Rapid Manufacturing

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Lecture – 05
Product Development Process (Part 2 of 3)

Welcome, to the course on Rapid Manufacturing. In the last lecture, we were discussing on the topic of Product Development and Processes.

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The content in this was product and its characteristics. We were also looking at evolution of product development. So, we will continue from the second rightly evolution of product development and we will keep moving in this lecture series.

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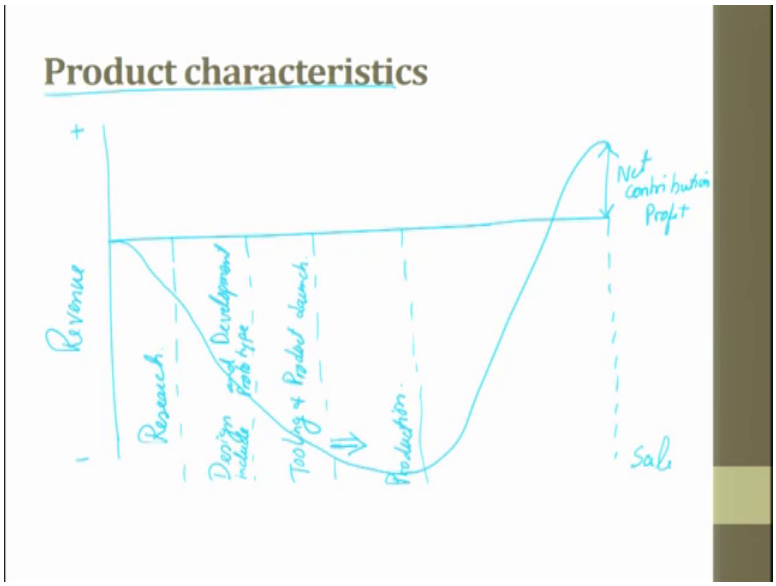

So, product characteristics we were discussing. So, I would like to just draw we are response or a graph which talks about revenue with respect to product life cycle. So, this is revenue, this is positive side of the revenue, this is negative side; that means, to say investment and this is we are getting back on the return from investment. So, the curve goes like this. So, it is divided into several faces; that means, to say where do we invest more and where do we try to get at return or a turn in the negative slope and where do we keep moving. In fact, if I do this then there is a end which comes. So, let me stop here. This is where we talk about is the net contribution profit, ok.

So, this is where you have started making sale of your product. So, this is the portion where production and this is where it is going to be invest on the tooling and product launching when you will invest in design and development, here we include prototype also, include prototype ok. This is going to be research, ok. So, while you are doing research we are going to invest money and the steepness of the curve keeps growing when we are doing design and development the investment and once we are getting into tools, it further continuous and in the production in fact, there will be a shift in the graph. So, this steep thing will continue up to tooling and then it keeps continuing towards production. So, let me redo it. So, it goes up to here and then we go up to profit, ok.

So, in once the production has started, then there will be a sale which is starts coming. So, during the sale from the deep negative side of the revenue, it starts moving towards

positive and moment you cross the basic investment, there comes your profit. So, this graph you should remember; that means, to say in the research stage minimum you do lot of investment in the design and development stage and the costing. So, here you in terms of money you do little, but your involvement you do very high and once the tooling is then the investment was very high because your POC is done proof of concept is done.

Now, you are looking for how do I convert my POC into a batch production then you are production has started. So, maybe 10 products are made, 100 products are made, 10000 products are made. So, you have invested and then you the curve moves towards the positive side.

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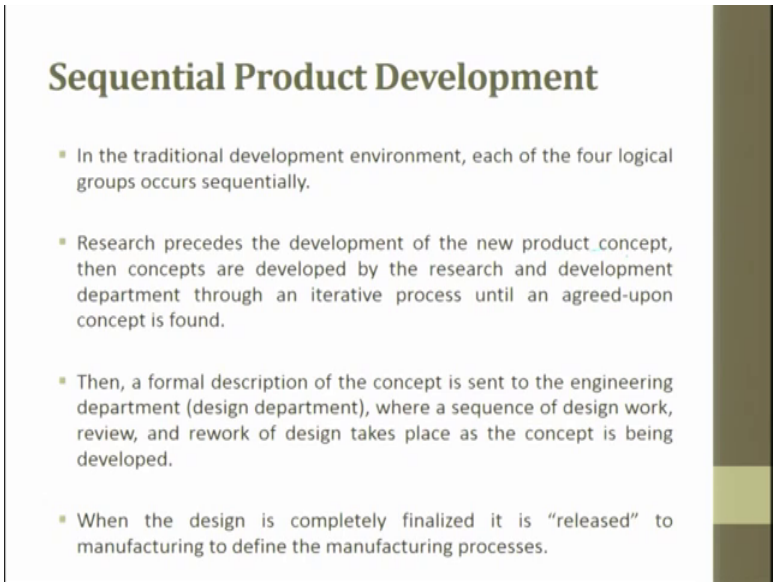

So, there is another thing which is called as a sequential product development. In the traditional development environment each of the four logical groups which we discussed in the last class occurs sequentially one after the other after the other after the other. So, here it looks like so, when we do it sequentially if there has to be an alteration which has to happen then again it follows only a sequential manner, ok.

