Six Sigma
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Lecture No. # 09
QM Systems Overview

Good afternoon, we resume on lecture today, this is in the series of six sigma.

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The topic today is to begin with a review of quality management systems; that is what we shall began with. And in that I will be discussing some concepts on TQM, then I will discuss a little bit of ISO 9000. I will give an introduction to system called QS 9000 which is used in automotive industry. And as we moving to this, I shall be bringing up other topics as well. And you find that it say pretty enriching overview of the total process of managing quality.

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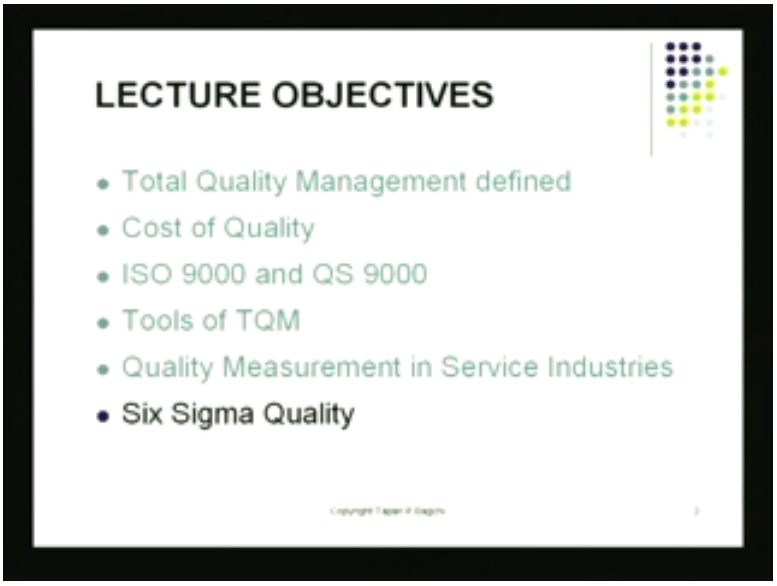

The lecture objectives for today, we begin with our definition of total quality management. Then we will discuss the concept called the cost of quality. I introduce ISO 9000 and QS 9000, these are two systems that are come about in the last, I will say about 15 years. Then will review the tools of TQM that will be done right off the bat. And as we getting to the measurement systems and in service systems, in service industry that also we shall review a little bit of and in fact we have a complete session on service industries managing quality in service industries. And of course, we talk it off with a little glimpse of the six sigma system for managing for quality.

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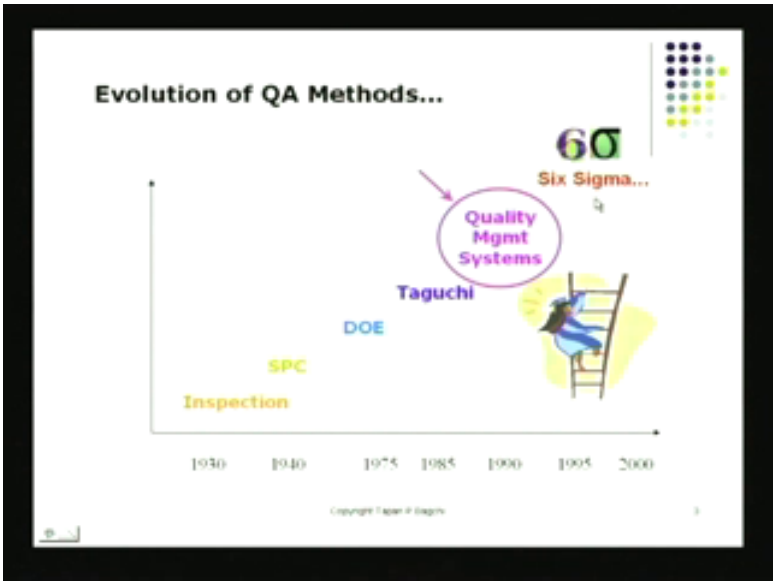

As you realize on this some (( )) of quality, the diagram that I have here, the display that I have here. It displays the years in which various systems have come about. And it began with obviously, the inspection then it went to SPC, then it went to design of experiments, then Taguchi methods come along, came along, then ISO 9000 and TQM these methods came along. And of course, the one, the most recent one of this front is six sigma, where the most of the leading companies are trying to get to that is like where we are. Today's focus is going to be on quality management systems.

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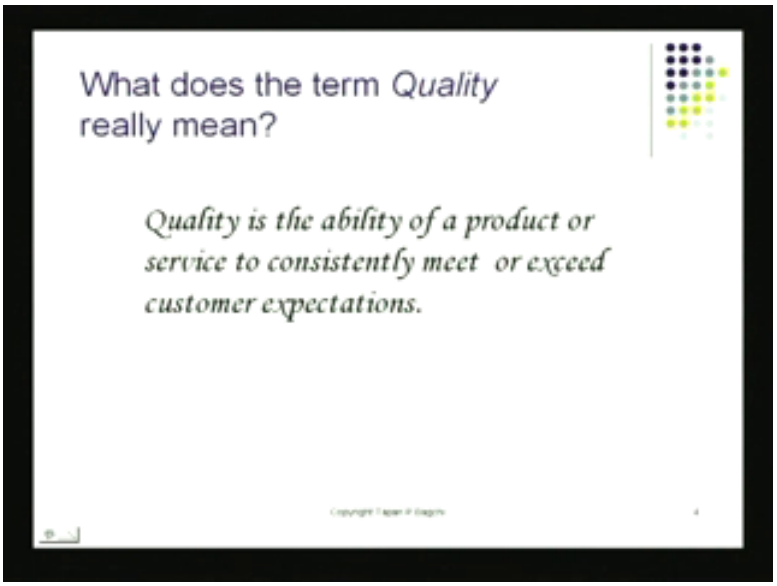

That is for is going to be our focus today. We begin with a recollection of, what quality really is? And quality is the ability of a product or service to consistently meet or exceed customer expectations. That is how quality has been defined professionally. And that is our goal.

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A historical summary again to retrace what we saw in the diagram is initially, we only had a few pieces produced at one time. Say in fact that point there was one person you had the focus, who was the producer also he probably the inspector, the evaluator.

And the proximately that was there between the producer and the consumer in those days that was like an artisan actually works. Then of course, industrial revolution came along and it turned out that many people had demand for the same product from the same service. Then long supply chains formed and the results was that there was a separation between consumers who are many in number, then and of course, producers who have to produce large quantities of products. It was then not possible to operate in the mode in which the artisan worked, it turned out that in that case we needed something that could assure quality and mass, a large quantities or products or services.

So, in fact at that point it was also the time when Frederick Taylor came along, it was the turn of the 19 century going to the 20th century. And unskilled labor was, what was thought to be the major resource in production and division of labor also took place so people got specialized into various things. And then they started doing their pieces and ultimately there would be one person who will be doing the quality inspection. Mass production actually was the way when we machines were also involved. And there was labor plus they were machines that together were producing these mass produce jobs.

We try to strive there for uniform quality, this was quite different from the old days when you produce one object at a time, you produce one piece of art at a time or one sculpture at a time and so on and so forth. It was quite different from that here, we were mass producing things and therefore, they have to be some control of the process. In fact it turned out that at that time we lost the understanding of the purpose of quality. We just thought perhaps, if we could produce uniform products with uniform quality that would be good enough. That was the time when Henry Ford started producing his cars.

