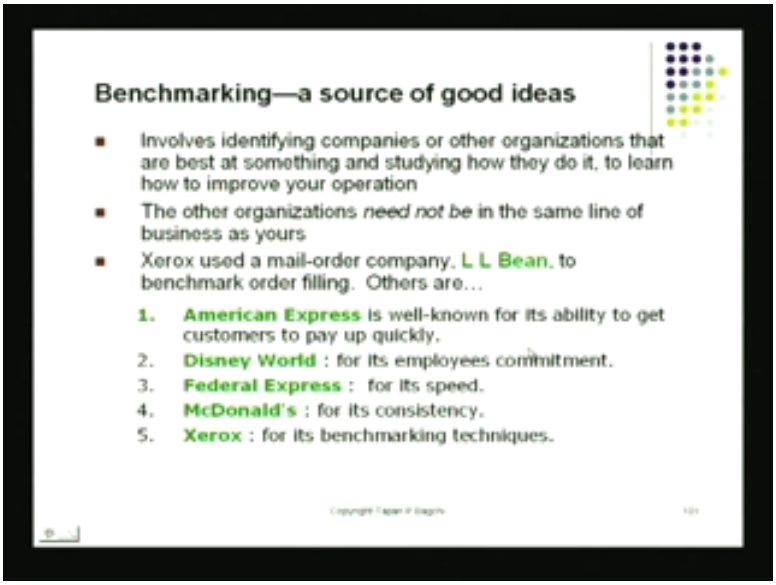

Generating ideas of course, brainstorming is a great way and this is something like that you would really practice and you should really see that how a good person does that. Benchmark is the great way to find out how other people are doing the same thing, but they are doing it better you basically, you just have to go there and observe what they are doing. So, for example, let us say you want to improve your study habits or you want to come up with you know with high grades in your class as an example. Somehow, find a person who is better than you and observe how he spends his whole day; find out what all different activities does he involve in himself will do? Yes his IQ may be different from yours, but what all the other stuffs he does, perhaps when he leaves the class he goes to an isolated area and glance through the notes.

Perhaps, he takes a pen and he marks all those things that he needs to get clarification on perhaps when he comes to the class he sits right in the front bench and he is always interacting with this with the with the teacher to try to find out, what is going on; perhaps he tries all the problems that have been assigned to him; perhaps he cross checks the answers with other people; perhaps he works in a group. So, find out what all things he is doing and find out things that you are not doing this is the way to Benchmark yourself his, Benchmark is here and you are here and you have to rise up to that level this is also done in by industry.

Many industry institutions organization, they encourage benchmarking because they want to be competitive not. So, much competing with each other because people may come from different area for example, here I got American express, they have a way to get customers pay up quickly and many people, many companies have real great difficulty in getting people to pay on time.

Disney world look at employee commitment and every time, I have visited the Disney world or the Disney land I have been amazed by the dedication people have their, these are the workers they probably do not get a paid a lot of money, their pay is not very different from others people other places, but somehow the organization is being able to inspire them in a way they feel they are there only to provide service to entertain people that is what and it shows on their face; it shows in their action federal express for its speed; it is considered to be a Benchmark. McDonald's for its consistency whether its Tokyo whether it is Delhi or its Newyork or any place you go to McDonalds you order something you order fish burger it will have the same taste the total sauce will have exactly the same in a tangy feeling, consistent it is just amazing he would not even know where it came from Xerox for its benchmarking methods if you just want to learn about Benchmarking look at what Xerox does like a great way to do that.

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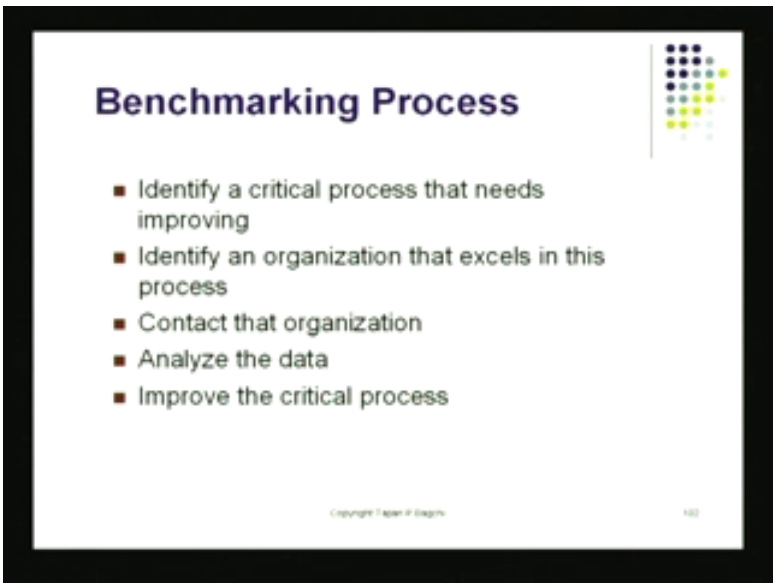

So, there are some details on Benchmarking process and I am going to be flipping through them and you can pause, if you want you can read through them and if find out exactly how this is done.

