Total Quality Management - I
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Lecture - 02
Quality and Variability

Welcome back my friends. I am Raghunandan Sengupta taking this course for total quality management. So, this is lecture number 2, and as you know we will have about 40 lectures, each of half an hour for the 20 hours series in total Quality Management.

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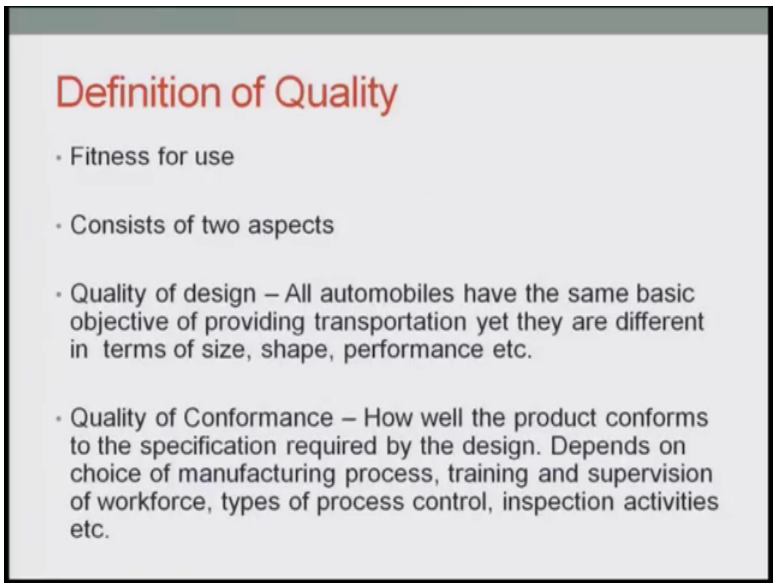

So, let me start from where we left. Now, if you remember we have considered the different dimensions quality, and I did gave you some examples how the concept of quality could be perceived, and could be understood in very simple terms as, that it will make sense for the customer, or for the set of persons who have purchase that product or that service based on which you can understand the concept of quality which is there with that product. Product means both tangible and intangible goods or services which are there.

To further this discussion let us consider the different type of definitions of quality, and if you do remember I did mention that even though we will be considered quality from a mathematical concept, but quality has much bigger consequences and un implications. It may mean that level of life which you leave, it may mean also developed type of

teaching which you do. It may also mean the type of time schedule which you follow. It may also mean to the level of efficiency which you do work, everything would basically above quality. It also mean by that type of person you are, and how you interact with your customers, or how you interact with your juniors or how you interact with you seniors.

So, everything has a concept of quality in-built in the system. So, that many things, may be expressed when we are discussing or many things may have to be perceived by you as a person, when you try to analyze quality for those different type of products or the services, which you are giving or which you are getting from different type of persons, who are giving the services to you.

So, definition of quality would be that how good, and how good the product is, and how fit it is to be used. So, the first would be fitness for use of the product or the services. So, if we have purchased. say for example, a scooter coming back to the Bajaj scooter examples, or say for example, you have purchased a fridge coming to the Godrej fridge example, or you have kind of purchased one services say for example, from McDonalds or for say for example, from Pizza Hut or you have purchased some product from Amul, this milk supplier, or say for example, the ice cream supplier and you want to find out how fit the product is, weather the expiry date for the consumable products are over, or with there within the expiry date or whether the packet which he has those products; whether a pizza or ice cream, whether they are tone or if they are they are damaged service. Whether they have being fit to use; obviously, that would be one an important characteristic, based on which the definition of quality would be rendered.

. So, that would be silly consist of two things fitness for uses point number 1 would be quality of design. So, how good or bad the design of the product is, one could be quality of conformance based on which what you want, that product to give it to give you, or the service to be given to you. So, quality of design would be; say for example, all automobiles we will have the same basic objectives of providing transport, safe transport yet they are different in terms of size, different in terms of shape, different in terms of performance, different in terms of maintainability, different in terms of, say for example price and cost of, will amount of safety features, which are there all this things.

