Product Design and Manufacturing
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Lecture – 8b
Translating Customer needs (Part 2 of 2)

Friends welcome back. We were last time talking about Translating Customer's voice and we were trying to understand the tooled called as quality function deployment.

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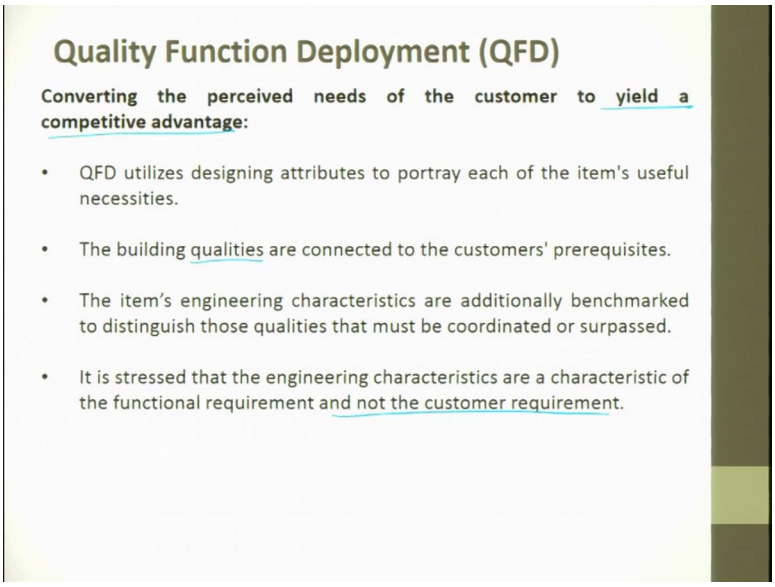

So, let me recap little bit about quality function deployment.

- Quality function deployment is a tool, which is used in converting the perceived needs of the customer to yield a competitive advantage. That means to say, you are trying to understand whatever customer wants, many of them will be qualitative, that converting it into a quantitative way.

- And when you convert it into quantitative way, you will also have to see what is already available in the market. So, that your product can go one step ahead of it, so, that you can reach out to the customers and do a wonderful justification to whatever it is. So, to yield a competitive advantage, if that what it is.

- Quality function deployment, utilizes designing attributes to portray each of the items useful necessities.

For example, when we talk about a pen, when we talk about a car, when we talk about a chair, you always say I would like to have these 1 2 3 4 5 6 7 8 9 10 requirements. And again these requirements, it will have to be ranked, and certain requirements, where you feel it is important, may be the customer feels that is not important.

For example, even today, we do not have a customized chair, which can suit individual's requirement. We all do a compromise in our sitting posture to the existing chair, whatever available with us. Even now it is a challenge, even now a table is a challenge, even now a pen is a challenge, even now a shoe is a challenge.

So, there are several challenges, but we are happy with whatever product is available and then we try to make the best use of it and we are happy with that. So, that is what we are trying to say, portrait each of the item's useful necessity.

- The building quality are connected to the customer's prerequisites.

So, this is what we are trying to say, whatever we are trying to build in our product, we will try to make sure that it fulfills all the prerequisites. Before this, we discussed about the Canvas model, in that canvas model, you have an expectation feature and you have a wow feature. So, that is what it is customer's requirement.

- The items engineering characteristics are additional benchmark, to distinguish those qualities, that must be coordinated or surpassed.

- It is trust that the engineering characteristics are a characteristics of the functional requirement and not the customer requirement. So, we also try to see majority of the functional requirement, customer requirements are converted into a functional requirement.

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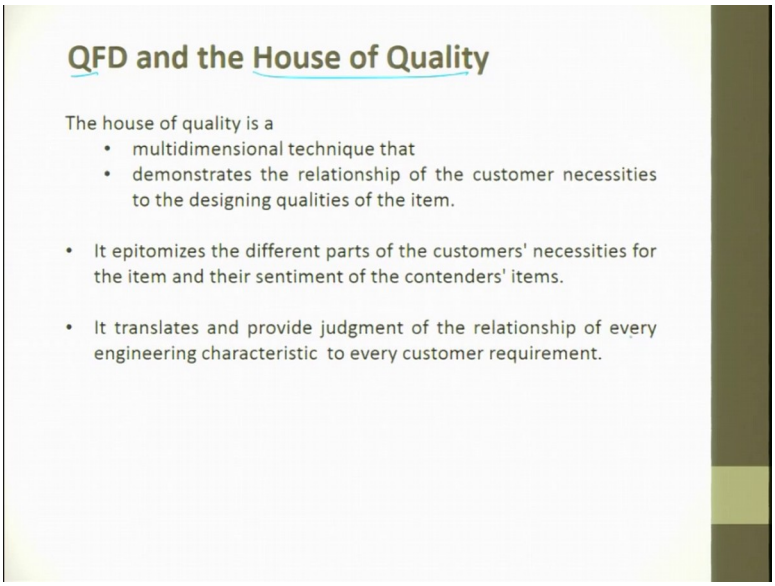

For this, what we do is QFD, we use the house of quality, what is house of quality.