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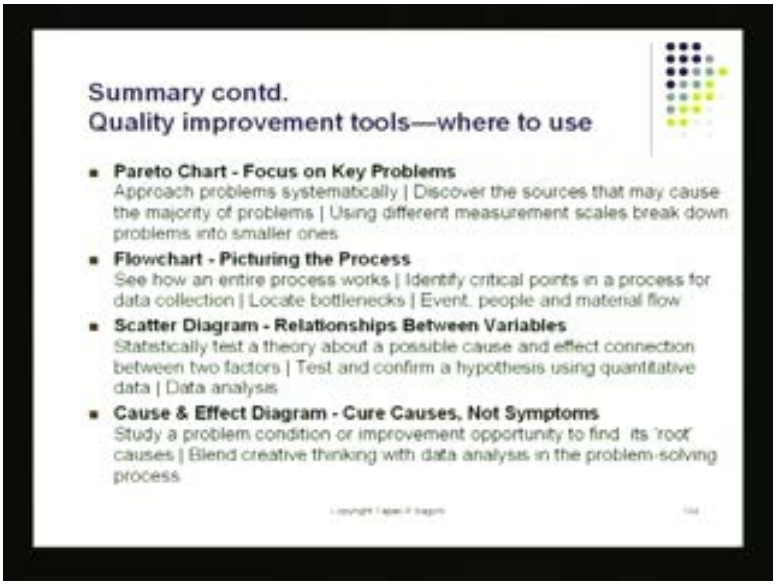

So, this is going to be basically couple of slides are there to summarize what all things are there in terms of the tools and their utility these are all TQM tools they are all utilized in eventually going your six sigma projects .

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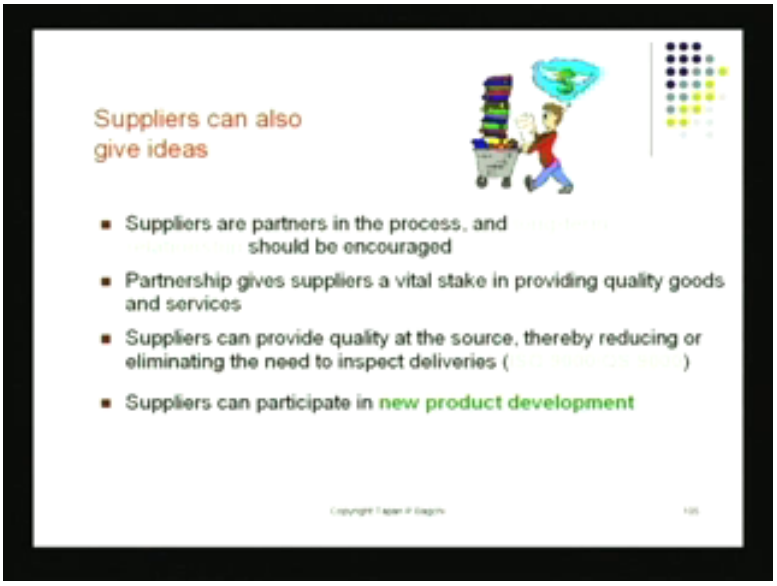

Your suppliers can also give you a good idea that also comes along something got to keep in mind is that in any of these things.

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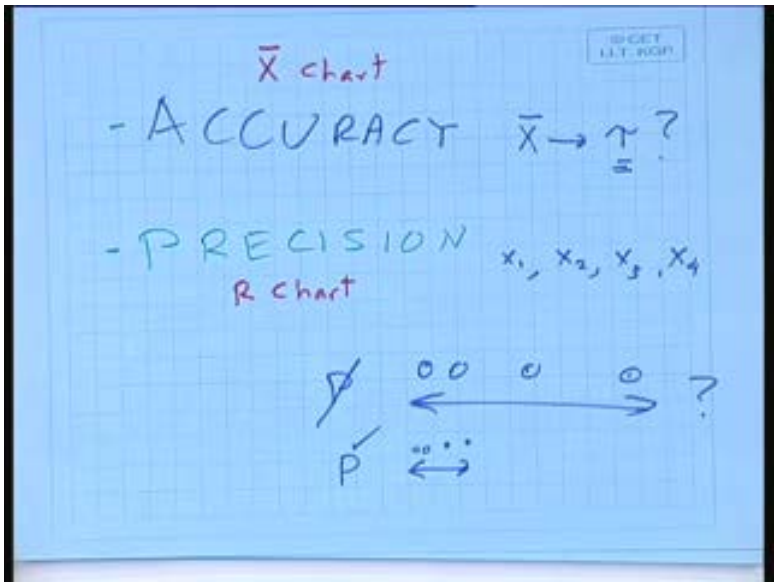
Whether you are drawing control charts or you are doing design and experiments or any of these things. You are making some measurements and you got to make sure your instruments are proper and there are two things there are two very important things in regard to instruments. The first one of course, is that the instruments have to be accurate. This is something very; very important instruments have to be accurate.