And he probably know, he got in to mass production and he put in you know some simplified versions of tasks that was assigned to different people, who are position along the production line and they were doing their specialize jobs. Sometimes production also incorporated some inspection but most of the inspection was done right to the end of the production like that is most of the quality check was done.

The result was people liked these mass produce stuff, when consumer is the most, the way in which people started to move. Many people wanted to get the same products and the demand began to rise. And it must very clear that was not only price but, also quality that people looked at. And that was about the time of I will say about 1930s and 1940s when mass production became pretty routine. And that was the time when many people, they sort something besides the lowest prize and they did want to have some good quality in them.

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How the total quality management come along? This was actually management system that was put together to address all the tasks that affected quality in one way, the other. What does the phrase total mean in total quality management? It actually in means, the entire organization, the full organization had to be involved somehow in the delivery of quality. We have to make sure it also covered all the process and all the products. And in fact all aspects of managing, all aspects of delivering the finish product which would include management, design, control and make sure you have some customers service after that this totality have to be covered. And this would be the goal, total quality management.

So, TQM actually turned out in the 50s and 60s, it was not a flavor of the month. It was not like another way of that would go away after sometime, it was not like that. As it true for many management facts that come along as times moves along. In fact, what we wanted to have here was we wanted have a long term perspective and assuring quality that is something that we wanted to do. And the people who were very fast to adopt this sort of new idea, what the Japanese, they really understood. That quality of it, quality have to be talked about right on top, right of the top at the senior management level, then it would gradually come down all way right down to the level of the worker.

Even though worker would mindful of what it meant to have good quality products. In fact, it turned out that at that time because, of many tasks involved and these were understood, these were broken down, those were checklist prepared. And this checklist was guided by the principals of total quality management. What is the challenge today? Things have really changed from those days of just either the alteration type of production or plain mass production; things have changed quite a bit from there. Today actually quality has emerged as one of the weapons to compute in the global market place.

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You compute to get more sales, you try to raise your profits, you also try to have contracts that are like where people are competing with each other to try to land a contract with you. And there is competition for jobs, jobs that you get for people. In fact it turns out that is the economic reality today. It has been like that for the past 20 or 25 years. Competition is actually equally challenging now whether you offering a service or you offering a product. In both places, in both sectors you have a lot of competition today because, there are buyers and also there are many suppliers therefore, there is this competition.

In fact it turned out people realize that the emphasize on controlling people that has really not worked very well in this new scenario, when there is a lot of competition. And what is emerging now, which is like almost the, you know it began about 10-15 years ago. In the 90s it began is continuing even now, the people are now trying to control quality not by just by using one particular system. They use TQM as the foundation and then they bring sophisticated technique such as six sigma for example, do design of experiments in six sigma and so on.

So, if we go back and if we review the whole thing today, what we began with was really one piece of a time. Then it became mass production, then as competition began to raise, people started to excel, people trying to excel in the delivery of quality. It got to a point when just near TQM would not do, just the involvement of top managers and the rest of

them it would not do by themselves. You also needed some significant techniques thus when six sigma came along. (( )) The thrust of our lecture series.

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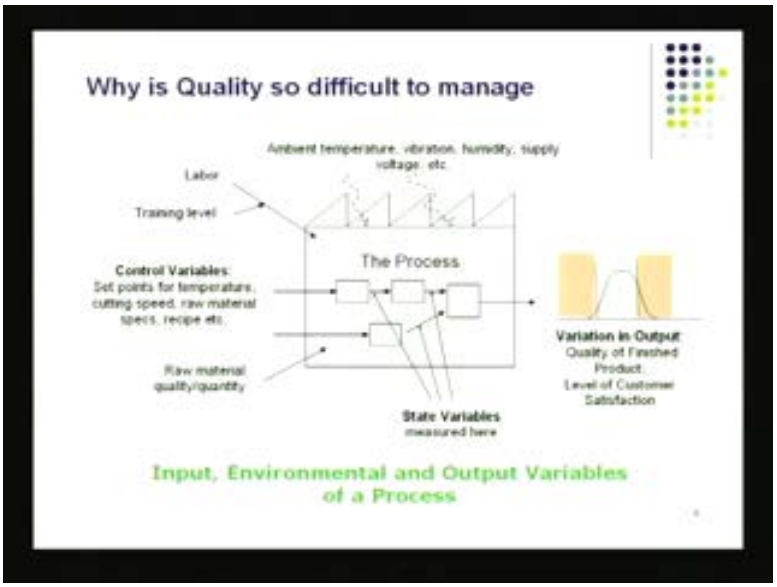

Why is it that quality so difficult to manage? Is they, is it something that is really complicatedness, look at the task. You realize this is a factory, what I have got here on the slides is the factory; there is a process there that converse the inputs into some output. Notice all the different factors that could be affecting the system here.

Then these are some of these factors are in your control and many of these factor they are in a control. You do not know when they are going to be active, when they are going to be inactive, we do not know. The result is when you look at the output, there is a lot variation. But a consumer cannot leave with any kind of output, he has got sudden requirements, he has got sudden specification, those specs you notice the red bars, you notice the output.

On the output side, I have got two bars here, I got a upper specification limit which is on this side and I am going to lower specification limit which are on this side. This curve here the bell curve, bell type curve, here that actually shows the variation that there is the output. It turns out many times the product is off spec on the high side or the product is off spec on the low side which actually means it has gone beyond what the customer would point to be acceptable. This is now the variation that is coming out of the plant and the result is the, it is resulting from all the different factors that are changing, that are

impacting the process. The result is that so these output they are not going to be acceptable to the customer.

Now, if we consider simple object like a pen for example. Consider a pen suppose, I start mass producing pens and do not do good quality control. And I produce these parts, I have the caps and then of course, I have got the body of the pen with along with a tip and so on and so forth. And suppose there is a lot variation in them, a lot of variation in the production of the caps, a lot of variation in the production of the things there. What will happen? They will not fit together. That would mean either I rejects some of the caps or I rejects some of the bodies, without that I will not be able to find something that fits together and that is ok for the customer.

Which should not means I might be producing some caps that I cannot really put into the finish product. That means I have to throw them away, it might mean the same way for the body also. The body also may be in some cases it may be off spec and i may not be able to use it to produce the finish product. Now, this is a real challenge what really happens because of this is, if you look at the production of parts whether they are within spec or off spec, it turns out the production of the part cost being the same. The body also would cost being the same whether it is off spec or within spec.

Suppose I produce a lot of products, lot of bodies, lot of parts, lot caps that are off spec. I will not be able to use them in production and therefore, i will have to trash them or up to really junk them. They are going to be losses they are going to be scrap they going to be waste. Unfortunately, money is tied up there, money has gone into it, material has gone into it, labor has gone into it, energy has gone into it, all those things have already cost me some money. If I am not able to sell them because, the finish product is not acceptable. What will happen to my profit? My profits are going to go down because, I will not be able to sell this defective item as a finish product, that is a big problem with quality assurance.