- House of quality is a multidimensional technique that demonstrates the relationship of the customer's necessity to the designing qualities of the item.
- It epitomizes the different parts of the customers' necessity for the item and their sentiments for the contenders' items.
- So, that means to say, the state of the art with their competitor, it translates and provides judgment to the relationship of every engineering characteristic to that of the customer requirement.

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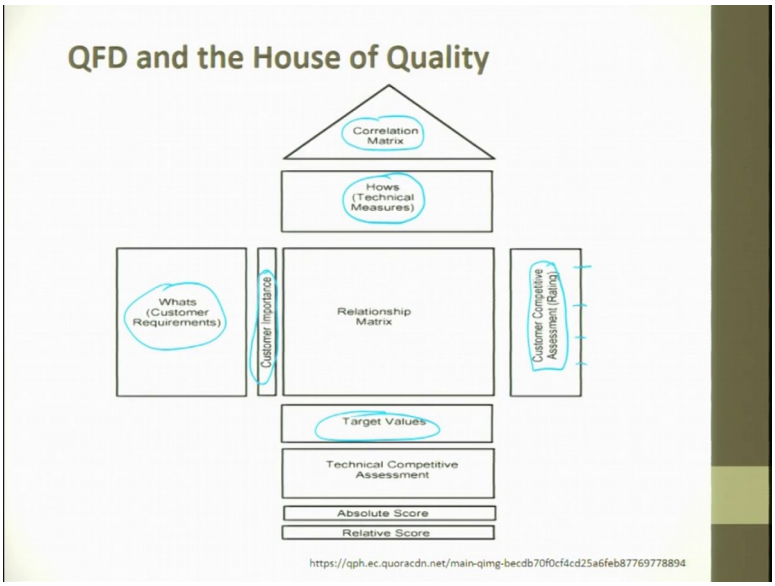

So, we will see, what is that house of quality? This is how the house of quality looks like. So, first we write down all the wants, what does a customer wants? And then what we do is, we start seeing that how are these customer requirements achieved, and for this how, you will have technical measures.

So, before even getting into this, we also try to give something called as customer importance. Customer importance are among this 10 15 parameters, which are 1 2 3 4 5, we rank them and then we try to move them up and down. And then we try to list them, how are these achieved, what customer wants and how are they achieved; this is where is the customer.

So, you have written all customer requirements, how they achieve and existing products, which are available in the market, how are they compared with the existing product, or with the requirements. Or I would say that, these are the competitive products which meet the customer requirements and how are they achieved, so, you have a relationship between them.

Based on this, you will try to choose one or two parameters best in each row, and finally, you try to set the target values; moment you set the target values, how are you going to achieve and on the top roof, whatever you have, is a correlation matrix. This matrix is going to talk about the relationship between the technical parameters itself.

So, this is what is called as QFD. QFD is otherwise called as the house of quality, this is a powerful tool which Japanese started, then Americans picked over. Then later electronic industries picked over, and they really enjoy the benefit out of this quality function deployment, house of quality tool.

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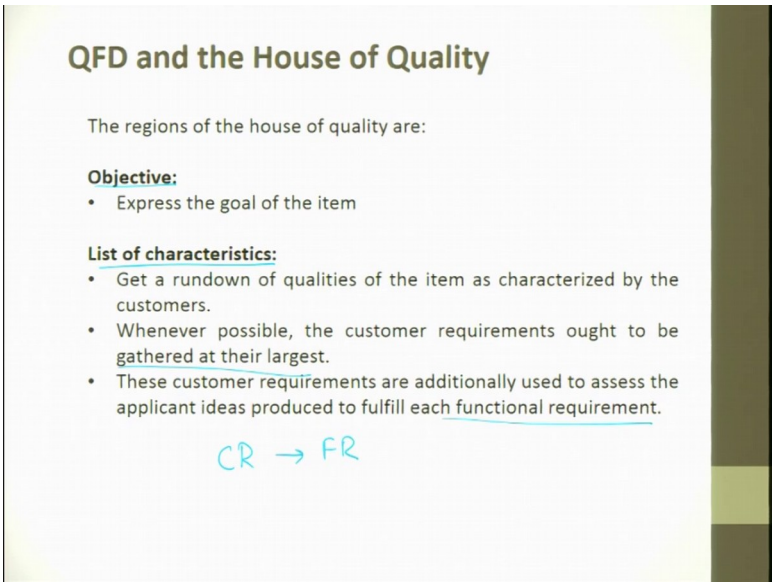

The regions of the house of quality are :

- Objective:
  - Expresses the goal of the item.
- The list of the characteristics:
  - Get a rundown of qualities of the item as characteristics by the customer, it should be soft, it should be hot, it should be sweet, it should be spicy, whatever it is.
  - Whenever possible, the customer requirement ought to be gathered at their largest.

So, please do not call from 2 people; for example, nowadays it is a most interesting fashion you can see, while booking hotels, you look at the star rating. So, last time I booked a hotel, which had a star rating of 5 out of 5.