That is a traditional way. The research proceeds the development of a new product concept, then the concept are developed by the researcher and development department through an iterative process until and agreed upon concept is formed. Then a formal description of the concept is sent to the engineering department where a sequence of design work review and rework of the design takes place as the concept is being

developed. When the design is completely finalized it is released. So, releasing of the product drawing to the manufacturing is a big event which happens in product development.

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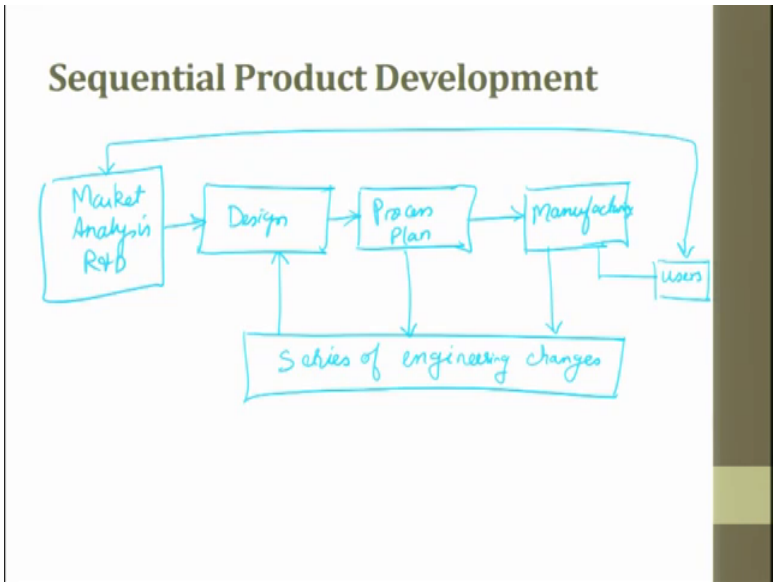

So, an important step so, I would like to about the block diagram market analysis, R and D, then we have design all these things are in sequence design, then we have process plan, then we have manufacturing, then we have of engineering changes, ok. So, this will go here, this will go here and this is all flowing in one direction and this will go from here to here and then we from manufacturing it goes to user or customer, ok. And, there is a back and forth movement which happens from here to here.

And, important step that is included in the manufacturing work is to determine which component will be made and when it will be made when it will be purchased or where it will be purchased.

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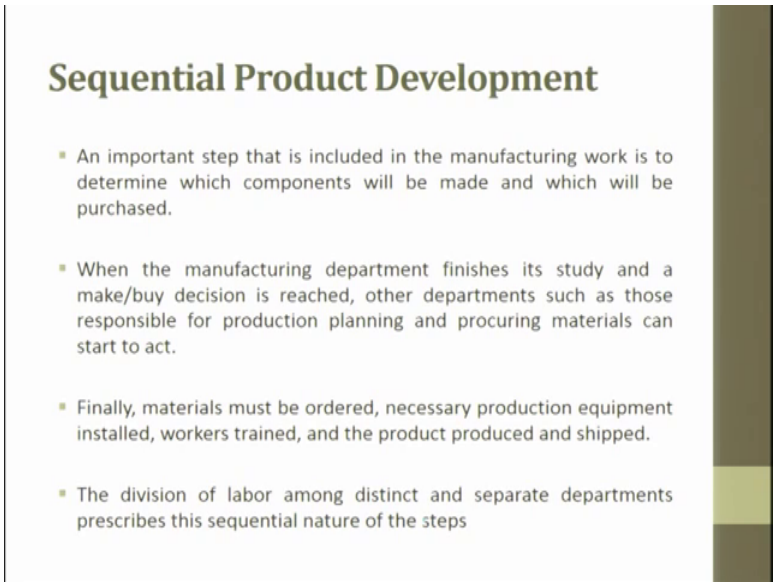

When the manufacturing department finalizes its study and make/ buy decision, so whether to do it inside or whether to get it done outside. For example, in house development of a small machine or a part it takes lot of time, but if you can find out a similar product which is already available in the market and do some few add ons to it. So, then what we do is rather than in house manufacturing we try to buy it from the market. So, many a times buying that off from the market looks to be economical and it is also of very good standards, but when we try to do in-house everything new it takes a long time.