If you do not have quality assurance we have probably produce a lot of caps that do not really meet the final specs, you produce a lot of bodies that also do not meet the final specs. As a result you got a lot of waste that means cannot be really recover, it is gone now it is in the trashcan and therefore, it is not going to contribute to my profits and therefore, my profit is going to hurt. So, what i am seeing here is? If there is poor quality

production is going to hurt our profit that is like a pretty big realization. In fact, what are the influencing factors?

You again look up the influence factors, I have the input as influencing factors, I have got the environment as the influencing factor and of course, i have got the output as the output of the process. If these factors are out of control most likely my output also going to be off spec and I am not be able to sell them and make some money.

What has been orientation in traditional management? The traditional management has always worked that aiming itself or directing itself to short term profits. What we have tried to do is? Many times we try to just watch the quarterly profit that is all we have done would not worried so much about losses and so on and so forth, in the long term perspective we have not done that.

Also many companies today they try to manage themselves in such a way that the stock price in market place stays high or goes up. By doing whatever, by manipulating inventories, by manipulating orders or whatever they have to do. To try to make sure that the company financial companies financial picture looks good they would really put everything else secondary. They have to try to make sure their stock price stays high or the short term profits they stay high that is the traditional way of, managing a company for example.

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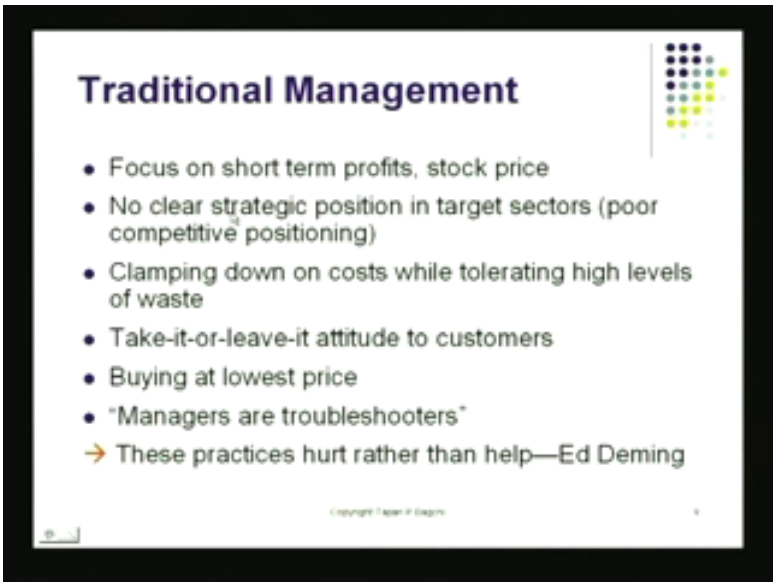

In fact, there is no really clear strategic position in many targets sectors. That means the many companies do not position themselves properly in the competitive situation, the competitive environment, they really end up with a poor position. Many times hope you also do is we clamped down on cost and we tolerate high level of waste and this is like something that is very short term focused.

I will give an example, let us say there is a batch that is being produced, some chemical that is being produced and is being produced in a reactor and it turns out that to finish the batch people will have to work two hours overtime. Now, suppose some more days (( )) short term cost, his going to really worry about that two hours of extra overtime that he has to pay. If you worries only about overtime and not that the batches cooking there which is the incomplete at this point in time and it will have to be finished with two hours of extra work.

He is probably just going to shutdown everything and go away. The result is this batch of product will not be finished, is very impossible when i come back to tomorrow, when the plant starts working tomorrow most likely this incomplete batch, the uncooked batch have to be trashed, that is a big cost. What was the tradeoff? I saved a little bit of overtime and I ended a paying with wasted batch completely. I have ended up paying a full full batch that was wasted only because, not enough time was given for it to be completely cook.

Also we have this orientation in traditional management which is toward customers, I just say take it or leave it. If it I really do not worry about their satisfaction or the delay that they might have with my products I just do not do it. I purchase my supplies only at the lowest price and that is being done still by many many companies. And in many cases managers feel they are the troubleshooters, they have the, you know with the most experience or the most education and so on and so forth so they become troubleshooters. In fact, they try to do troubleshooting right on the floor. Now, who is the person really knows most of the process that is going on? It is not the manager, it is really the personal who is running that machine or running that reactor or running that particular equipment. He knows, how that particular equipment work.

For example, a welder for example, if he he knows why the welding defect can be and because of what the welding defect can be their, not his supervisor, not his manager

unless they have also worked as a welder and many times they have not. So, it turned out many times people and these are the people who at senior position they become troubleshooters. And they try to come over the (( )) solution which they (( )) actually in their chambers these practices there was a thinker his name is Ed Deming. Ed Deming basically said if a practices are like this, the one that are shown here in the bullets here, these practices hurt rather than help, no matter how hard you trying, these practices help.

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What is the alternative? You need a different perspective, different you need a different way of looking at this whole business. Customer satisfaction would be should really recognize as the engine for growth. If company has to grow, it is customers have to be satisfied, they have to be delighted, they have to be satisfied more than the kind of satisfaction they derived from, a competition for example, this is a must.

And the company must engage just like an engages profit management, supply management, bunch of others human resource management, it should also engage experts for experts in quality management. And that would really mean assisting recognizing and meeting true requirements and these are true customer requirements. And these customers are going to be, some they are going to be external customers, some are going to be internal customers both sides of customers they have to satisfied, they need some and the expectation those have to be understood very well.

And what we really have to do is? We should try to see if could satisfy those needs and even excel in the expectations which are there. To win over the customer, we must delight him besides, we must also try to do something that it delight the customer. And this really good go beyond just pulling meeting these needs and expectation, this is the modern way managing quality.

So, again to summarize, customer satisfaction release the engine, if you want growth you got to delight your customers, you could satisfy, you have to fully satisfy customer then you have to go beyond. Because, the customer generally has a choice you could go to competition, you could go to difference store at a different market place, he could pick a different product. Now, what we have to do is? You have to obviously make sure that he remembers that he did delightful experience in dealing with you, only then he is going to sustain your business.

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Now, are these new thoughts, are these something that you know we are generating by basically saying that these are good things do, they have come from like since my motherhood for example. Or we have read that in some special book, read about these things in special books, it is not like that, it is not a simple as that. Many people and these were people with a lot of wisdom, lot of hands on experience, a lot of theoretical insides into various things they started thinking about these issues involved in the management of quality.

And the first and foremost gentlemen there was Edward Deming, he came up with a system called plan-do-check-act. This was his p d c a cycle and that process is cyclic and I am going to go over this again as a get deep into the lecture. He also came up with 14 points to worry about guiding management to transform the organization.

These fourteen points has spelled out very very carefully, these 14 points were given out they were they were giving out of the list. And any place where Deming wanted to go and do training program, he wanted to make sure the top management heard what he was saying. J M juran joseph juran he was the next expert. And he again emphasize some practices to be top level management practices, he emphasize training and he also emphasize something called the cost of quality. Which I am going to describe to you in a couple minutes.

Then came Feigenbaum, Feigenbaum really realize that quality control could not be delegated to the quality control department. He could not be delegated, he could not delegated to the inspector, he just could not be done that way everybody had to be involved. If the story goes like this that Feigenbaum had these thoughts and he had he was doing his p h d, by the way just by the way he had some thoughts. And he thought perhaps the total organization should be involved in the delivery of quality.