So, then I was pretty happy, I booked the same hotel and I went to that hotel and somehow I was not very happy with the hotel accommodation. So, then I came back and then I was looking at, where did I make a mistake, I picked the hotel where it had a star rating very high. Then I saw that the star rating was given by only 1 person. So, when the lot size is very small, the qualities or the result are not reliable.

So, we are always required to collect the largest, take a large data points and then pick up the requirements. These customer requirements are additionally used to assess the applicant's idea produced to fulfill each functional requirement. So, Customer Requirement and Functional Requirements are different. CR will lead to FR.

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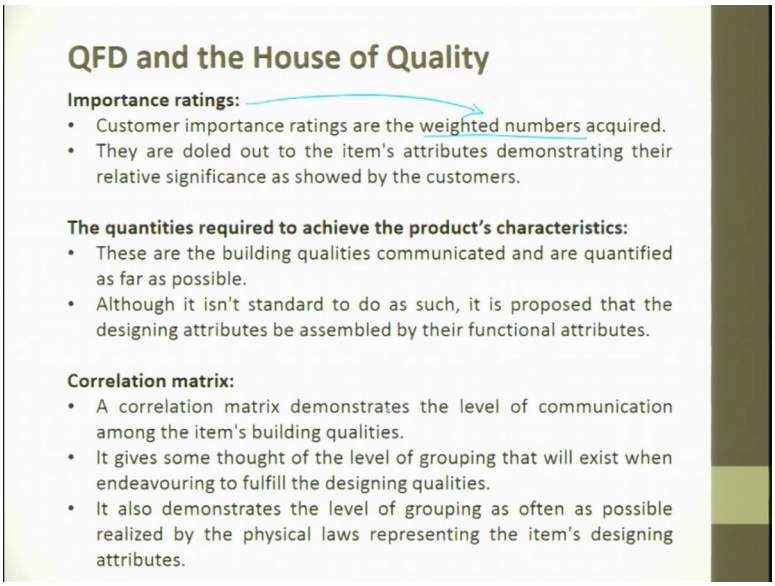

Importance of rating, the customer you have given 10, as I already discussed you have given 10 items. So, now we try to give them with a weighted number; why are we doing this, because see if you try to say qualitatively, I have to convert into quantitative. And moment I wanted to convert them into quantitative, it is easy I play with numbers. And all these things will always lead to weightages, when I do it as a multiplication factor with some other numbers A, B and C.

So, now I will know what is the difference and by looking at the numbers, I will be able to pick up, how significant is this parameter with respect to your output. They are doled out to the items attribute demonstrating their relative significance, as shown by the customer.

- The quantities required to achieve the product characteristics are the building quantities communicated and are quantified, as far as possible.

- Although, it is not standard to do as such, it is proposed that the designing attributes be assembled by their functional attributes. Correlation matrix was on the top; the correlation matrix demonstrates the level of communication amongst the item built in qualities.

- It gives some thought of the level of grouping, that will exist when the endeavours to fulfill the designing quantities.

- So, you can move them up and down and then try to take it and moment you move them up and down, what you can do is, you can try to have a sub module ready, so, that you can start producing it.

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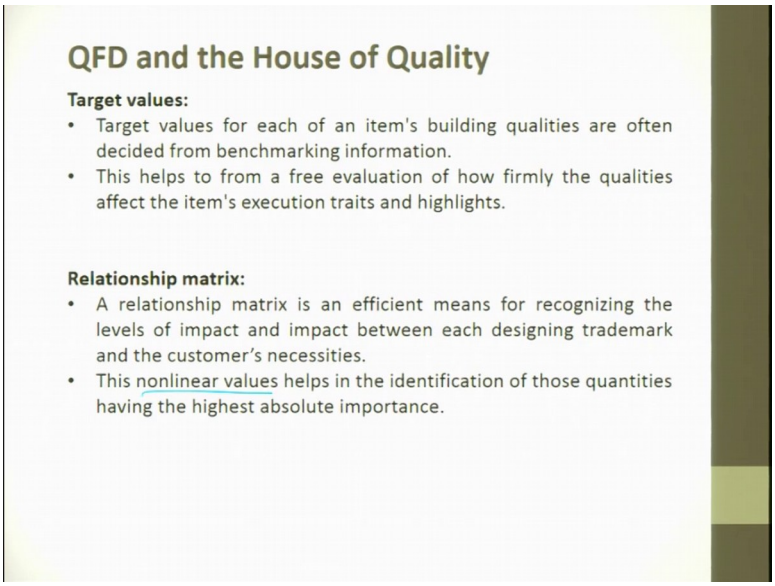

So, target values, this is what I told you and then finally, relationship matrix.

- Relationship matrix is an efficient means of recognizing the levels of impact and the impact between each designing trademark and the customer necessities.

- This non-linear values help in identification of those quantities having the highest absolute importance.