So, the decision of making a product in house or buying it decision is very critical and crucial, maybe at the POC point of or the time of it we do everything in house. But, moment your POC is frozen your designs are frozen, then it is getting shifted from the design department to the manufacturing department that time we have to take a decision whether to make it in-house or buy it outside and where we do two things one is cost the other one is time. So, we evaluate these two and then we try to take a cost.

Other department such as those responsible for production planning and procurement of material then starts acting on it. Finally, materials must be ordered, necessary production equipments installed, workers trained and the product produced and shipped. So, all these things are at the last stage once the product is made. The division of labor among distinct and separate department describes this sequence nature of the step.

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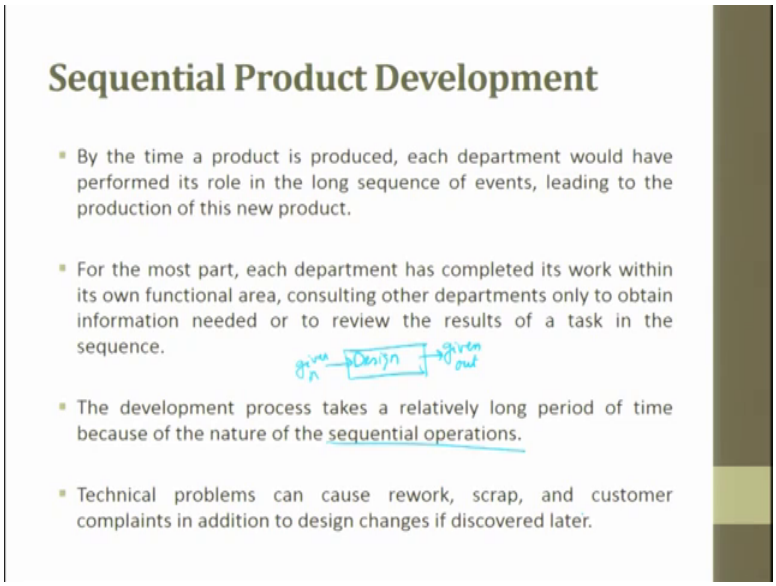

By the time a product is produced, each department would have performed its role in a long sequence of events, leading to a production of a new product. For the most part, each department has completed it is work within it is own functional area, consulting other departments only to obtain informations needed or to review the results of the task in sequence. We do everything within ourselves, but we ask the customer the next person who is going to use our product further that what is more required and what was the quality problem.

The development process takes a relatively long period of time because the nature of the sequential operation. Because every house, so, what we are the design house is at is a small block and everything tries to iteratively happened here and they will work on what they have been given and what this is given in to them and what they have given out they will always try to check with the next customer whether it is or not and do the quality problem improvement.

So, you see every box takes has a set of functions, it does the set of functions to the best of it is knowledge and then it tries to produce, but the holistic view of the product is not told to the design department and from design department whatever he gives it is an output the manufacturing works on the constraints of design department put on the manufacturing drawing. So, by this if you do, it takes a long period of time when we follow the sequential operation.

The technical problems can cross rework, scrap, and customer complaints in addition to the design change if discovered later. So, as far as designing a new product is concerned earlier the defects, if a product could feel early it is very much appreciated rather than a later failure. Because failing at the customer end is going to cost a huge image lost for the company as well as financial loss for the company. So, if the product has to fail let it fail now, that is the slogan which is company uses it when it is in the prototype.

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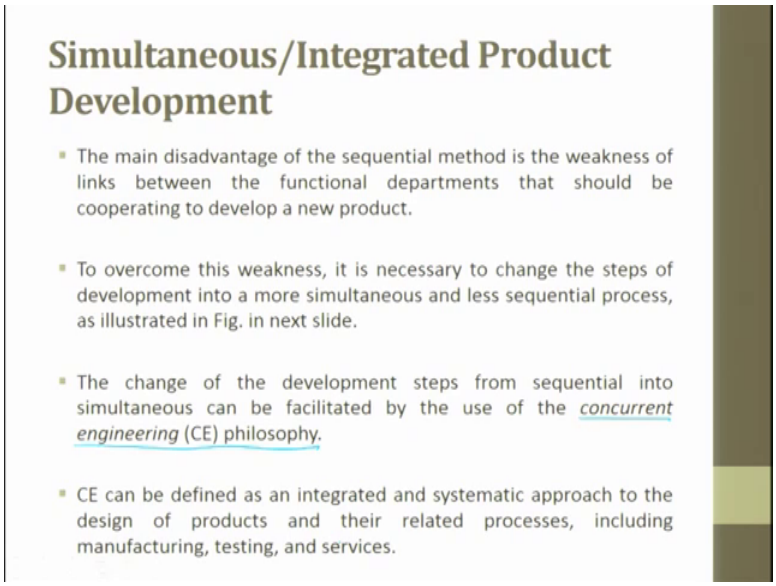