So, accuracy is something it is very important when you are using an instrument and the second thing is the Precession also has to be good let me define these terms for you very, very quickly Accuracy basically says how close you are average is to the target. So, let us say my average is X bar how close is it to the target tau the closer it is the more accurate your system is. So, if you look at an instrument for example, if you are looking at the gadgets, which are on the screen here you have to take a standard object and you know its two dimension then you take some readings with these instruments and you look at the average quantity if that happens turns out to be close to the target, which is the true value your instrument is accurate what about Precision what about that dimension if I take multiple readings X1, X2, X3, X4 are these kind of scattered around white space or they scattered here they scattered over a wide area if it is like this, then the Precision is lacking, but if the measurements individual measurements of the same object if they turn out to be close to each other like this. I have Precision I have good precision.

So, it is the strength of repeated measurements that will indicate to you, how precise that instrument is and these are two things that are also very important in process control when it comes to accuracy. We want to make sure our stay in control they are Accurate and also they are precise to try to make sure that a process is accurate, we used the X bar. chart the X bar control chart and you to try to make sure my precision is there I use what is called as rain chart or the R chart, that the R chart will make sure that you are able to get precision in your in the delivery, on the output side of the process, which I will discuss again when I get to SPCI will discussing about this again you just be aware of it.

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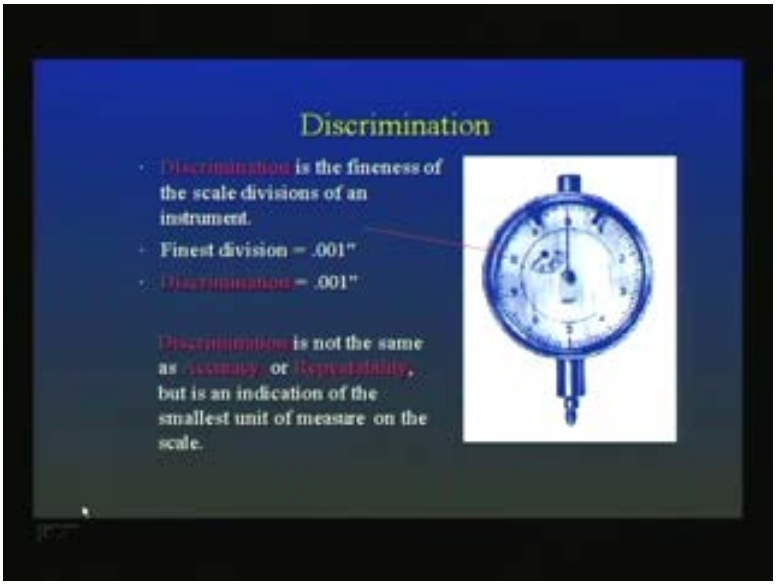

So, Instruments have to be right and there are certain things that are called gage R and R study.

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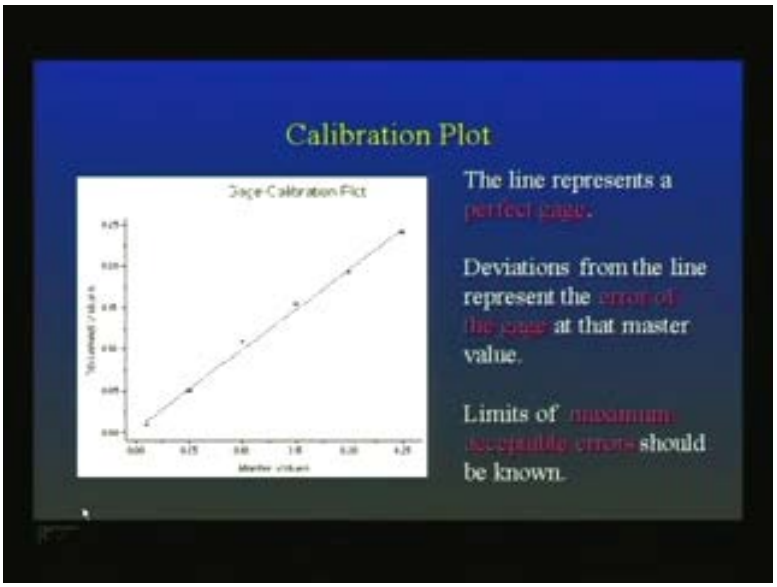

The finest with, which you can make the measurements your Calibration should be right. Calibration by the way it helps you make an in accurate instrument still provides you measurement that you can take to be corrected Calibrated readings. If the instrument is calibrated, you know that a certain reading is equal to a true reading of this value that is done by the Calibration plot. This is something, this you got to keep in mind and this is

something kindly taken into consideration. Whenever you are using an instrument, please go through the records of the instrument and try to find out it has been calibrated using some standard methods.