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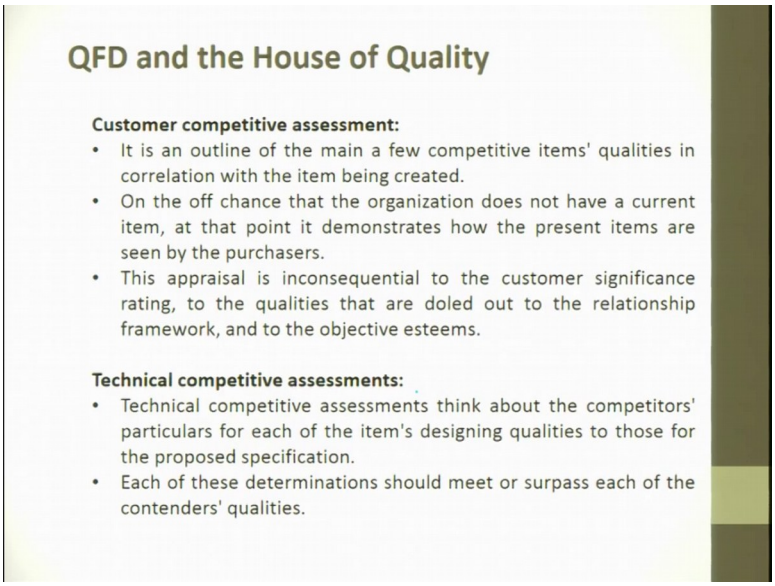

Customer competitive assessment, we have already discussed and the technical competitive assessment also we have discussed.

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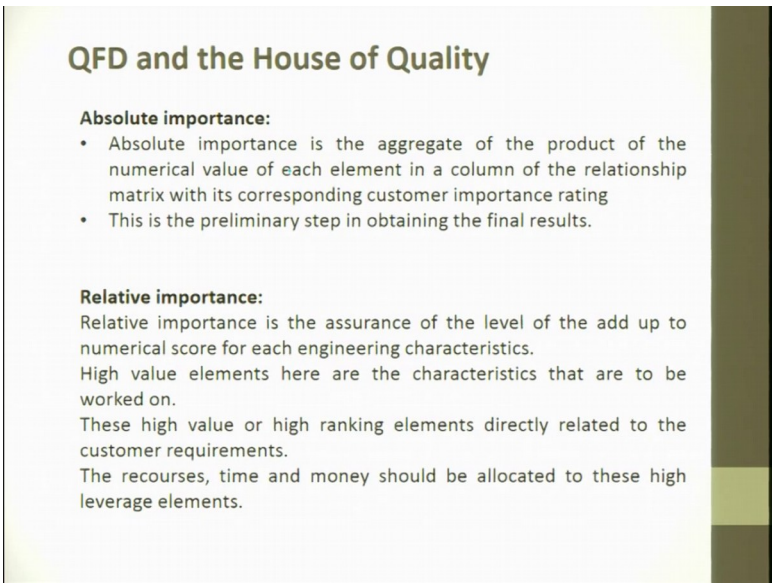

- Absolute importance: it is the aggregate of the product of the numerical value of each element in a column of the relationship matrix with its corresponding customer importance rating.

- This is a preliminary step in obtaining the final results, so, that is absolutely important.

- Relative importance: it is the assurance of the level of the added up to the numerical score, for each engineering characteristics. High value elements here are characterized, that are to be worked on and the lower one are given a second importance and start doing it. So, you keep iterating step by step, so, you will try to get the requirements.

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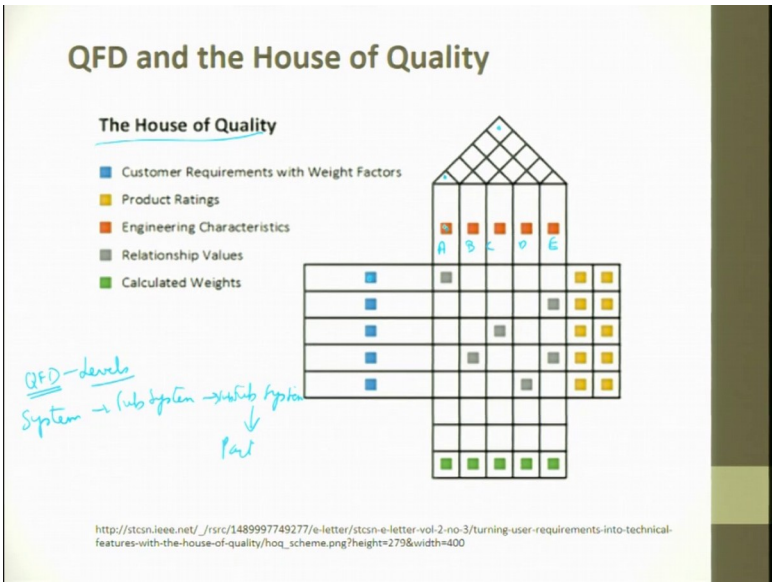

And I would like to tell you that, quality function deployment is drawn at various levels. So, it will be drawn for a system, then it will be drawn for a subsystem, then it will be drawn for a sub subsystem. And then it will go towards a part and then you will try to do QFD.

- So, every QFD will lead to a next level QFD, that will lead to a next level QFD. You can keep iterating this QFD and when you start working on it, you will try to get the best out of it. So, these are the customer requirements with waiting factor I was talking to you about.