The result of was this he wrote up this little (( )) and that was a green little book is a pretty fat book was but, what two inches thick. He could never get his p h d but, he produce this book that is called TQM, the book on total quality management. And is the gem of book it still today it in the foundation for the management of quality, it still today that way.

Lot of japanese because, the japanese started to take quality control very seriously in the 50s and 60s. In fact, they hired Deming and Juran to come and do training in japan. And Deming and Juran they started working with the top people there, top people in japan, top managers, industry owners and so on and they also go with the engineers in japan. And the many people many many experts in japan they also not only they heard deming and juran do their pieces but, they also created some new tools. They created for example, the quality circle, it is a great way to involve people. And also one of there was kaoru ishikawa, kaoru came along and he ended up devising this 7 tools, i am going to revealing that those 7 tools with you, i am going to be revealing that with you. He came

up with these 7 tools which are now called 7 tools of TQM, then there was an a gentlemen his name was Philip Crosby, and he looked at the losses

If you remember the diagram that I had earlier, I had these red zone, these red zones have the losses. What Philip Crosby said was? If you remove these losses, if you remove these parts which are like the waste, if you remove them all together, if you create a system that produces stuff that is only totally within specs you not have these losses. And they extra effort that you are putting into try to get things within specification, those extra efforts would be more than compensated by the reduction of losses here. And therefore, Philip Crosby started saying that zero defect is a good target and quality actually becomes free if we try to produce things that are all within specs.

Then there was a japanes expert, he was a hands on person, he was an engineer. He still around, this is 2009 and Genichi Taguchi is still very much around, he is 87 years old if i remember, today he is 87 years old. He came up with a scheme by which one could produce better design, let me tell you about this little bit. Many times what his thought is that the quality of the finish product is mostly due to the manufacturing process. And then the care we take in inspecting all the little parts and pieces and so on as we put them to together.

So, in fact it turns out that in this old believe old way of thinking quality is really control by the manufacturing process. When you look at when you do some postmortem, if you look at defective items, you pull up defective item, pull up another defective item and you started taking a part. And you do what we call a postmortem all them and you go back and look at their defects and you closely look at the root causes of these. Any times it turns out that the product is not doing a good job because the design is defective. It is not because of the manufacturing process that produced it perhaps not so well. It is really what I started with? And i started with the design of the product.

Two-third of problems which finish products, they can be traced to some shortcoming in the design, this was recognized by this gentlemen his name is Genichi Taguchi, he is a japanese expert. He came up with a scheme by which you could produce better designs and those are called experiments, those are called orthogonal experiments. Taguchi also give us an idea of what happens if you do not have quality?

In fact, if you do not have performance that is right on target. In fact I am going to be showing this to you later on with a slide, that is not very far away from here. Where I show you the target, I show you the ideal quality characteristic that is going to be the best characteristic as far the customers is concerned. If I produced anything that is slightly to the left or slightly to the right in both cases I am hurting the customer because, he wants things right on target. But, what am I doing?

I am producing, I am getting in something that is slightly to the left or slightly to the right. The customers going to have a consequence, because, of this variation there and that variation actually causes him a loss. Taguchi was the first person ended up saying that there is a such thing and I can quantify that for you, that is called the Taguchi quality loss function. And this was the first time it was articulated very clearly that just trying to be within spec is not good enough for us.

We have to find that ideal condition, the ideal requirement, which is why we should set the target or we should try to be as consistent as we can in delivering products that meet that come out performing exactly at the target as closely as possible. So, do not just try to be within specification, try to find that point which is the target, which may be in the middle may be somewhere and try to deliver it consistently. If you do that, you are doing a good job and the customer going to have maximum satisfaction.

Another thing that Taguchi came along and said was many times our products do not perform that. For example, if you look at these pens, these pens are suppose to write on various types of surfaces and also they are suppose to perform all right if I leave them on the table. And if I do not actually put a cap on this table, I just leave it there and I remove the cap when I left it like that. Now, as you all know that the tip is going to dry up, after some time the tip is going to dry up. What should really happen is? It is should write well when i am writing it now and after that if i laid down for 5 minutes then I come back. And I pick up the pen again and I started writing with the pen again, it should continue to right well from here to here.

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There has been 5 minute delay (no audio from 27:41 to 27:47) in the time, the tip of the pen might have dried up that is going to lead to poor performance. Which really means my writing here the initial writing was ok but, this is not going to be so good. And that is because the product itself is not a robust product. This pen is not a robust product if it was robust even after five minutes it would retain it is good performance which is what i had right there.

Now, this effect is due to the environment, the environment is basically drying up the tip. The tip probably had some amount of liquid in it, some amount of fluid in it but, as time went by the tip began to dry out. If I use a solvent that dries out very quickly, then of course, this lower line this lower line is not going to be so good. Or robust design will be such, it will be using a solvent which was sustain it is fluidity even after 5 minutes or perhaps in 10 minutes that is going to be a robust design, this is a secret that taguchi articulated for us.

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What is the current situation worldwide as I already indicated to? There is more competition worldwide. And there are many people coming up with fiercely competitive strategies. And as you probably all know now financial systems are going to be fluid, they are going to be behaving in a unpredictable way credit crunches there and so on and so forth. Customer expectations are increasing, employees expectations will also increasing. In facts investors also expecting more and they wanted quickly. And there is very rapid change in technology that is also something there is happening worldwide. Now, that is actually making our job to deliver quality more and more challenge.

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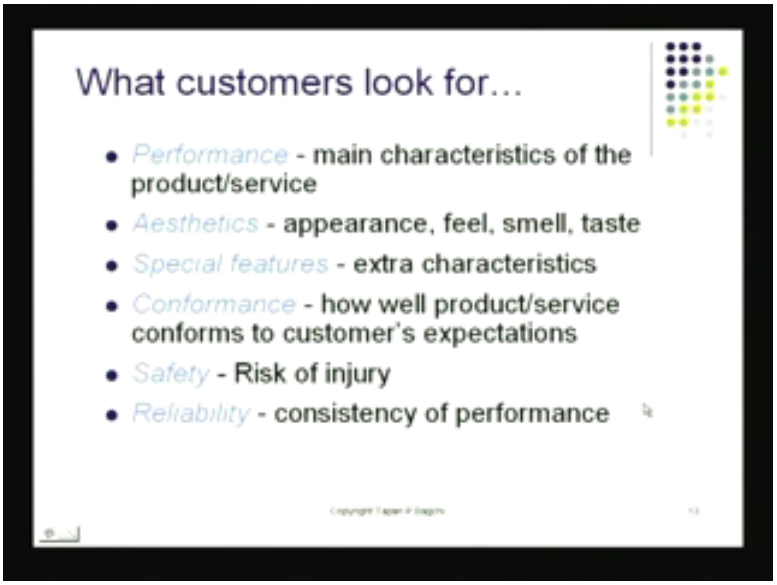

What is that the customers are looking for? They are looking for clearly performance, there is something they are looking for, they are looking at good aesthetics, they are looking at special features, they are looking at performance to specification and so on and so forth.