So, the main disadvantages of the sequential method is the weakness of the link between the functional department that should cooperate to develop a new product. To overcome this weakness, it is necessary to change the step development into a more simultaneous and less sequential process which we will illustrate in the next slide. So, we are moving towards simultaneous integrated product development from sequential product development model.

The change of the model steps from sequential into simultaneous can be facilitated by the use of concurrent engineering philosophy. Concurrent engineering can be defined as an integrated and systematic approach to the design of a product and their related processes including manufacturing, testing and services.

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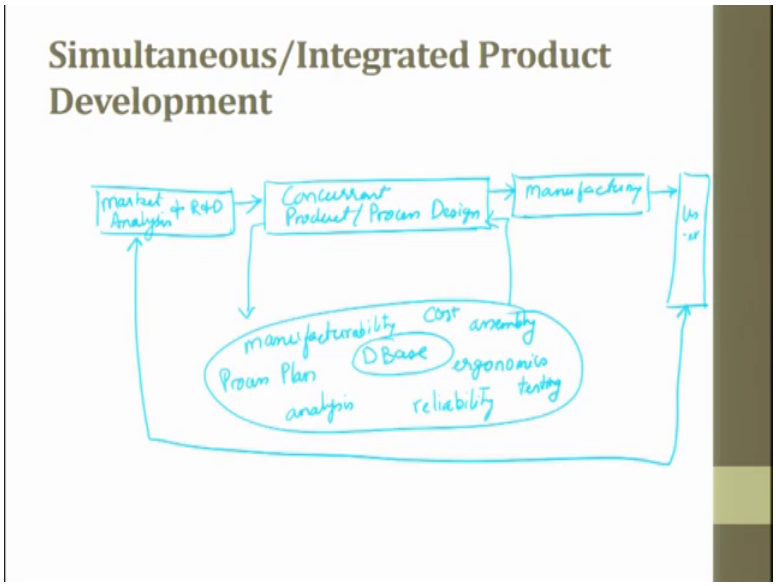

If you look at the drawing here, we will have marketing market analysis, and R and D, ok, then we will have concurrent product slash process design, then we will have manufacturing, then we will have a user; this is a user ok. So, here we will have a big block where it talks about database, wherein which you have manufacture ability manufacturability you will have process plan, you will have analysis, you will have reliability. Today what people expect is reliability and repeatability of the product. The product should perform the same task after a long period of time. So, liability is very important.

Then, there will be cost, there will be assembly and today, there is lot of importance given while product development itself for ergonomics and testing. So, these are the inputs which are given at the conceptual stage itself and we start developing it. So, this is more of concurrent engineering approach rather than sequential approach. It is called as simultaneous slash integrated product development model as against the sequential model. So, this model moves faster towards reducing the product life cycle time.

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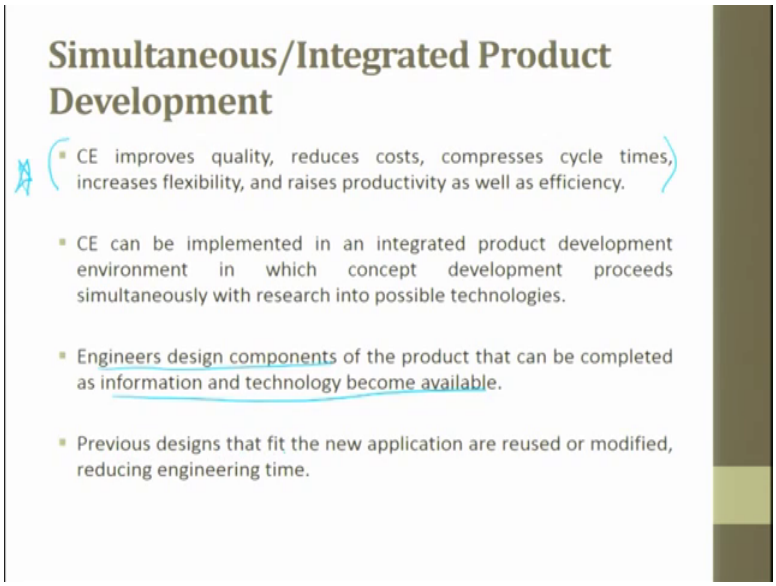

So, concurrent engineering improves quality reduces cost compresses cycle time increases flexibility and raises productivity as well as efficiency. This is the major advantage of concurrent engineering or following simultaneous product development approach. The concurrent engineering can be implemented in an integrated product development environment in which concept development proceeds simultaneously with research into possible technologies.