- Then the next one is, the product rating, what it is. And then, these are all the engineering characteristics. This is a correlation matrix which tries to tell me how is this fellow related with this fellow. So, for example, A is related with B, C, D

and E; how is A related with E and how is A related with D, you can start giving it. And the same way, how is D related with A, also you can see.

So, this is a correlation matrix, and then these are the engineering characteristics; how do we achieve what customer wants. And these are the relative values; for example, how for this customer requirement, how do we meet out this engineering characteristics, and then what is their ranking with respect to this.

So, you can have 9, you can have 3, you can have 2, whatever it is. Then you have relationship matrix, which we talked about and based on all these calculations, we have a calculated value at the bottom. So, we try to look at this and try to solve, and give priorities and then solve the requirements, by that we increase the product specification.

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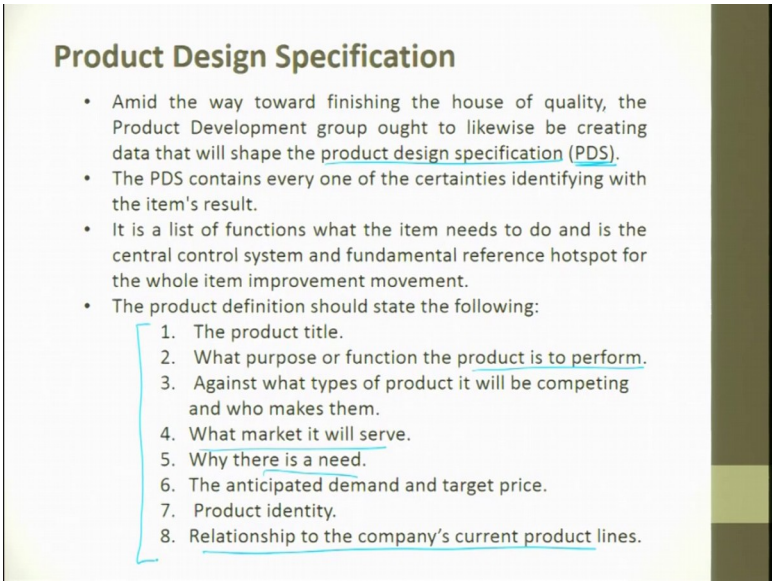

When we look at the product design specification,

- It amid the way towards finishing the house of quality, the product development group ought to likewise be creating the data, that will shape the product design specification, PDS.
- PDS contains every one of the certainties identified with item's result.
- It is the list of all functions specification, what the item needs to do and is the centre control system and fundamental reference hotspots for the whole item

improvement movement. The product specification should state the following things, what is the product title, what purpose or function the product is to perform.

For example, I asked a student a question, what are you doing? The student said, I am a research scholar. Then I asked him, how are you doing? He says that, I am happy, then I asked him, what do you mean by happiness? He says, I recently published one paper here, one paper here, I am sending one paper there.

So, then I asked him, is writing papers the only thing as part of research? He said no, then I asked him, tell me what are you doing? He says that, I do this, I do this. But I could not understand what he does; so, then I told him, see now it is time that you should write down what you want to achieve in your PhD and where are you now, and how are you going to achieve to the rest of the targets.

So, then he started thinking, he started listing it down; believe me, within the next 1 year, he was able to complete his thesis and graduate. So, specification is very important, you should know what are the targets and how are we going to achieve and how is it right. So, the purpose and the function of the product is to perform, what do you expect from a pen? People say, I expect this pen to write, fine, anyhow this pen writes, I want to write the pen smoothly.

So, now comes the question, what is smoothness? So, then I say that, when I use this pen, the ink should not flow out, my hand should not get wet, the ink should not make my hand feel dirty or so, all that things, so, that is what is a pen should be like, write clean, neat, without spilling ink.

So, now you see, you have put many of those things in the purpose and function of the product. Against what type of products will it be competiting and who makes them. For example, you might say these pens are available in abroad, when I was young, people used to hold that paper made pen, then they used to write.

And in India, we did not have that, I am talking about 20-25 years back, we were never even aware of a concept of use and throw. So, when I have to make a product, I should always look at, what is national, what international, who makes it, and how do they make it? Next, what market will it serve?

- The anticipated demand and target price, this also you should know, product identities and the relationship of the company's current product line with respect to it. For example, it is interesting for you, take TATA as a group, TATA is very famous for iron and steel; TATA motors. Look at their spectrum, they also make salt, TATA salt. If a big company comes and when they had to enter into market, it was very difficult for the TATA company to convince customers to say that, see we also make products in the domestic domain.

- People did not accept it in the first round, it took lot of time for customers to accept. And then, they started accepting and today they have their own market. So, the relationship of the company's current product line also plays an important role while releasing the product. So, these are all important product definitions which should be stated.