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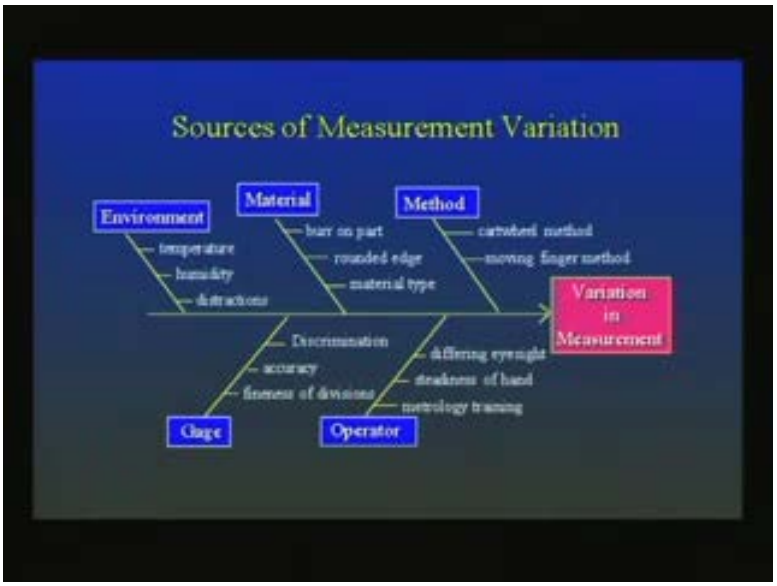

Then of course, if variation is in the thing then your precision could be impacted and further you have to do some studies and you have to run some special tests.

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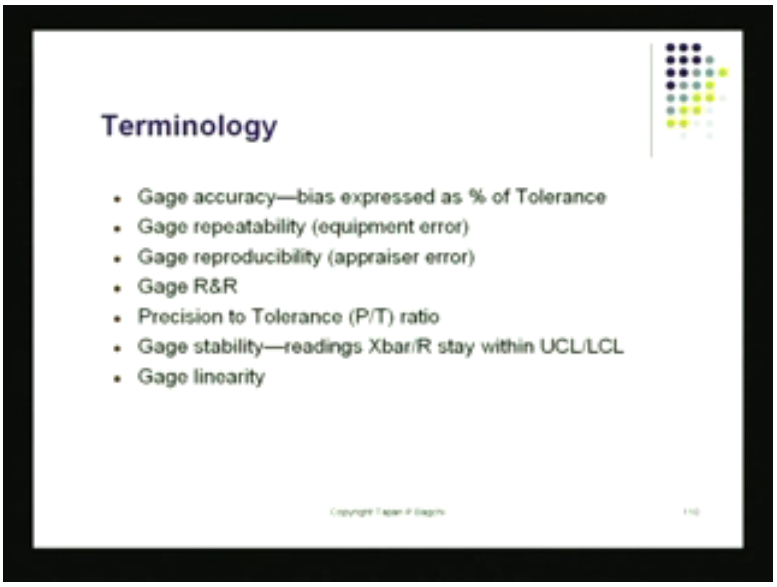

Special experiments to get an idea of how precise that instrument is or how poor the Precision is and this whole area is called gage R and R.

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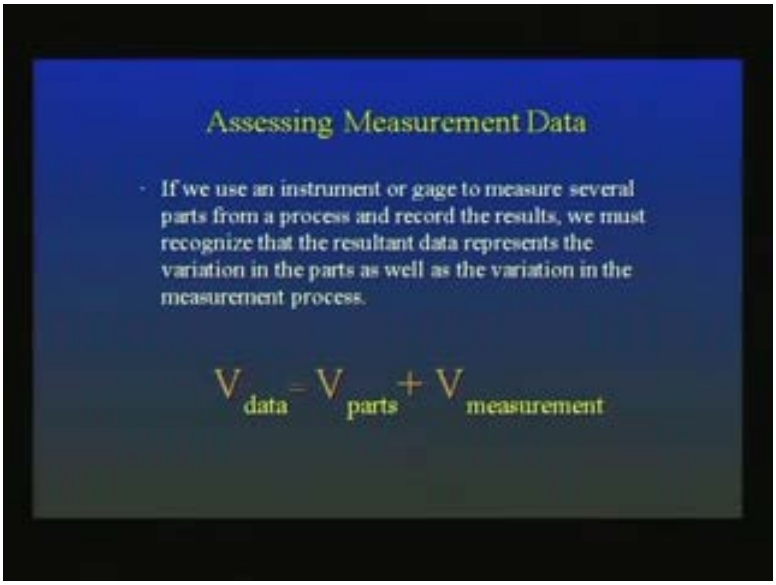

If you are collecting some data, part of that data could be because of the parts that you are using and part of it due to measurement errors. Part of the data the variance that you are seen in the actual data the numbers that you had collected to come out of this instrument readings those could be due to the two parts; that those two variations could be because of the different parts they are using. These different parts, which produced at different times there may be some natural variation. You know there heights are different there thickness is different and that is the natural variation; that is the part to part variation, but if I am using an instrument to measure their height then the instrument also itself can introduce some variation.