So obviously, design would basically render these qualities concept in a very distinct form, for consider the product which is now there in the automobile, it can be a say for example, for a fridge. So, how good is a fridge in cooling, what is the actual utilization of electricity, or where how frequently does the fridge needs to be repaired or serviceability is required, or if the temporary fluctuation in the outside; like we in the room where the fridge is kept. Whether that varies very heavily or up and down, or the maximum minimum temperature is very high, and whether the fridge is able to perform its actual functioning.

So, those would be the concept, which will consider under the quality of design and quality of conformance would be, how well the product confirms to the specifications required by the design. So, depends on the choice of the manufacturing process, types of process control inspection activities etcetera are there.

So, a product has been designed, consider you have designed say for example, of brush and the brush is the. Brushes are not very hard, they are soft, whether they even if they are soft; obviously, it means that it is doing it is, is actual which is required to be very soft on the gums, but if the brushes are not able to clean your teeth; obviously, it means that the actual functioning for the brush, which is basically conformance of cleaning or teeth, if it is not being made.

Obviously, it would mean the level or the definition the quality for each you want to put to, the brush is not being made, or say for example, you are trying to utilize a bicycle, and try to find out what is the performance of the bicycle, live with, depending on the level of quality it is, if say for example, the conformance are that it, the bicycle is not able to take the load of even one person; obviously, it means that level of quality, definitions based on which you are trying to analyze that product, which is the bicycle is not being met.

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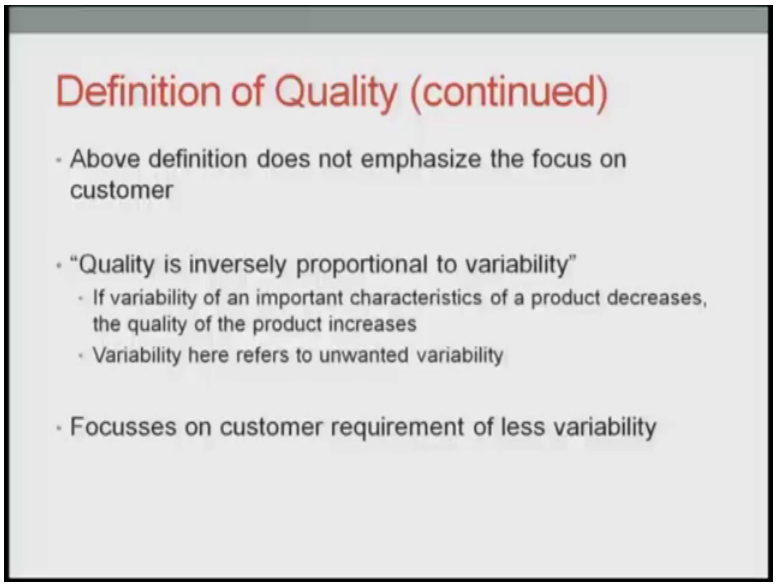

So, definitions of the quality to further consider, it would be the above definitions does not emphasize the focus on the customer. It basically means the customers would definitely. So, sorry to make it a very bold point, customers may have different levels of quality. So, say for example, I may be a person, I am very finicky about the way the car works, or I am some person may be very finicky about the level of maintenance of car. Here, maintenance you want to give spends for that car, or some person may be very finicky about the overall luggage space in the car has. Obviously, different customers have different levels of satisfaction, based on different levels of product we are going to use, even if they are the same product, the level of satisfaction would differ, depending on the different type of aspects of the product I am going to consider.

So, when I am trying to consider the level of quality or the definitions qualities, they should be or database which I will try to analyze the product, and how the product conforms to, is actually functioning for which it has been build. So, coming to this word the quality, is basically inversely proportion to the variability. So, the better the quality is, less is the variability of the product, or say for example, less is the actual amount of time needed to basic repair the product or the durability of the product is very high, or the robust for the product is very high. So; obviously, it mean the proportion of the variability for this durability being very high or robustness being very high would mean variability is low. Variability being low means quality is very high. So, if variability of

important characteristics of a product decreases the quality the product increases. So, less the variability as I mentioned, would better would their quality.