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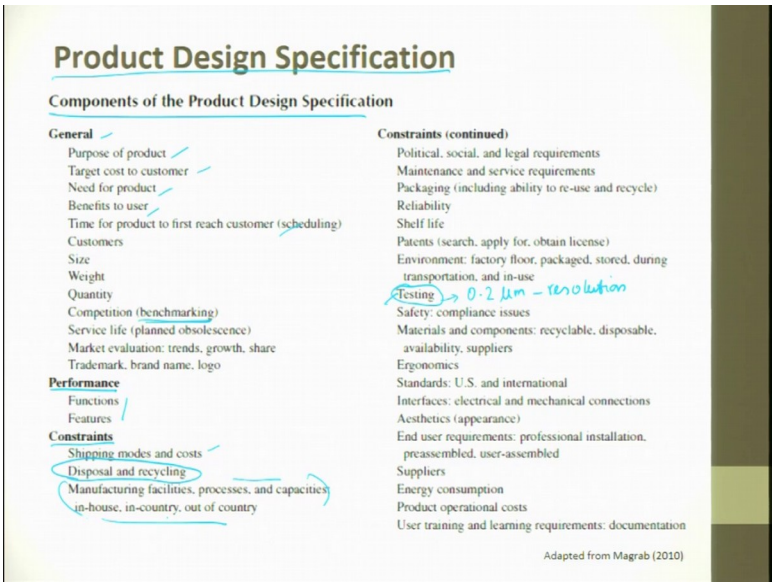

So, the purpose of the product should be very clear and then the target cost to the customer should also be clear. When I say, I want to make a pen and you should have a pricing for it.

When you have a pricing for it, then you start reverse working at; for example, when TATA motors started making a Nano car, they first fix that overall price of 2500 dollars and they said or 1 lakh rupees. And then they starting saying, this is the maximum Indian middle class family can give and now I will try to make a car for them.

So, then what they did was, listed down on all the subsystems and then they put the weightages of all the subsystems. And then corresponding to their weightages they started dividing their 1 lakh. And then they also found out, what is the weightage of that particular product in the overall performance of the car.

Then correspondingly, they made a costing and then next what are all the very salient one, which they cannot undergo any risk. For example, radiator, engine, they cannot take a risk, they can spend more money, so, then they did one another costing. Then they tried to have the matrix ready with them and then finally, they decided, if there is a component A in the car, this will be the maximum price they can give.

So, I said purpose and need, purpose and need are different, need benefit for the user then, time for product to first reach customer, that is also very important. If I decide to buy a car and then, I pay booking for the car and I wait for long time and then I realize that the car is supposed to be delivered after 18 months.

So, people will say, no, I do not need it and today in this e-world and digital world, where the supply chain is very strong, people do not even feel like waiting for even 24 hours. People today get fast food within 30 minutes, I ordered, after 30 minutes, I get a delivery, so, that is what it is. So, in general purpose, you will also try to do a benchmarking.

When you are looking for a product, you should always do benchmarking, look at your customer, see what they do and never try to mimic them, go ahead of them. So, benchmarking is what, you know what your customer wants, or your competitor makes, draw a line and break that line and go further. Service life, market evaluation and trademarks, as well as performance is concerned; look at their functions, look at their features, you try to get the performance, then comes constraints.

So, cost is a constraint, this is an interesting thing which people are now talking about, disposal and recycling. After these laptops are over, they have lot of rare earth materials, how do we discard, that is also required in the product specification, today; how are we going to recycle and discard. Then manufacturing facilities, process capabilities, in house, in country, out of country, these are some of the constraints which you have to look forward.

For example, people try to make lot of wooden furnitures; the wood is a constraint in our country. So, it has to be imported, or thermal power plant, coal is a constraint, the good quality coal is a constraint in India, so, it has to be imported. So, these are all certain things we should see, how do we go about in the product specification itself.

And keep continuing the constraints, testing facility today, I was trying to work on a machine and I was trying to buy xyz states, where company said I have 0.2 micron resolution of the states. So, my first question came to me, I will buy this, because this is what is the resolution I want for my machine, but then I asked a question for myself. Suppose if the person who delivers it, comes and says, here is a machine of 0.2 micron resolution, please validate it, I do not have a capability to validate it.

So now, if he says 1 micron, it is , because I do not have the capability. So, testing is other thing which is very important, when we make a textile cloth, there are characteristics tests which are to be performed, it has to withstand 10000 times cyclic load. So, those test facilities should be there and based on the test facilities only, we should try to do a product design specification. Same with aesthetics, energy consumption, all these things are small components of product design.

So, you can pick up and then try to go through the list and start filling up the details for each item and then you can try to have your own product specification or customer requirements.

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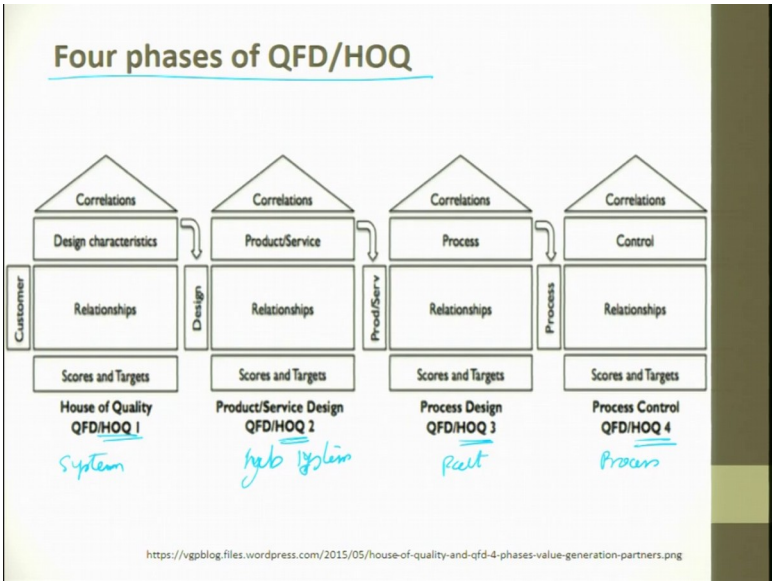