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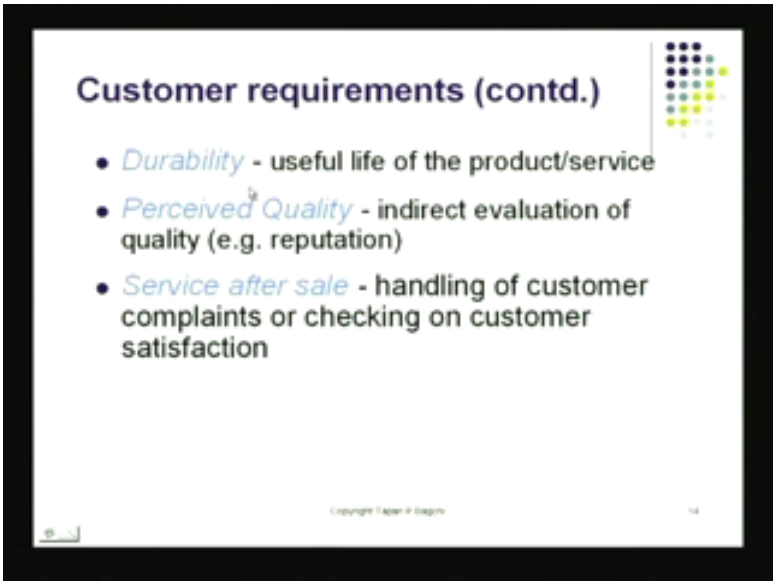

They are looking at safety they are looking at liability. And besides they are looking at durability, they are looking at perceived quality. How does it really feel? And they are also looking at this very important they called service after sale. So, in fact it turns out like for example, we have a p c here. As you realize we have a computer here and many other things are there for which actually we will let us say this little pieces of device which as an attachment, which is a mouse which is attach to the computer. Now, it might be all right when I unpack the thing. I take the product apart out of the packet and performance very well.

But, the point is this many times it turns out that the is there service available after sale. After sometime when I have some trouble with the product is there going to be service available for it. This is especially true for autos, special for machines, special for any kind of engineering products that you buy. Many times would like to have some service available after the sale takes place. That also something customers are looking for.

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What are some of the contemporary practices? How are people managing quality these days? How are they going to be doing that? As you already are aware with some people are using TQM. Many people go and get registered by ISO 9000 and some people they get registered for QS 9000. Some people are using some special methods like just in time lean manufacturing poka-yoke and so on. All be giving review of a lot of these things. Then of course, many of the leading people in industry.

They are going for the six sigma program. It is not so much of a human resource program. It is really a business process improvement program. That is what six sigma is. So, these are various ways people are attacking attack the market place.

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It is really wise it that we have to do all these because today in today's world customers are looking for the total experience. What is this total experience? Imagine you have bought a car and obviously would be concerned about it is performance everything works and so on and so forth. That is the finish product. The finish product must perform as expected. Alongside I must also have service component which is the auto repair. In case something goes wrong you can see you can read the details here. It actually tells you what are the expectations besides my purchasing the product and making sure that the products works all right.

I must also have to be available these service facilities, these service as actually I should have them available. Aesthetics is also something that customers are looking for. For example, the interior design of the car, the soft touch on the leather and what about the service component of it? Clean work and when I coming to a auto repair shop for example, they should be waiting area and obviously work should be pretty clean. Special features which are probably there in most of the cars and it turns out special features have provided to you as standard as as components of the real product.

But, what about other things that might go with this special features? For example, their location, where is the c d player located, where the switch is located, where the telephone located. And also for example, can I do computer diagnostic if something goes wrong. Can I have a port their when I bring a device. For example, and I connected the plug and

it tells me some the some device tells me these are the thing that might be wrong with your car. These are the thing that might need some replacement of parts or something or please have their repairman look at these these particular things.

That is like something that also should be available. That something now I am looking for beside just having those special features. Safety and again if it say, if the vehicle obviously we looking at anti-lock brakes, airbags and so on and so forth for safety. What about safety in the other area which is like in the service area? This is like auto repair shop for safety they should really have a separate service area.

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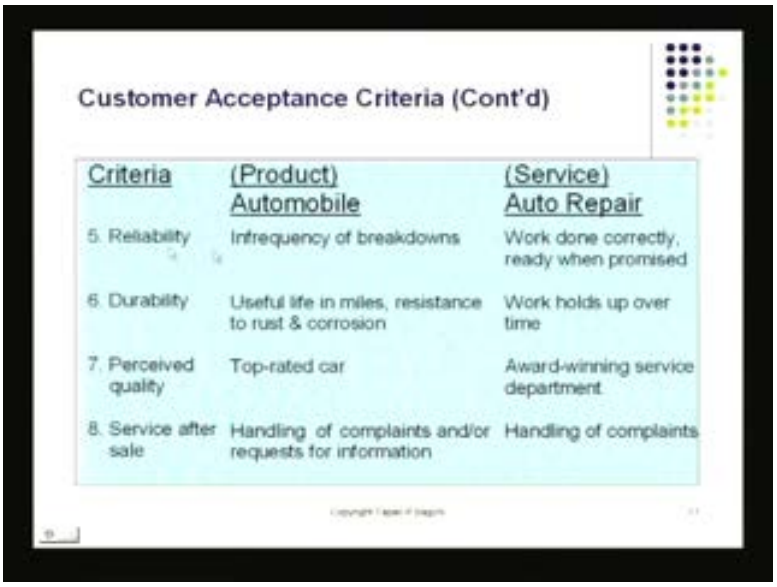

Let us keep looking here for liability we look at the infrequency of breakdown. The car should not breakdown too often and reliability on the services side is going to be the work has been done correctly. And the vehicle is ready when it was promise the work is complete. Durability obviously useful life in miles that is like something we should try to look at and resistance to rust and corrosion. That is also something would be looking at in the product.

But, when it comes to service the work must hold up overtime which is like the performance should be such that for sometime I do not have the same problem. I recently very recently I had a radio repair by a shop and this it did repair itself cost me a lot of money. I took it at home after one week it is stop working. Now, what is the issue here? The issue is this almost dissatisfied because I spend good bit of money and I have to

travel to the shop and so on, so forth and wait for they are getting some parts and so on, so forth.

So, probably they did a job they might have done a job, but, was it really durable? Was the repair that it was it really durable? Probably they changed some component that might have been god knows what? It might an used component that the put there or may be the soldering was not done right or something. This is something that I am also looking for. I am not only looking for good performance, the movement I take it away from the shop.

But, also I am able to enjoy it for the reasonable period of time. Perceived quality you know what is the perceiving quality? Obviously when I buy a car, it should be top rated car. Why I should get a Honda or Toyota? There is something I uses a regular commuting car and as far the service is concerned not only I should get a brand, good brand from the car. This service facility also should be award-winning. You should delight me and service after sale this is like handling of complaints or request. If I request for something it should be handle as far the product is concerned it will be handle very very easily very very quickly. Again handling of complaints is something that is also service component.

So, what I am looking for here if you go back to the top of the page there. There is a product component for my satisfaction. There is also service component today for satisfaction. So, today people are looking at the total experience. That is what people are looking at. When the buy something on the recommend something to a friend, they are really talk about the total experience not just one or two things.