Variability here refers to unwanted variability which basically, when you are trying to analyze in a very laymen terms, is basically the white noise or the external influences of the influences which are not at all required. So, say for example, if I am considering again, coming back to the fridge, or coming back to the heater, if the temperature fluctuation in the environment is very high, and if the trip switch off that actual heater or the functioning of the fridge basically fluke is very heavily, which means the variability is very high, which basically gives us the concept the level of quality for those products is basically low definitions of quality.

to consider it further focuses on the customer requirements of less variability. So; obviously, level of, set of customers example which I gave for the car somebody wants less cost, somebody wants less maintenance, somebody wants more luggage space, somebody may require more safety, somebody may require more number of passengers to visited in the car.

So obviously, different customers I have different levels of, needs or different levels of requirement. So, when we try focusing on the quality of any product or any services; obviously, I would be giving examples, or if you have listened very intently to all my examples, maximum amount them, from different spheres of manufacturing product. Obviously, it does not mean that the examples are not there on the service sector, but I will definitely come up, as we proceed for those type of examples which are there in the services sector also.

So, coming back to the last point, it focuses on the customer requirement, and the level of the customer requirement, would basically mean that they are, there requirement of less variability. So, the type of customers who are there, they have the same level of satisfaction or the same level of requirement from that product or the services such that if there is variability or maximum the customers would be effected; such that you can say that the level of the quality for that ever product for which the average customers is being effected is definitely high, which means it will have a implication that the level of quality or the definitions of quality, which we are trying to utilize for that product or the

service is definitely on the lower side; so coming back to the level meaning of the quality as a final goal.

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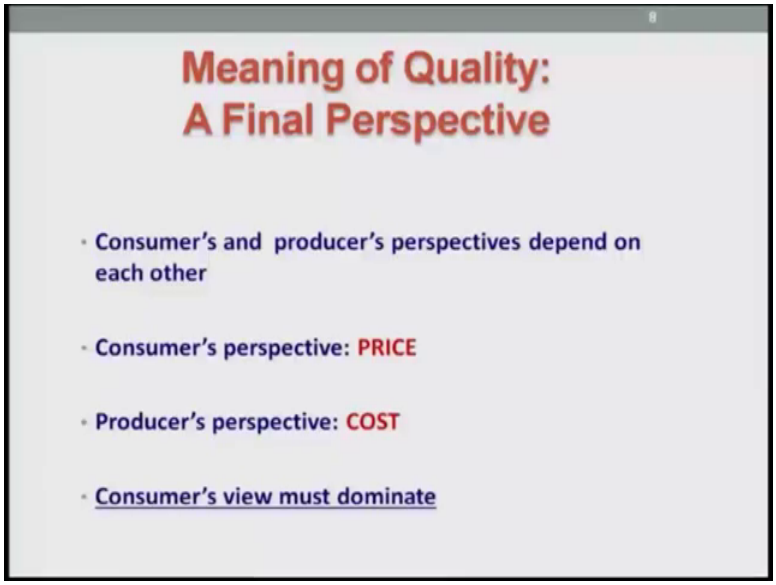

So, it means basically the customers and the producers perspective depend on each other. So, how the customer, if I am a buyer of a food product from one of the vendors, who is there in the locality. So, I would basically if I place a heavy level of trust on the quality and the price of that product to that vendor. It means that the level of satisfaction is much higher, which means the level of quality, which I am getting from that cost from that vendor is higher.

Or on the other hand say for example, if I as a vendor, I am supplying different type of products to one of the factories, and if I think the overall payment period by the company takes to pay the bills for the products, which I am supplying or say for example, the level of quality inspection, which is, they do is as per the general norm, and this that is actually according to the satisfaction of both the customer and the vendor. Obviously, means the level of quality impregnation between the customer and the vendor is much higher.

The customer would always consider the perspective of quality from the price. Price means the net, what which I am getting. So; obviously, it does not mean, it might returns, it may mean that even if I am able to pay higher price, if the level of quality or the level of working competence of that particular product of working competences of the services

which I am getting, needs my requirement, I am willing to pay that actual high price, because I get the level of satisfaction of utilizing their product. While the producers perspective would be on always on the cost. So, I would always try to reduce the cost of making that product, or giving the services, and the consumer would always try to basically pay the least price, pay the less price in order to get the services of the products.