So, this is the first level house of quality, from the house of quality, it led to a design and then starts the next house of quality, then it led to services and this services let to process. So, moment you start working on several levels of house of quality, I am sure you will try meet out target, because at every stage, you try to meet out a score and a target one, so, your product is good and every stage, you will try to beat a customer and go further.

So, that is what it is called as four phase of quality function deployment or house of quality. So, this can be a system, this can be a subsystem, this can be a part, this can be a process, whatever it is. So, you see we can start working from a whole system and we go to the last point and see what is that required.

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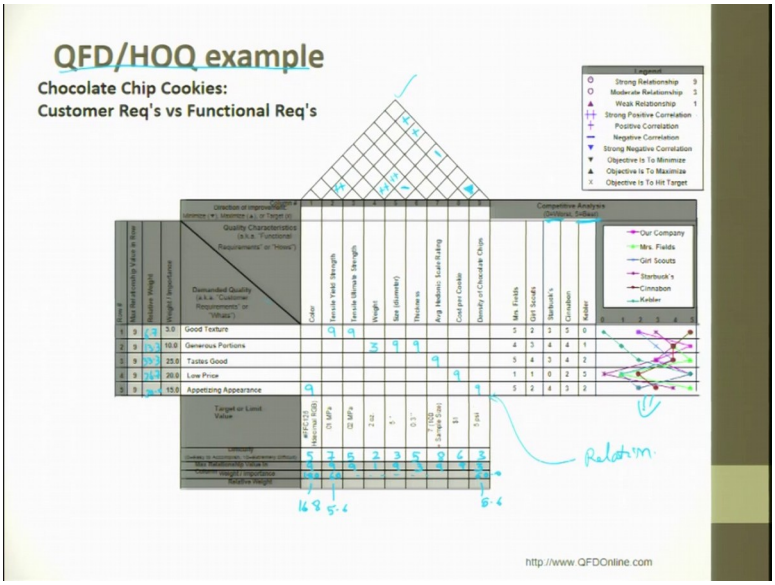

So, correlation all comes in the top, so, correlation comes here and then relationship comes here, you get relationship. And this is all their competitive analysis and these are the companies and these are the target values whatever we have put here. And these are the difficulties in achieving the target, this is the maximum relationship value you get. Then you have a weightages and then you have a relative weightage, with that you try to draw a house of quality.

So, here is an example, where trying to talk about chocolate chips cookies has to be made. The customer requirement versus functional requirement; customer requirements are the demand from customers. It has to have a good texture, it has to be generous

portions, and it should taste good, it has to be low price, it has to have an appetizing appearance.

So, here you will have the quality characteristics, so, these are the quality functions, these are the quality or the functional requirements, colour, then you have the tensile yield strength, tensile ultimate strength. Then you will have weight, size, thickness, average sale, average hedonic scale rating, cost for cookie, density of the chocolate chips. So, all these things are the functional requirements and these are the customer requirements.

So, you have written 1 2 3 4 5 and then maximum relationship value in each row, you have given. And then you have given weightages of each one. So from this, we try to take the relative weightages, so, the relative weightages, you will get 6.7, 13.3 and 33.3.

So, you multiply and then you sum it up and then you divide and find out what is this ratio, so, you get it, then it is 26.7 and then you have 20. So, these are relative weightages what you get, so you take this total and then divide it by the sum and then you get it here, so, now, let us see the relationship. So, the good texture, it has a strong relationship with respect to the output.

So, I try to give 9 marks. So, I will try to have a high tensile strength, I give 9 marks, so then, this weight. So, generous portion and weight, they are very weak, this thing, the relationship. So, generous as a size it is very high, then you will also have thickness, it is very high. Then tastes good, this is 9 points and then lower price cost for cookie, it should be as low as possible. And an appearance, I should a colour is one and then the density also plays a very important role.

So, now let me look at the relationship between these two fellows. So, the yield strength, the tensile yield strength and the ultimate, they have a strong relationship. So, I will give them double plus and then I have the weight with respect to size, they have a double plus. Then I have weight with respect to thickness.

So, I have a negative influence size, with respect to thickness. So, they have a negative correlation, size, diameter with respect to thickness, then I also have a negative for this density versus size. So, then I can also have very strong negative correlation; very strong negative correlation is cost and density.

So, the similar way, I have a positive correlation between this and then I have a positive correlation between this. So, you can keep adding it, so I have just put a relationship. So, now, you have now your competitor analysis are doing, 5 is the best and 0 is the worst. So, you are trying to compete with the competitors and see how is your rating , how is their performance which meeting out the customer requirements, so, you are trying to get this done.