We do not talk about one technology. In the earlier case the market research was done, they found out this is the requirement, they gave it to the design department. Design department understood whatever the market gave and then they started working on it. Without even talking to the manufacturing department whether there is a possibility of changing or is there a manufacturing difficulty there. So, they were taking independent decisions. But, when we do simultaneous these up and down time movement and corrections can be reduced in a large way engineers design component of the product that can be completed as information and technology becomes available.

So, engineers design components of the products that can be completed as information and technology becomes available as and when you start doing it. And, on top of it when you do this simultaneous and if there is a database, every time you do not have to start the product from the scratch you will already have some existing models available, you take those models, see how can you tweak those models to meet out to the customer

requirements. So, that is also possible when we do simultaneous integrated product development. Previous design that fits the new application are reused or modified reducing the engineering time.

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Simulation and prototyping occur simultaneously within the engineering design activity. As design work progresses, development begins on the manufacturing process. All manufacturing functional areas participating in the design efforts, and cross-functional teams must be formed. So, this will try to bring in a healthy environment while product development.

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So, generic product development process: a generic product development process can be constructed starting with needs recognition and ends with the marketing of a finished part. So, it starts from need analysis and ends at market sales of the product.

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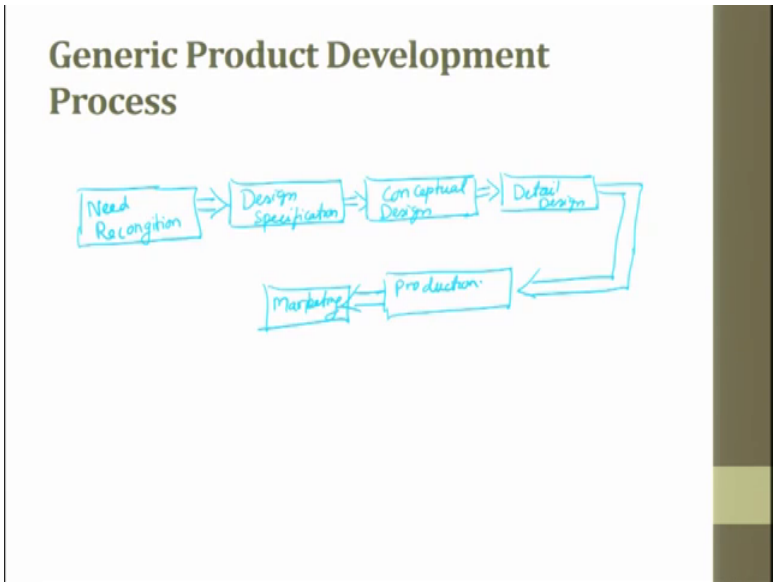

So, if we want to explain in a schematic diagram, so, we will make it need recognition, then we go for design specification, then we go for conceptual design, then we go for detail design, we go for production and we then go for marketing.

So, need recognition, understanding the customer which I told you when I decided to develop a product I have to first find the customer and then understand what customer wants; I gave you an example of ballpoint pen, I gave you an example of a shoe. So, these are need recognition and many a times there will be spelt out and silent needs are there might be something called as expectation from you, but it will not be spelt out, ok. So, need recognition.

So, then from that you try to make a design specification. This is need you convert it into engineering requirements that is design specifications and then based on the design specifications you start doing conceptual design and then you start working on detail design once the detail design is released, it is too hard for you to go back and start iterating back and forth. So, once the detailed design is released, then immediately manufacturing team takes over. Manufacturing team produces and give it is to the marketing team where marketing team finishers the product and complete cycle by doing sale and making profit to the company.