So, in general the consumers view must dominate, because you as a producer, as supplying some goods or services to the customers. So, if you are basically the person who is giving the services, you should always looked into the picture that, what actually the product, which has been designed, weather it is able to meet the requirement of the customer, who are the main person, or set of person who buy your product or who buys your services. And obviously, there you may be able to see; for example, build the best machine, best car, best fridge, best scooter, best washing machine, best mixy; whatever it is, but if it actually does not meet the requirement of the customer, even though it may be very sophisticated obviously it defeats the whole purpose in my trying.

To manufacture those type of products or say for example, if I think that I am able to serve the actual services of, consider from the point of view of the custom, from the hospital, if I am able to get the best services, but and in the patient is secured, but; obviously, if the cost is very high, then it may becomes a dictate for the patient to utilize the services of the hospital, for which I am basically giving the hospital services. So; obviously, in these cases, whenever we try to analyze any problem from a customer and producers point of view, or a service providers point of view, I will always considered the customers point of view in such a way that the quality would be based on the fact that, how the customer analysis the overall product, that the services which he or she is getting.

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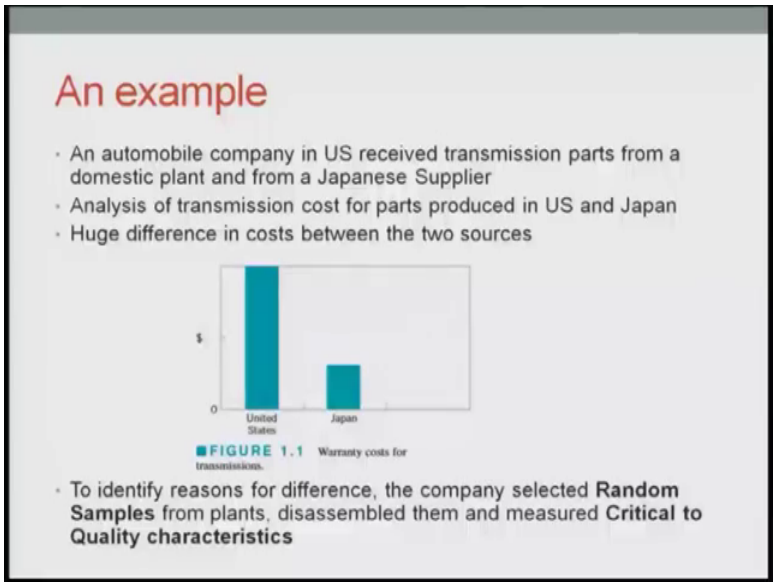

So, let us consider an example. So, as an example consider an automobile company in US receive transmission parts, and these what I am mentioning are actual, some real life examples. I will come to that later on, but I am just trying to basically analyze what are the highlighted points from the point of quality, for different type of products or different type of services. So, in a automobile company US received transmission parts from a domestic plant, and from Japanese supplier. So, analysis of the transmission cause for the proof products produced in USA and Japan. So, that was basically a huge difference in the cost between the two sources.

So, if you see the figure 1.1 which is shown on the screen. Now it is basically if you remember when I started of the class, I mentioned that all of the examples until and unless stated that are all from Montgomery which is basically the basic book, based on which this course has been designed Dongles Montgomery about the concept of quality. So, if you see in the concept of the costs for the transmission. So, the costs are given on the y axis, the metric is given is dollars, but; obviously, I am not going to the actual values. So, if you see and along the x axis you have that two countries; one has the supplier is being United States itself. Their internal supplier from the same country, and another was Japan.

So, if you see the cost perspective the costs of Japan was about in this figured, as it shows, is one third of the total cost of the United States. So; obviously, it mean that level

of cost with respect to the services, which are being rendered or the products which are being rendered by this two companies. Company one and company two, where company one let us consider is USA, company two is in Japan. For company two; obviously, the cost are much high less so; obviously, if I am the customer I am getting these two products. My main aim would be reduce the cost and get the same level of quality, or same level of services for the products which I want to buy.