So, now, what has happened, you are trying to look at the difficulty level, how difficult it is in getting these things. So, you can now start giving numbers, so, 5 7 5 2 3 5 8 6 and 3, so, these are the difficulty levels. Now, I can try to meet out the customer requirements, I have just given the rating.

So, you can again start giving this relationship values. So then, it is weightages per importance, now I am trying to multiply this and try to get the weightages right, column weightage and importance.

So, you can keep doing 60 and then you can keep doing all these values, I get a value of 60. Now, I try to see their influence on the total score, so I try to get the relative importance. So, 16.8, then maybe I get 5.6, so it goes on, so I get a 5.6. So, this is over the relative weightages, and then from here, I try to pick the values and start working on it. So, this is how you try to fill out the house of quality in quality function deployment.

So, like this, if you start filling up all the relationship, you can start getting a complete value, you get all the numbers and from these numbers, you can start giving the relative weightages. From this relative weightages, you know the significant parameters and you start attacking the significant parameters to meet out the customer demand. And here is it talks about, how is the company’s performance with respect to your product.

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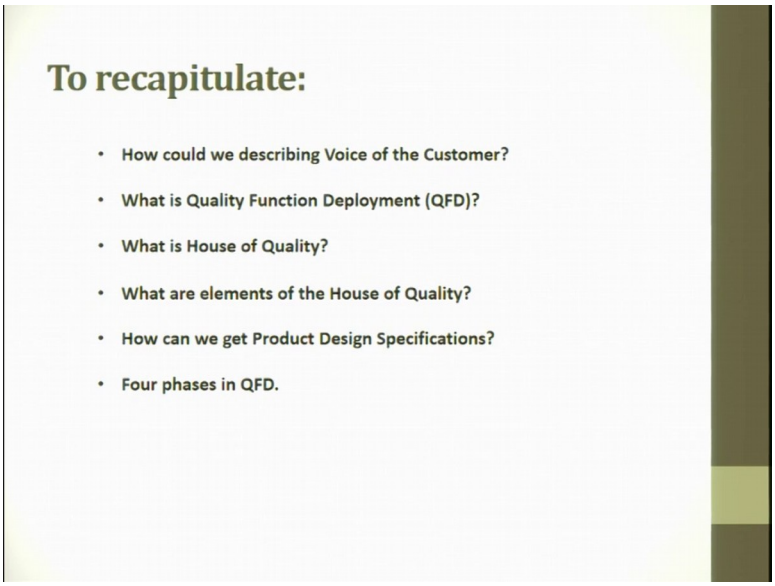

So, with this, we would like to come to an end for this quality function deployment. So, to recap, first we saw how could we describe the voice of customers, then we saw what is quality function deployment, then we saw, what is house of quality, then we saw elements of house of quality, then we saw how do we get the specific product specification and then the last one we saw, what are the four faces in QFD.

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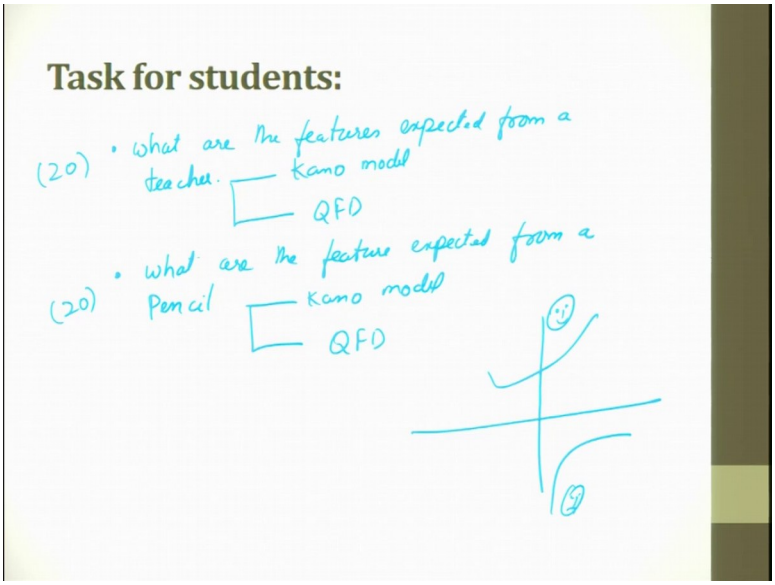

So, as a small example, which the student is suppose to try and need not submit with us, try to find out what are the features expected from a teacher. So, you are supposed to

develop a Kano model and then you are also supposed to develop a QFD for it. What are the features, so, features expected from a pencil? Again you are supposed to do a Kano model and then a QFD model.

So, you are supposed to do this model and try to figure out and you are also supposed to do a quality function deployment. So, you are supposed to talk to 20 people and try to take the voice of the customer and convert it into a Kano model and then QFD models.

So, voice of customer and quality function deployment and see how difficult it is, how iteratively it changes. So, with that two examples, we come to an end to this lecture.

Thank you.