So, there are two parts of it. There is the parts variation and then there is a measurement variation. It is very important for us to make sure measurement variations are as small as possible and most of the variation that I see in the data is really due to parts variation because that is what I after I could not be bothered about the performance of the instrument. I really want to make sure the data that I see is reflecting true part to part Variation that is what I would like to see for that you need to do.

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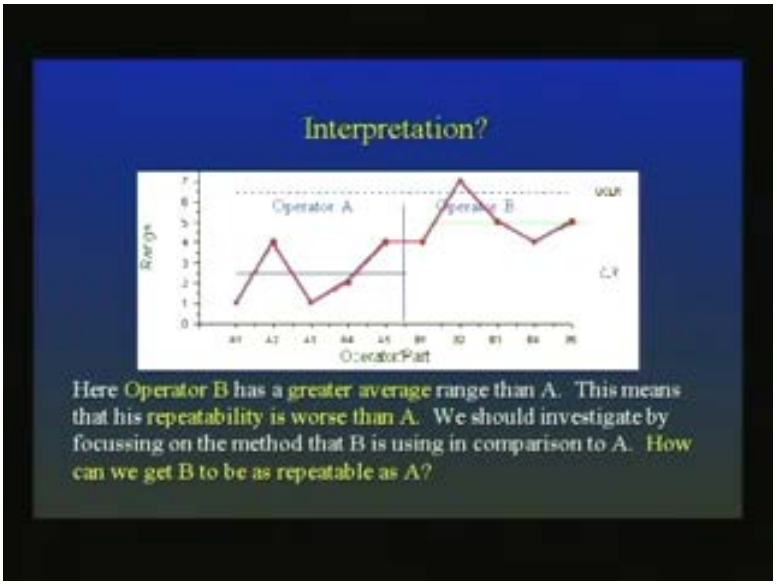

This gage R and R study there is some methods are there I just mention this ports to you gage R and R.

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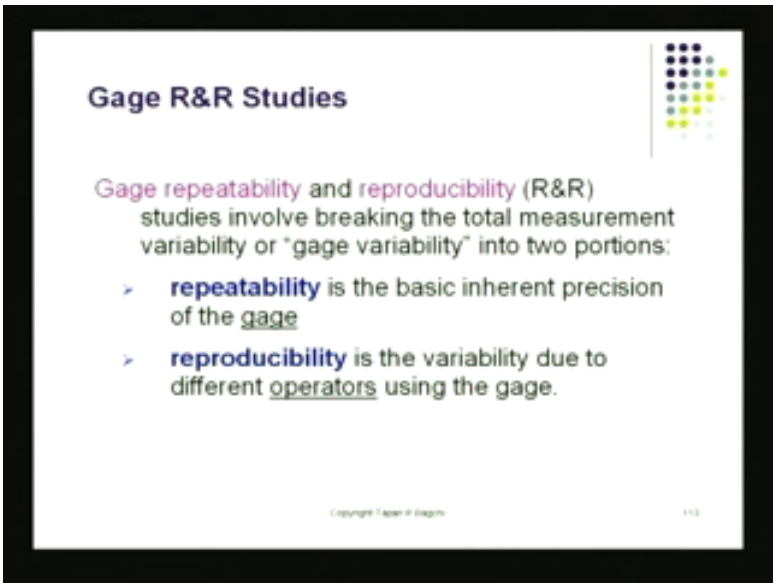

So, where ever you are you please try to make sure people have done a gage R and R study, before you go into an TQM application; before you go into control charts; before going into six sigma projects. Please make sure the gage R and R studies have been done only then you start your six sigma project.

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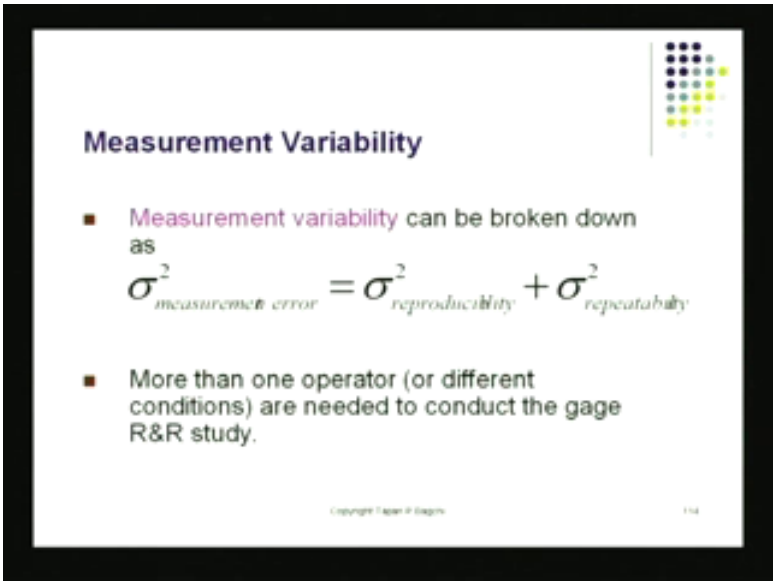