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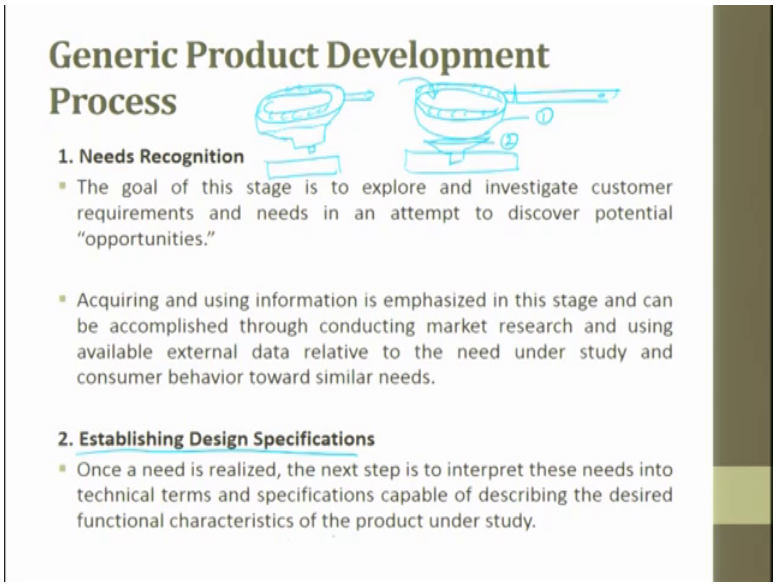

Need recognition the goal of this stage is to explore and investigate customer requirement and needs in an atom to discover potential opportunity. See even with a very minimum cost very minimum cost you can develop innovative products and these innovative products can make a huge market change. It can be even a disruptive technology; for example, after the digitisation coming into effect the photos which were

taken in roles were thrown off. Today nobody uses photo unless you are a very serious photographer you do not take photo films at all today. It is all done digitally and when we do it digitally we look at the potential users and we look at the opportunity while for developing a new product.

So, acquiring and using information is emphasized in this stage and can be accomplished through conducting market research and using available external data related to the need under study and consumer behaviour toward similar needs. So, what we are trying to say yes we are trying to say please do empathy study. When you feel that there is a product required please you yourself get into the shoe of a customer, start looking at the problem from the customers perspective and start developing your product or start developing your requirements need statements.

For example, you decide that I would like to make chocolates for school going kids. So, then you get into the shoe of a kid and see what all chocolates will the children accept. Should it be in vanilla flavour, should it be in coco flavour, should it be only should it be a mixed with nuts. So, you look into as a problem statement, you look from the customer's perspective. You become a customer, look at the situation, look at the other competitive products around and then you see what new think you can do such that you can flourish into the market.

So, that is need recognition. Many a times we will develop products those products are not even required right. So, these are the things. So, need recognition. Interestingly, I will tell you I found out of funnel in the market this is a funnel in the market usually we used to have it is not a funnel it is a filter sorry it is a filter in the market which is available. So, this is used to remove dust in oil and other things this is a product, right. So, you just start pouring oil here and it gets filtered and then you put it in a container. And, generally what we do is in a container again we will put a funnel so that we make sure that we do not spill oil outside; this is one part, this is the second part.

Today, I found out from the market that there is a product which has got integrated these two you have a filter whatever it is and then along with the filter itself you they have attached a funnel. So, this is a filter which is funnel attached and now you can exactly pour into the container. Earlier we were looking for funnels now funnel is an integral part of the filter itself. So, somebody found out there is a market need they have developed

this product today this product is very successfully moving, right. So, you have to find out an opportunity and then start doing it.

Next is establishing design specifications. From the customer we will say I want the product to work as comfortable as possible. So, this comfortable has to be converted into a engineering specification that is what we start doing establishing design specification. Once a need is realised, that we need to pour oil into a container, the next step is to interpret these needs into a technical terms and specifications capable of describing the desired functional characteristics of the product under study.

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The third one will be you start developing conceptual designs. Several alternative designs will be developed on a on paper or on virtual mode today. We develop so many concepts. So, these concepts are developed based on the design requirements whatever you have put and how did it come? From the customer need statements.

So, several design alternatives are generated and evaluated for their function ability and cost effectiveness. You can do it by free hand sketching or you can do by a digital form and today, people started using digital form in a big way because it gives you a freedom of editing on the base model. The solutions and concepts that meet the design specifications are generated in the form of idea and are alternatives.

A number of design alternatives are generated with no detailed analysis of an alternative. So, we do not talk about dimensions, we do not talk about the material, we just only talk about concepts form and whatever are the functions how are they to be done. At the end of this phase, the most acceptable concept is selected for further development and analysis. So, here we put all the functionality also, it is not the same size alone we also put all the functionalities and then we try to choose this design is ok, we start choosing it and then based on the conceptual design whatever you have frozen we start working on detail design.