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What happens? If you do not really deliver quality there are various adverse consequences. Let me give you some of the examples. This clearly loss of business that is very possible. If you have poor design or if you got defective products or services it can be to loss of business. Quite clearly there is nothing no real surprise here that would really happen. Also many times if we do not deliver quality for example, if I sale defective tyres and stuff like that or if you really have medicine that is really not you know there are some bugs on it and so on, so forth.

In fact there are perhaps undesirable things makes with the real medicine that you purchase. You will be a suit for you may be taken to the court. You may be liable for some damages. This from the damage to life or it may be damage to property and you watch out. You know there are lot of people now. There are these consumer association and groups and so on. They have become pretty focal rightfully. So, if you paid for something if you had certain expectation that is what was claim to be true and if that is not delivered the person is the supplier is liable.

Productivity how does it hurt? Again I go back to that a little diagram that I had little diagram here or I had the bell curve and I go back to the bell curve there. Notice here productivity is really production of parts that are within specs. If I have poor quality perhaps 5, 10, 20 percent of my output is going to be in this red area. That is not going be

a such a good news because that is going to be hurting my productivity. So, here is a direct playing with a poor quality and lack of productivity.

So, there is a direct link there and you can all see it is pretty clear that this is something that I also have to worry about. In fact this is what is being going to be hurting my profit. If I do not have productivity due to poor quality is going to be hurting my profits. And obviously costs, poor quality will also increase cost. Then I have a special section on this when I am going to be discussing cost of quality and you will notice right away that it is something that we need to worry about.

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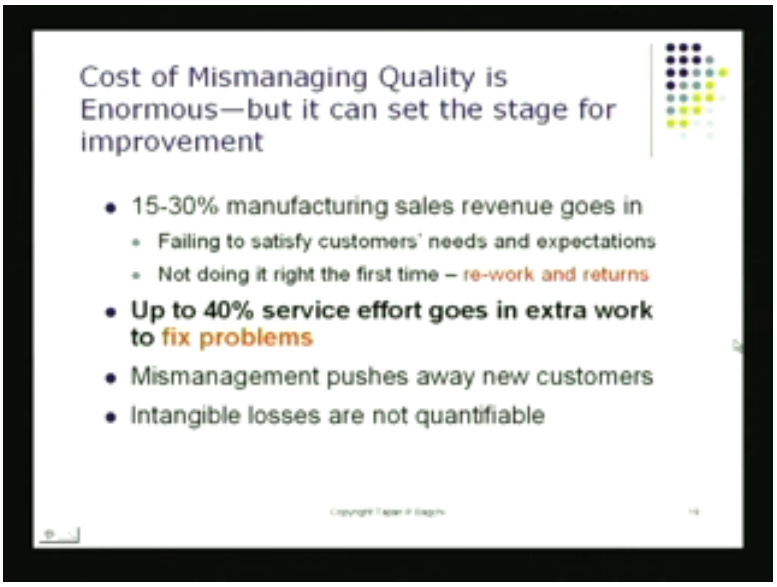

If you look at the cost of manufacturing the cost of miss managing quality. That means not really responding to customer requirements, customer desires, customers delights and so on and so forth. Not really even caring to find out what is it that they want and doing things on my own way because my business is just to produce the widgets. So, I produce all these different pens. I do not really care how they function? My job is to mass produce these pens and (( )) behold hopefully no one is going to find the defective ones. If somebody does find the defective ones I can basically ignore them. Probably he is not going to come back even if he tells to his friends I still have probably plenty of other people who will buy my good pens.

So, in fact what I am doing is I am ignoring all those people who have some problems with my products. It turns out many times the guys who ended up with my defective

product. They are going to be telling their friends and probably they may even take me to court and that is going to cost me money. So, I not only I am causing a loss to that buyer, I am also causing a loss to society. It turns out 15 to 30 percent of manufacturing cost, 15 to 20, the costs are so high that 15 to 30 percent of manufacturing sales revenue goes into rework and returns that is huge (( )) that goes into rework and return.

You might be thinking I produce so much and I have sold and make so much money there. You could have made more money because the it turns out that a lot of the products that you produced they do not make quality and they were probably returned or they were probably scrap and that is a real cost to you. 40 percent of the service effort in many companies that goes into fixing profits because the job was not done right the first time and they are complaints and they are returns and they are hustles and they are negotiations and they are price reductions and so on and so forth.

Lot of other things go on when you produce something that is really not a good quality. Mismanagement also pushes away new customers because the one goes around pretty pretty fast and of course, there is something pretty big which is like there are intangible losses that you might not even be aware of. For example, new business is may not come to you or your real customer may go away that is going to shrink your market share. Those things also happen and they are intangible losses.

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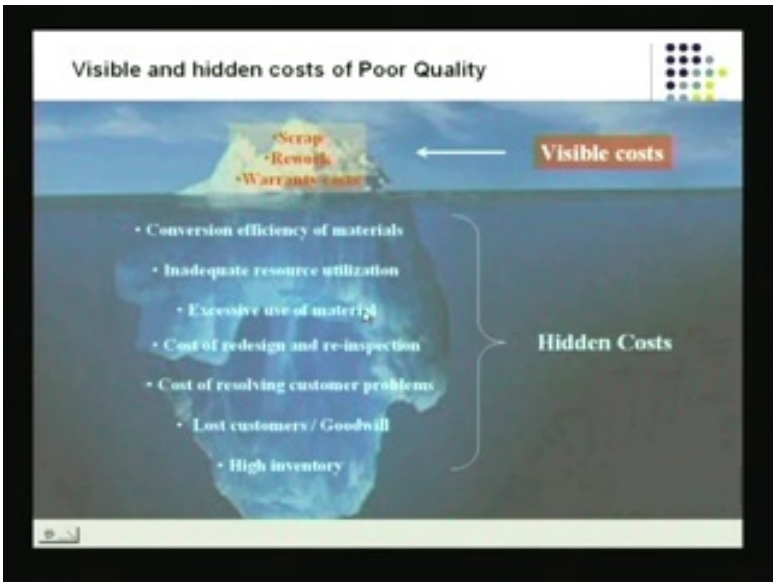

I have a picture here and I show here an iceberg. This is an iceberg and you probably know when the when a piece of ice floats just small part of it. Probably 10 percent is above bottom 90 percent of it is underneath the surface of bottom. Quality cost are the same way the visible costs of poor quality those are in the form of scrap, rework or warranty cost. These are visible to you. Those are the once that you really thing. That you think many times mistake in the that those are the only cost I have if I have poor quality.

But, look at these other areas conversion efficiency of raw materials. If my quality is poor I will probably have to use some extra material to make sure that I have the amount the quantity and quality that are really desire. Inadequate resource utilization many times because of quality machines have to shut down or the production stages they have to stop. My labor is going to ideal my equipment is going to ideal and so on and so forth. So, inadequate resource utilization that also something that results from poor quality.

Excessive use of raw material that also happens because of poor quality. I know about a grinding of operation in factory. With the grinding operation I had very poor precession. So, what they have to do was? They have to have extra material on the raw material. So, they brought some tubes. They brought some of these tubes and then torn the tubes and they produce something that was slim enough to fit into the next part that they were going to be producing.