This is like taking care of your down keeping basically your housekeeping. So, measurement errors actually they themselves could be caused by people or they could be caused by instrument. If they are there are different technicians we say, if different technicians are producing different readings the measurement system has a reproduction problem. If the same instrument produces different readings in the hands of the same individual then there is a repeatability problem, these again have to be understood and you got to make sure that this total measurement error again is quiet low. Normally speaking in industry people say measurement error should not be more than ten percent of what you are trying to measure. That is just like rule of thumb that is all it may not be good enough for you, but that is something that will have to do.

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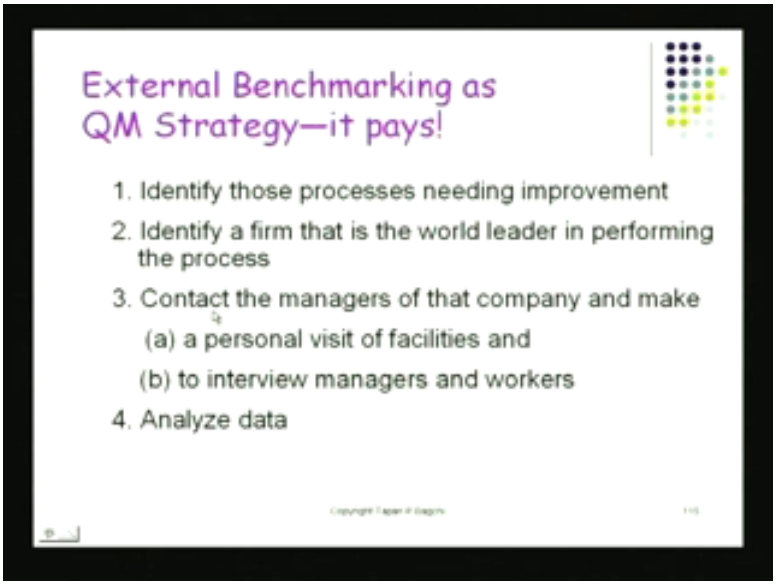

Then of course, is this issue of external benchmarking. That is like you take your work workers to another company. For example, if there is one particular company that produces electronic parts like you know inside mobile phones, there are these little printed circuit boards on which they have got the transistors mounted and the registers mounted and coils mounted. Sometimes that soldering is not quite good and you have some defects in the instrument or the instrument stops. For example, even in mouse here inside there are some soldered parts and if soldering is not been done very well then you will have difficulty in using these instruments for example, in the old days the pc's used to be that way.

Many of those they came out hand assembled parts and they did not really behave very well. The issue was this how do you produce well, good? You know properly soldered printed circuit board. A machine came along which is called a wave soldering machine and this really. Lets the PCB, imagine the PCB floating on this the little wave of more than soldered and the PCB floats on it. When it comes in contact with the mountain solder, it picks up the solder and the joints they become properly tinned on and so on. The solder is perfect.

Now, this is all fine, if my machine is controlled very well this is a process machine and I am floating; I am basically floating this part from one end to the other end. There is a heating stage, there is a warming stage and then I insert the path and then I bring over

this thing then I cool them of and. So, on this is the process with different stages; if this process is not controlled well you may not work with; you may not get proper outputs. There was one company, where they were using this web soldering system to produce their parts. They converted on to this web soldering system because they got tired with the manual soldering they had all this you know these soldering guns and it was hanging by a cord and the worker would go there and he would sold out this he would sold out, this he would sold out this.

That is how, he was doing the assembly they found this was highly Labor intensive. There Intension was to produce good parts and also make sure they could cut back all Labor requirements. So, they installed this gigantic web soldering machine, after six pumps of operation they could not really produce good parts with this new system they could not do it. In fact, they had to bring all those people that they had laid off, back in the shop again and their job was to take these parts that were not behaving very well and touch them up here and there and so on, touch them up. So, that it could be put into the real machine inside may be mobiles or whatever ever they were suppose to go inside, they were really frustrated.