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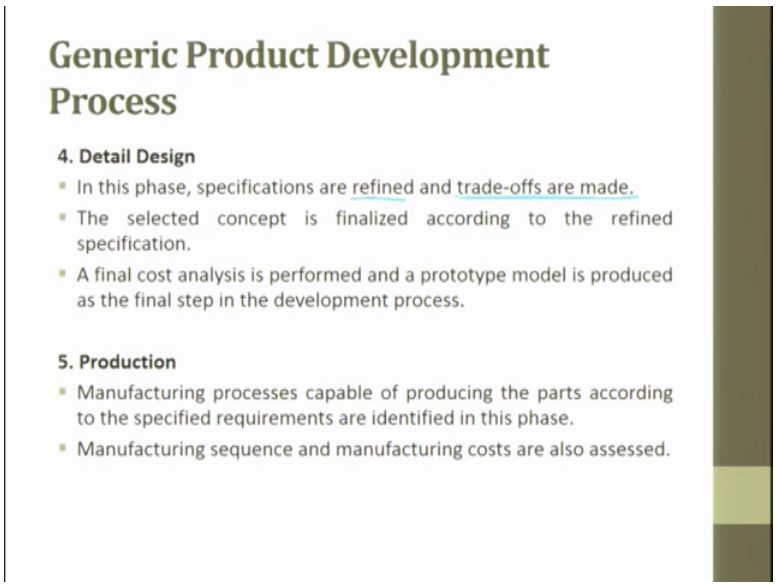

So, you said there is a funnel, but what should be the dimension of the funnel that you start giving in the detailed design. In this phase the specification are refined and trade offs are made. So, here we also go back and forth with the conceptual design saying that see this is not possible for us to make. So, then the change the conceptual design, then it comes back detailed design we start working on it. The selected concept is finalized according to the refined specification.

A final cost analysis is performed and prototype model is produced as a final step in the development process. So, you make prototypes, you show it to customers, you fix it up in the shape size whatever is required, you do back and forth iterations, you keep changing the detailed design, then once the detailed design is done engineering releases done then gets into the production.

So, when it gets into the production what we do is we look for to machine tools, we look for tools, we look for jigs and fixtures, we look for material and other things. The manufacturing process capable of producing the part according to the specification, specified are requirements are identified in this phase. Manufacturing sequence and manufacturing costs are also assessed.

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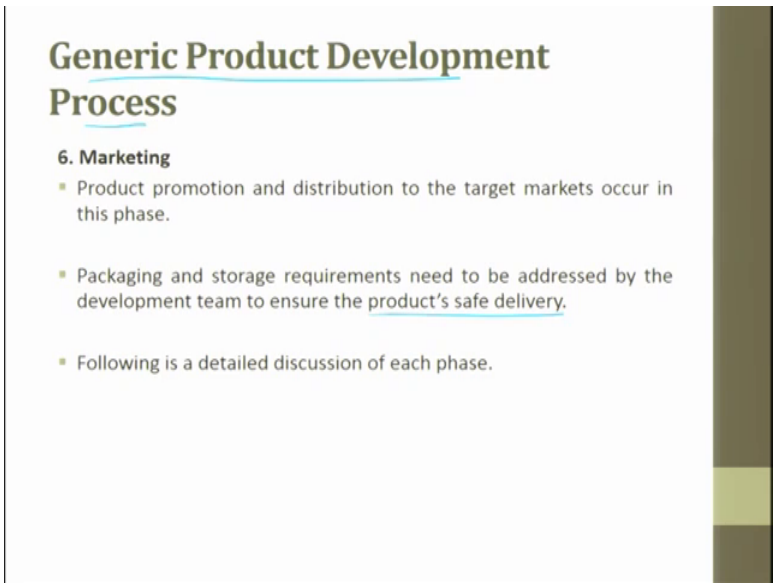

Marketing comes the last phase of the generic product development process. The product promotion and distribution to the target markets occur in this phase. Packing and storing storage requirements need to be addressed by the development team to ensure the products safe delivery. So, today when we do all these online purchase many a times we see when the product comes to us it gets damaged. So, now, companies have started putting lot of efforts in doing proper packaging such that it reaches the customer without any damage. You produce a wonderful part, but if the part cannot be delivered to the customer in a safe form then it is of no use.

So, today packaging and storing is also been addressed in concurrent engineering and it is given importance right from the design stage itself. For example, if you try to make a large projection; projection of a solid block and then you want to packet and send and if it has sharp edges it is going to poke, it is going to tear the package material. So, right in the design stage itself, you work back and start removing following is the detail discussion of each phase, ok.

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Need recognition: the product development begins with identification need. The design process can be identified based on the idea for a solution to an existing or identical need or form from an idea for a product process for which it is thought a need can be generated. I have already explain to you then comes the product idea needed must look promising. It should not be here is a product I will definitely I will have a customer no it will not happen like that, if you have a customer your product will have it is living.