These rods or these bars or these tubes they had the extra material on them because the grinding operation itself was not so good. So, they have to have actually waste a lot of material just to make sure they got the right dimension in the end because the grinding quality the performance of the grinding process was not good enough. Then you got something called the cost of redesign or the cost of inspection. That also is something that is the result of poor quality. Quite easily you can you can see that resolving customer problem. That is also something say natural consequence of poor quality. Then lost customers or goodwill I already mentioned that the bad words that travel pretty fast you know.

It is very possible that a person who had a pretty bad experience with you. He is going to probably tell 10 of his friends that please do not go there, do not bother buying that stuff. As so those people they are not even going to come to you and it cost a lot of money to

land a new customer. You have to do advertising, you have to promotion, lot of other stuff and any other live customer and he is going to go away because of poor goodwill. Then of course, other consequence and this is probably last in the list that I have here is high inventory. That also is something that happens because of poor quality.

How does this happen? If you got stages of production I am just going to draw a little picture here, I am going to show you.

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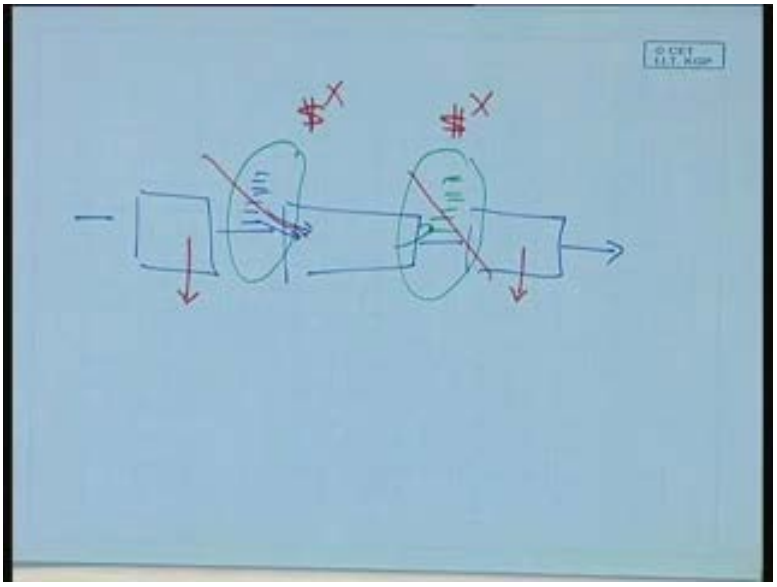

You got stages of production and these stages they basically feed each other. And then I am going to final output there. It turns out if this machine has a breakdown and breakdown I can always show by a red color. So, it has some breakdown is down for a while. If this breaks down the supply to this second machine is going to stop, the second machine is going to start. So, what I am going to do? If this machine is liable to fail and probably going to pile of some inventory here. So, that this this machine it can keep driving from there it can keep running for a while.

Now, what would happen down the road again suppose this machine has poor quality performance and it also breaks down. In that case again instead of smooth flow I will have inventory pile up. So, if you go to a typical company you will find many times there are inventory inventories that are being run out of because of poor performance somewhere or there is inventory piling up because some stage is down. These inventories these inventory they actual cost you money.

You better remember that these cost you money, this money costing here, there is money costing here this is totally avoidable. If you had perfect quality the machine is not going to be breakdown. If he had perfect quality, if had perfect state of repairs and so on this machine is not going to breakdown. You would not need this, you also would not need this that means you would not need this inventory. You also will not need this inventory and these are going to be pure savings for you because anytime you have got inventory you got working capital involved and that is going to cost the companies some money.

So, that is how actually we say if we got poor quality is going to lead to high inventory. This is something you got to keep in mind whenever you are talking about quality. So, there are these costs, there are these few costs that are visible because they appear in management report, they appear on a monthly basis, weekly basis perhaps, but, there are these hidden cost that are really not visible. And we do not know if they are really there and these are actually far bigger than these visible cost. Many times we lose a good business. If you lose a good business that is a lot money loss and that could happen purely because of not because of good you did not offer someone a good deal or a good price, but, because you quality was poor.

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Now, where should the responsibility for quality then should then spread? It should go all the way from top management to the design department, to purchase department, to production and so on and so forth, did all be there. In fact production or operations

people they just happen to be one of those in the full chain of the processes that really are involved in delivery of quality. Then of course, you got quality assurance people you got packaging and shipping people. Then you got marketing people, then you got customer service people. Each has a role, each of these people they have a role. They have role to play.

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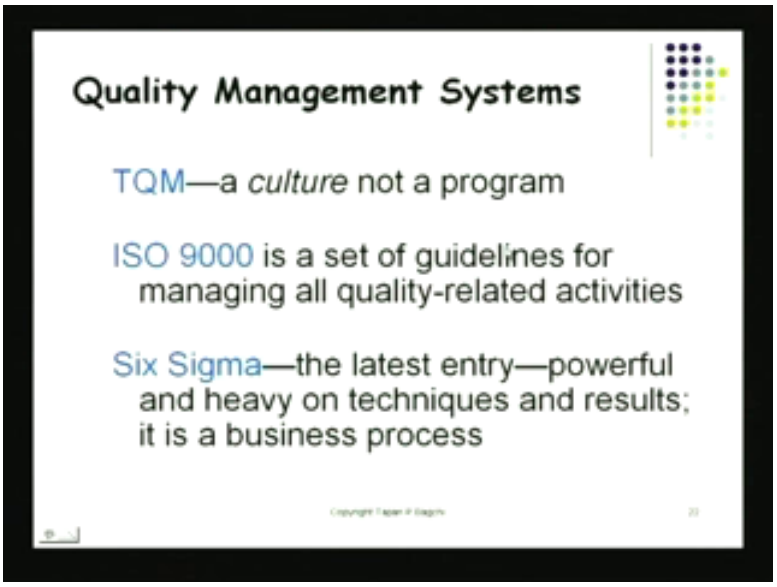

Now, what are the different system that are used to right manage quality? This obviously the TQM. TQM has been you know recognize to be a very very important step and important innovation in fact. It is a cultural of course, it is not a program it is a way you think. It is a way everyone everyone in the company should think TQM is that mode of thinking.

Then of course, I have got this system called ISO 9000 which is a great way to put your house in order. If you got various activities that might be affecting the quality of final product. ISO 9000 is a great way to make sure that you really have everyone, everyone following a standard operating procedure and those procedures are such that they are assure quality in the end. That is like something that we really or after in the end and these procedures these refine procedures, they can be audited. They can be looked at by an expert he can really say yes, you seem to be doing the right thing.

So, you should be doing the right things so, you should be doing things right, both of those should be there. This is assured by ISO 9000. The latest of course, the latest way to

try to manage quality is the mode of six sigma where what you really try to do is. You try to control two things one is you try to reduce variability and production. And also if there is any place there is a loss. You try to cut that loss.

So, six sigma has two purposes, six sigma obviously is built on a good solid foundation that is TQM. So, six sigma is built on TQM to begin with. Then it is got standard operating procedures and everything else. You got extensive training and then you got this strong emphasize to try to reduce variation, try to reduce variability. That is like something six sigma is after and also what six sigma does is? It provides you would method by which you can cut losses. So, six sigma helps in two ways one is reduction of loses the other is reduction of variation.