And again I got called in and I was told; could I help them in certain ways and ;I looked at their system and I said well it looks like lot of things like have not been aligned properly. So, you have to do some study and do it and the manager like most managers is very impressed, he said well professor, “I do not have that much time; I have already spent six months and I think; I have done all the training that; I could and still we do not get good parts what do we do what do you think”. we should do our professor; obviously, took some time in two, three days once I was brushing my teeth early in the morning and I got this idea may be what I could do is; I could load up these guys these workers couple of supervisors in a mini bus and I could take them to a place where they had a properly functioning web soldering system and I had just led these guys just watch.

Do not ask any question nothing at all just watches. Watch this system in operation they had their own system in their home in their home based which is the factory where they work and they would not taken into this new place the other factory they would just they would just allow to watch basically what is going on because; obviously, the other company did not want to share a lot of tricks with them, but they could really you know like people come to for site seeing and all they could probably have come and take a look

and so on…Later of course, I got them to talk to each other also that were because I knew people personally have both hand sides got new people. So, I could bring those people together and I got them to have coffee together. That turned on to be a really successful project benchmarking project what happened was? When I brought this team of workers who are really bad performers poor performers in the eyes of their management and that will operating this pooled function in web soldering machine, I brought them to this other company where they had a properly functioning system there.

These people watch the system for about half an hour, there was totally silent and they watched it some more after that one hour they started watching some of the a bit more carefully, what exactly was going on in the shop they found the lot of tires; lot of controls; lot of this; lot of that; these were not there in their own system they were not there they are like a temperature gage there is speed indicator that something else and. So, on all these things were there they had a video camera somewhere and other was the system was the system was the same they had back in their own home.

They are the same system, but these people they had many more other things that will almost monitoring this thing particular there was some gages: Speed gage, temperature gage and so on. they were there and occasionally they found, you know that little the wave was there the wave of molten of solder some fellow went and took some sample sort of in it put a little you know little thing and he dipped a little bit of it took it out and did something with it and he came back took another little thing. He was taking samples basically he was trying to find out was this getting oxidized was the tin getting oxidized, I was just still for you know some more another hour.

These people the visitors they observed this very carefully, I actually asked them at that point in time are you finding anything new here and he looked at the system and So on. So forth are you finding anything new here. he said professor I cannot tell you how great full we are I said tell me what did you see, he said first of all it seems trying there is some relationship between speed and temperature and all these things we do not know that our manager says produce, produce, produce. So, we had done it as fast as we can. Now I do not know I personally do not know if any of you have when you young if you tried your hand at soldering done. I do not know if you have done that you have to give it a certain time to warm up, if you have give it a certain time to for the beat to become shiny the time; the length to become shiny you have to give it some time to hold it there

till the junction actually takes place then of course, you can let it cool lot of things have to happen correctly.

So, the masters soldered people, they really know this thing very well and none of these actually had been optimized in the system, that these guys had installed they said professor there are. So, many things we have to do can you just make a note of at what speed they are running and bla bla and those things. I said that I do not have that permission today; I will try to get that and perhaps you should you guys should go back and try to pull out the technical manual that you have dumped you have a similar machines. So, you must have a technical manual with it.

So, pull it out and just see what it says and compare that to your own running condition, how did this happen? How did all this happen? it happened by benchmarking it happened by benchmarking this is like something that is I will say it just opens people eyes you do not have to do any training at all they are smart they can see it is like you watching your buddy who is getting A after A after A in every exam and you are not doing. So, may be you are goofing off a little bit too much may be you are spending more time at the tea shop or something may be you are staying up too late and may be you are too goggling in the class, when you come in the morning now you are like you going like the class; you cannot really concentrate you cannot really pick up much, if those things are happening watch out you area a prime candidate for benchmarking.

You can improve if you keep your eyes open; if your ears open and; if you go there with an open mind, I am there to learn; I am there to see and observe and make some notes you will end up taking up a lot of tips a lot of tricks and these are shortcuts. you do not have to try this and try that and then get to the right spot; you will not have to wake up at five a m you start your studies six AM start your studies seven AM start your studies and see at which hour, I wake up; I get maximum marks in my quiz may be its six point five or something you do not have to do that just watch that other fellow, he is similar to you in most aspects; he is similar to you the Japanese; obviously, other methods like Shingo's method.

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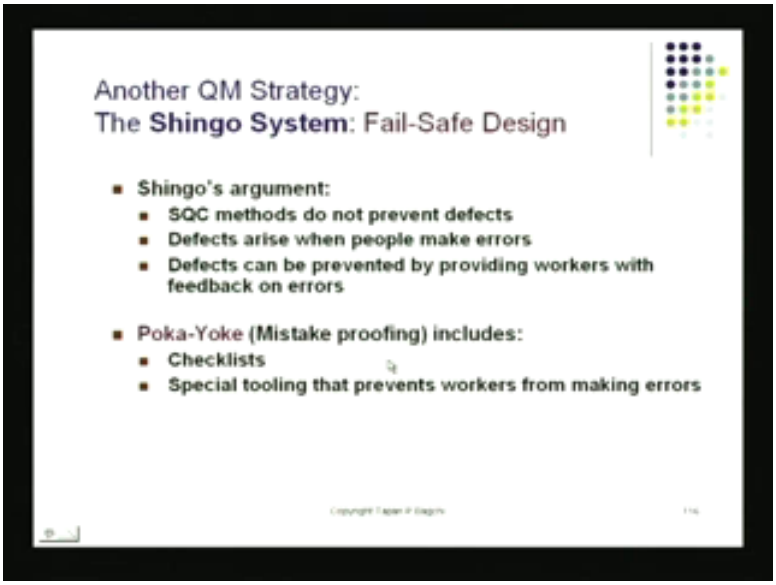