To identify a reason for the differences the company, selected random samples, random samples I am just utilizing is, for the first time, but I will; obviously, come in to a definition of random samples later on. So, what we mean by random sampling, I am just now explain that in very simple logical terms, consider that you have a huge set of population. populations means the all set of observation, which you have and you pick up a sample randomly without any predetermined way, how you pick up, and if the random samples are say for example, they are any number, this small n or small n can be 50, can be 100, can be 125, can be 150; whatever depending on how you basically designed the sampling plan. So, sampling plan means how you pick up the samples.

So, the company selected random samples from the one dissembled them, and measured the critical to quality characteristics of these two products. So; obviously, it would mean that, if it picks up two random samples, the cost in the first case for customer one, a high, customer two was low. Custom means who are basically given it to the vendor in USA. So, based on the fact that, when you consider the critical to quality characteristics, it may mean with the actual level per unit of the product, which you are trying to utilize may be higher for customer two, then for customer one then a very objective decision has to be taken, weather product one or product two, which has been supplied by customer one and customer two are better, or they are words, but if you look at the grass as such customer two want; obviously mean that is supply, able to supply the transformations at a much lower cost, which is about one third which I noted down

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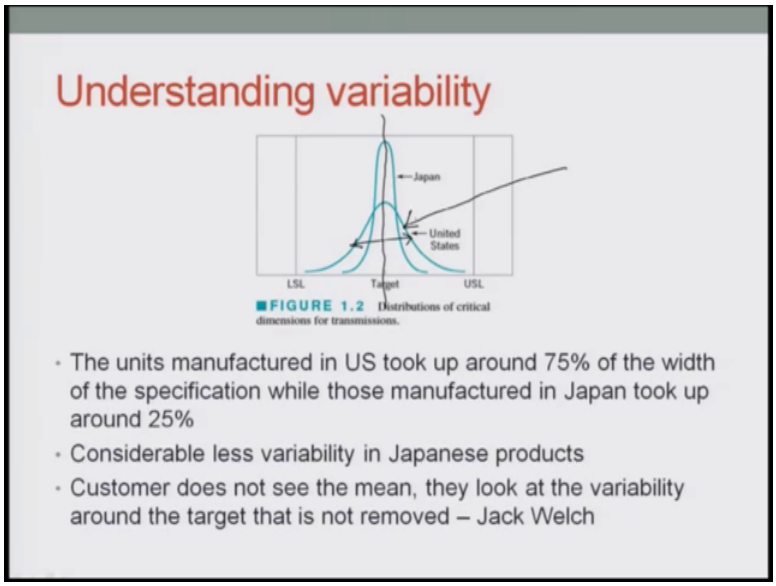

The units manufactured in US continuing the concept of quality, for this example the units manufacturer in USA took about 75 percent of the width of the specification, where the manufacturing Japan took up about 25 percent of the width, considerable less variability is there in the Japanese product. Now when the product was picked up from both from the customer one, which is in USA and customer two which is in Japan. The variability was calculated and the variability was found out. If you have listened to me and what I have just mentioned about two or three minutes back, it was about 75 percent for the US products and about 25 percent in the Japanese product. Now with that information let me come to the second diagram, which is there on the slide, which is figure 1.2. Again I am mentioning that it has been taken from Montgomerys statistical process control book.

Now, in this figure along the x axis, it is now no longer the country. This is basically the measure matric, which you are basically trying to measure. Measure may be strength, measure may be durability, number of hours a parts, but transmission line can work before it fails transmission system in the car. Or see for example, the length of the tie rod which you had basically you are trying to utilizes the transmission system, it maybe say for example, thickness of the rod whatever it is. So, we measure that along the x axis and along the y axis. Basically we have the actual frequency or the relative frequency, or the probability graph, which is being measured for both the product separately.

Coming back, let me come to the slides the first one, which you have the first one which you have, which I am marking now, is with the black money's for the United States. So; obviously, it means the average value which is there, is being made which is the target, but if you see the variability of the product, which is the more broaden part of the other dumbbell shaped curve. So, this is the dumbbell shaped curve which we know is the normal distribution curve. It is much higher, which means the variability is very high for the US products, but if you consider the Japanese products.