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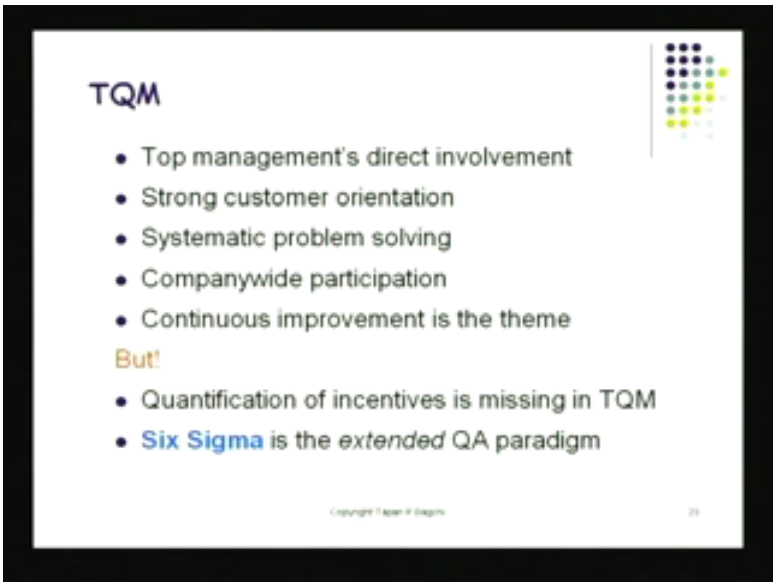

T p TQM how will you recognize the TQM is there? If you keep looking at these steps here you should see top management direct involvement. That is like something it mandatory for TQM. Strong customer orientation and here I am including both internal and also external customers. Then I use problems solving method but, these are not ad-hoc methods I use systematic problems solving methods. Then I have got something called companywide participation. Nobody is stands on the side on the side line when you talk TQM.

Everybody (( )) in everybody tries to participate and do his piece. Continuous improvement is a theme this is like something that six sigma is also building on and so on and so forth, but, TQM uses that as a theme.

But, there is something that is missing in TQM. Many times what we have seen is that a company you know it does a lot of training and orientation and seminar and so on and so forth and it tries to instill in the mind set up in the minds some people this new mind set. Having top people directly involved, having strong customer orientation, having systematic problem solving methods and so on and so forth. Everyone participates and so on and so forth.

All those things are done, but, this is only given as a you know something that is good for you almost like a motherhood (( )) philosophy. Managers are not motivated always by just plain philosophy. They want to see results and there is something that we missing TQM. What is missing in TQM is going to be quantification of the incentive. That is missing in TQM. This problem this gap was rectified one people went for six sigma. One people went for six sigma at that point people realized that we have to go somewhere that is beyond TQM and that is when six sigma came along.

A six sigma looks at quantifying the incentives. Before you began and improvement product project then is based on the six sigma orientation. You must quantify the incentives beforehand. You should produce something like an ROI, something like an ROI. This something you should try to do.

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Commitment to quality is quite easy to detect. It shows on the shop floor, it shows everywhere else and a results are quite apparent. In fact it turns out material problems are corrected with supplies. There is a follow up equipment problems are fixed right then and there as quickly as possible. People are trained; partnerships are built with suppliers and also with customers. So, you share your specs and design requirement and everything else. Continuous improvement is observable if you go back to the same company after a gap of like say couple months you will see things done differently. And the biggest sign is you know when you have commitment to quality business. Business begins to grow that is all something that begins to happen.

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A quality system if you have it in place it helps with competitive positioning. Competitive position actually decides or it going to be competing on the basis of low price or you going to differentiating by offering people a variety of different products. Is this how you are going to be competing the market place by providing a variety which is like how you differentiating your product from competition. Also in fact you might be going for niche marketing. Niche marketing basically says that there is something some particular product that I only have. I only have this product nobody else has it. So, it is a niche market. That I could go after.

Thus like one way you could differentiate itself from others and also you could do it by assessing the strength of pure buyers, your suppliers and your competition. If you could do it all you could find a way to compete. You could work out your strategy and your tactics and your operational details by doing that. Determining how you are going to be adding value and how this value? The added value or the cost savings you know how they are going to be shared between your suppliers yourself and your customer?

This is also very important if you savings some money by doing some smart things other people should have been sending to support in your mission. And that is done provided you share the saving that you have. Not everything clearly, but, some of you should be shared. TQM basically we start by identifying the needs and expectation of the targeted

potential customer. So, I decide how want to compete? Then I find the way how I am going to differentiate my offering from others?

I decide whether it would be on the basis of lowest price that means I got to have a low cost also. Is it going to be a niche market? Am I going to be offering differentiated products? Are they some special strength that my suppliers have or they some special strengths that my buyers have? What about my competition? What is the picture there? Do i have an edge there?

Someone so i decide how I am going to compete. Then of course, I have got to make sure I share the value added. I share the extra money that I make by doing all these good things. I share the extra money that I make. So, that my suppliers, my customers and everybody else who is trying to support my business they also have some incentive support my business. This is very, very important.

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Getting started, how will you, how where will you start a mission toward quality? Where will you really start? Start by recognizing customers that really the best place to start. Discover what they need and try to find out their expectation are? This is the great place to start. Also set performance standards that will meet performance standards for yourself that meet customer requirements. So, performance standards for yourself that meet customer requirement. This is also something when you could really start.

Find out what your customers required and find out for your own performances and recognize that gap. That is also one of the place you could really start. You should also start, you could quite easily start by looking at some measure called CPK. CPK is process capability of your conversion systems. If you got a conversion system in fact every company has a conversion system. It takes some input it conversion it into some something that the customer really want then produces the output. How will I am converting the input into this output? How capable I am meeting the final customer requirement? That is a measure of my capability.

This is also one place you could do your start in this thing. You got your establish quality management system, you know you either you go by TQM or you bring an ISO 9000 and bring QS 9000 or if you are really good then you go for six sigma. This is like something you got to decide. So, again you could make a start there. Set your quality policy so, that it becomes to clear to everybody in the company. What is that this company is going after? That something that is going to motivate people and this motivation must be provided through leadership. This is also something that we should be able to do.

We should be able do this and there is really no problem there. And we must equip our people we must provide the training that we want to be able to do their job. They are various people I am not going to be doing. Everything if I am the CEO, I am not going to be doing from the beginning to the end of the process. I am not going to be executing those things. So, I should equip people to be able to do that and also I should empower them. This is also something I should be able to.

If a person feels that is some action should be taken in the interest of quality, in the interest of customer's satisfaction, in the interest of customer delight. They should do it and example is in a supermarket and some product was taken home. It was used; it was probably a jam or something. And the user found after some time after half of the bottle was used. They found they did not really want that that particular to use that any further. So, they came to the store and offer the bottle back and this will be want refund because we do not really like it.

The lady the at the service counter sure them part to provide the exchange on the spot. She said madam just leave it here. No problems at all, please walk in and pick the jar that you want as going to be honors so, it is going to be free of charge. This lady she went in,

she did pick up a jar and she also purchase another piece of a larger jar of some jam there. So, not only they this company was able to build a goodwill. It was also able to materialize the additional sale. This happen because of the special care that they took.

This was the empowerment that was so important for the company that they started to do the same thing the propagated this news and just started to do things. Do the same thing across among in on the on pretty well all the service counter. I will continue with this and in just a few minutes again will start with a next session. Thank you very much.