I have done this poka-yoke method which is like which is like you see a lot of these things when you look at electrical points. For example, I try to see, if I could find a there is a plug point there on the wall you cannot probably see it because its outside the range of the camera, but many times if you look at the sockets, if you look at the holes in the plug they have used some bit of Poke-Yoke. So, that the five amp five amp plug will not go into the fifteen amp plug fifteen amp socket it just would not because they have applied some bit of poka-yoke because people make those mistakes; I remember in the early days, when the connections were difficult to find the telephone wires the guys those who fix telephones in your homes they use the same plug to.

You know basically take it two from plug and that is used by you know electrical amp people and they use the same plug to telephones also some I have physically seen a lady you know quickly pick up a telephone and plug it into a volt plug which has electricity and sit a little far there luckily she was safe, but I have seen it with her own eyes the plugs looked exactly the same it was no difference that is not poka-yoke. Poka-yoke is when the plug shapes are different and plug size are different and. So, on this is like something by which the Japanese produce a lot of good quality products.

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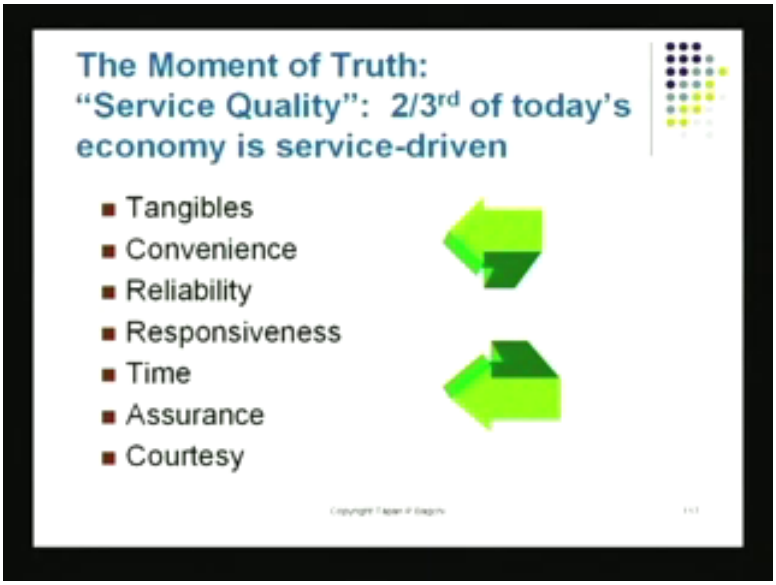

So, there are in the end, when you look at service quality the moment of truth is when you directly come in contact with customer face to face. Lot of things happen, then there is a lot of interaction and at some point in time people say you get the message. why is it that we call something service driven, because we look at tangible things that the customers is looking for; we look at convenience; we look at reliability, if he curse that again does he see the same thing; responsiveness time and so on.

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This is like on whole area, and there are five shades of about service quality, and service quality as; obviously, and lot of these things if is like a hotel for example, you see you see facilities that are clean; convenience is something that you would like to see lot of convenience is shown there reliability is also again something, that you would like to see responsiveness and you can read them; you can really see and you probably agree with them that these are all vital, when it comes to providing service. I should tell you about one or two of these things for example, in a surprise that I got when I went to French hotel this is in near Mantria hall I walk in there and I as I was getting of the taxi, there is this bell boy he walked up and he said [FL] [FL] and I said [FL] nice, nice good wonderful and so on.

He just asked me very simple question sir have you been here before and I said yes; I have been here before; I stayed here before that was quiet some back a couple of years back I was here that is all, then I walk up to the counter and the young lady is there. She looks at me; she gives a wonderful smile. It is wonderful to see you sir you are back again it's wonderful. I was really surprised; I was shocked; I had never met this lady; I could never remember that, I met this lady how she was saying this.

You know what happened, the bell boy, because he asked me that question that have you been here before he was standing behind me; he was with my bag and his hand went like this. I of course could not see that he was doing this behind me and that lady picked up the signal from there, this is an old customer, and she specially good is to me and I felt like I was wanted here, and I stayed there one extra night. So, they got some more business out of me, because I felt, this is the difference of quality service this is approaching six sigma. I continue with the theme as we move into this, I will continue with the theme. Thank you very much.