If you see the variability is much low in that case, it would mean that the overall type of the variability which we want for the products, which are there for being supplied for the Japanese market, or the customer is much low, which I mentioned. If you remember the variability was about 25 percent. So; obviously, it means the level of satisfaction the customer. Now I am using the word customer, is actually the person who has bought this two products; one from Japan and one form US. So, that customer satisfaction level is much higher by using the Japanese product. Hence we will definitely see the level of qualities being met for customer two, which is the Japanese supplier.

. So, continuing the discussion if you see the second point. I mean, the consider between less variability is there in the Japanese product. So, as for Jack Welch who was basically the CEO of General Electric for a long time and who was considered a very stalwart or considered very important person, in trying to basically revamp or turn around. So, it says the customers does not see.

Mean they look at the variability and the higher the variability of which would mean the, what is the quality of that product is lower the variability means better the quality of the product is obviously if the variability is very high, very low along the target which you if it is not removed. And which means that the product which is being supplied by customer one, which is the US company, would be in that level of quality, and for customer two who are the Japanese from a, for that the variability is very low, it would mean that the level of quality for that product is much higher.

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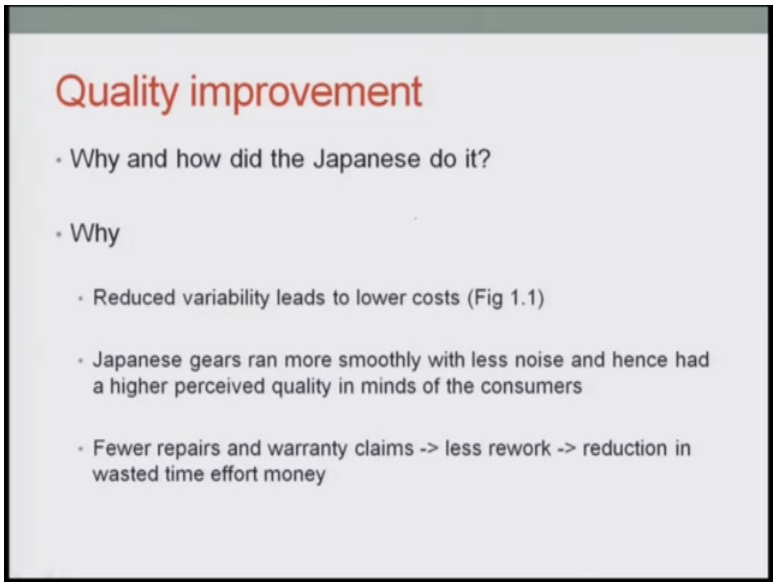

So, the next question comes and if you know we have already read in a literature. We see many at times, in books we seen in many times in different type of manufacturing products, and if you remember in the first instances of the first class, I did mention during World War 2, and later on Japanese products were not at all considered a very good products, and while the duality and the reliability of the German products still. Now the German products are considered a very high quality, but; obviously, the overall scenario of the Japanese products has really changed their considered less costly and definitely much durable, and to a much higher level of reliability, considered their costs.

So, the main question comes out is, that why and how did the Japanese do it. So; obviously, it came up after World War 2 and later on, when the different type of industries from in US, the steel industry is the, car industries were taken over and replaced by Japanese forms. Obviously, the question started coming it that how and why did the Japanese and how they were able to do that. So, why the question can be answered? So, basically they reduce the variability, and that leads to lower cost. If you read the first figure, where the cost were given on the y axis, and the countries where given on the x axis. So, lower the cost means, it will basically read it in need to lower variability for the Japanese customer on the form.

Japanese give us much more smoothly for this transmission line. As I mentioned that tie rod or whatever it being utilized for the car industry or the truck industry or the Lcd

Industries Japanese gear ran most smoothly with less noise, and hence at a highest perceived quality in mines of the customers. So, these are the example, which I knew in the actual analysis, which has been done and based on that, I am trying to basically highlight the important point, not trying to basically go into depth, but give you the highlighted points, which are specific to the quality with respect to customer one, and customer two. So, the last point was that fewer repairs and warranty claims were there, which means less rework. So, if the number of complaints for the Japanese product is less.

Obviously, it means less work for by the Japanese from which means the products which are being utilized and which has been supplied by the Japanese are working on a higher level of reliability, higher do durability level. It also means that deduction in the wasted time, and effort on money is much less; such that the products can be utilized considering the fact that the level of quality perception, and actually which is true for the Japanese product is much higher. So, the question comes is that first was how, why and next question is how.

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So, for the Japanese quality improvement basically means reduction of variability in processes and products. They also focused on reduce deduction of the waste materials, because if waste is very high, it would basically add up onto the cost. So, the amount of wastage amount of spillovers amount of residues, which are basically coming out from

the processing plant, when you are manufacturing. Say for example, this transmission tie rods if they are less; obviously, it would mean that per unit utilization of raw materials you are able to utilize that, and manufacturing much more number of transmission rods than your customer one, which is basically the US form.

Specially pertinent to the service industries would be improving the service process leads to less effort and time in correction. So, if you are considering the service industries, and considering that you are delivering pizza. So; obviously, if you deliver the wrong pizza, it means that you have to again re run your whole process, which means a huge amount of loss of time, huge amount of loss of a customer, huge amount of dissatisfaction among the customers, huge amount of cost incurred. So; obviously, they would leave lead to a lower level of quality satisfaction amongst the customers, who were getting your services.

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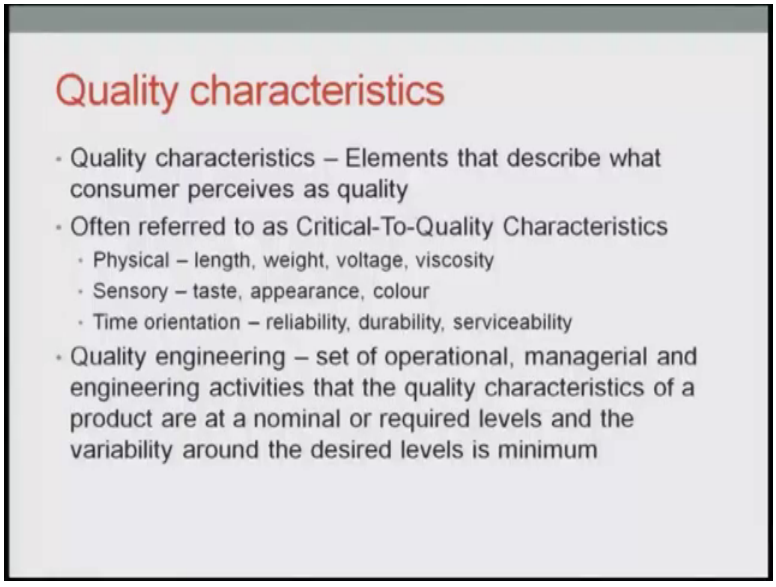

Quality characteristics if you consider. So, quality characteristics can be of different types. So, what are those I will just consider that. So, just to take a note, take a break, but I want to say that whatever things I am considering if you remember, I did mention in the first lecture. Also I had mentioned in the second lecture, also in the beginning that please consider Montages book as the bible, based on which you can at least understand the concept. It is a thick book you have to basically spend a lot of time and trying to

understand that, but if you understand the concept, it will really bring out the flavor of quality which had been mentioning time and again.

So, quality characteristics basically would mean elements that describe what consumers peruse as quality. Quality referred to would be basically be related to critical to quality characteristics, which would be it can basically to do with physical characteristics, which will be length width voltage viscosity amount of resistance so on and so forth. It may also basically be related to the sensory perceptional; like taste appearance color, it may also depend on the time orientations, basically it mean deal with respect to reliability, may this deal with respect to durability, may deal with respect to serviceability.

So, quality engineering in the concept; that is sets, the set of operations and managerial and engineering activities, that the quality characteristics of a product are at a nominal or required level, and the variability around the desired level has to be minimum; such that is able to meet the quality characteristics, for which has been designed.

So, with this I will basically end the second lecture, and then continue our discussion about quality levels, quality metrics, and all the interfaces in the quantitative, as well as the qualitative aspect for quality, as we proceed in lecture three and so on and so forth. Have a nice day.

Thank you.