So, the product idea needed must look promising giving the current market situation, technology available, company needs, and economic outlooks. It is important to analyse the needs carefully and clearly in detail before launching the product development process.

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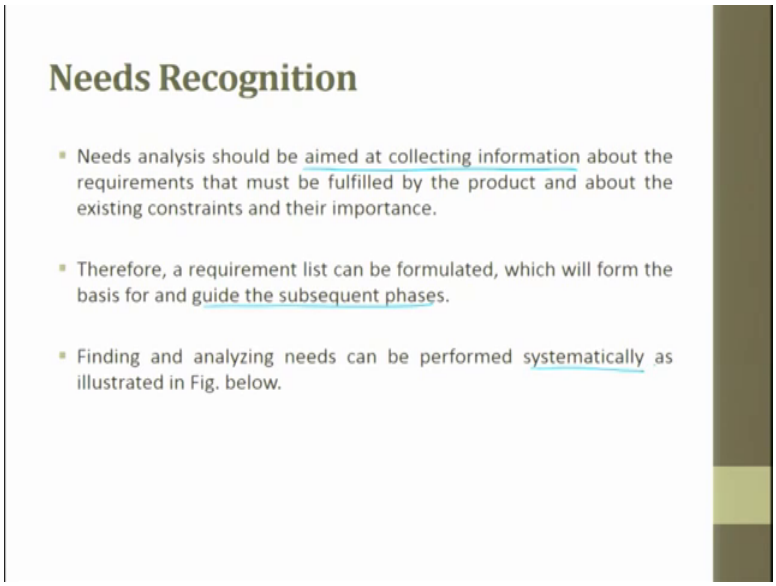

The need analysis should be aimed at collecting information about the requirements. The requirements listed can be formulated which will form the basis for and guide the subsequent phase. Finding and analysing need can be performed systematically as illustrated in the figure below.

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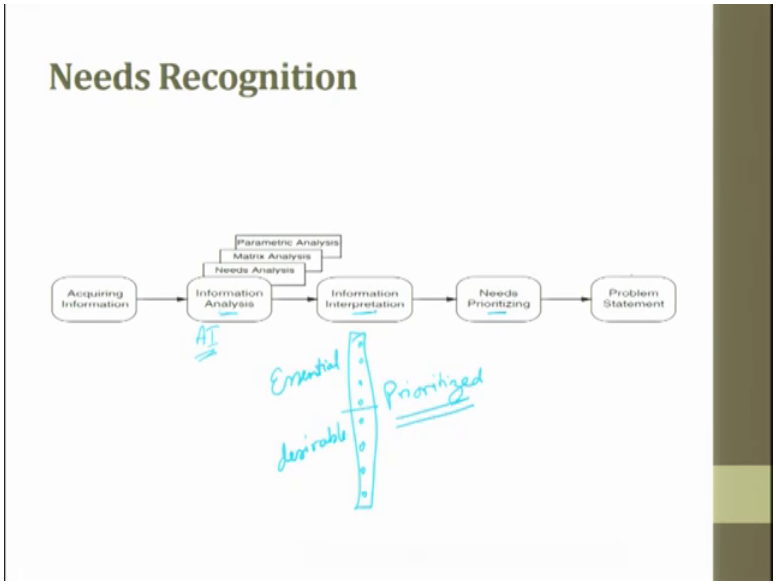

So, you can see acquiring of information. Acquiring information, information analysis, need analysis, metric analysis, parametric analysis we do all these things in the information analysis. Then based on the information whatever we have got we do

information interpretation then we try to do a prioritisation then we try to write the problem statement. All these things are there whatever earlier we were talking about is only need. So, now, you see need is done state of art is done. When you talk about state of art, what are the other products existing and how should our product be different from them.

So, information analysis; so, this need analysis; then matrix analysis; then parametric analysis. Parametric analysis all these things have to be done. So, then what gets done here is information analysis. Today, artificial intelligence is exhaustively used for this exhaustively used for this. People have started integrating artificial intelligence into information analysis and this is for need analysis and matrix analysis, ok. Then what we do from then information analysis we do interpretation, ok. Interpretation is what is the existing scenario what is the existing products lifetime and what is the futuristic product which other companies are going to launch, where can we launch, how are we going to blend and other things.

Then what we do we find out some 10 needs are coming out. Now, all the 10 needs have to be prioritised all that needs have to be prioritised and moment these 10 needs are prioritised then finally, what we get is a problem statement because these prioritisation tries to tell us significant parameters, significant and non significant or I will try to use the same terminology what we learnt essential and desirable. So, desirable if it is there it is ok, but essential it must be there. So, now, we do the prioritisation and then based on this we try to identify the problem statement.

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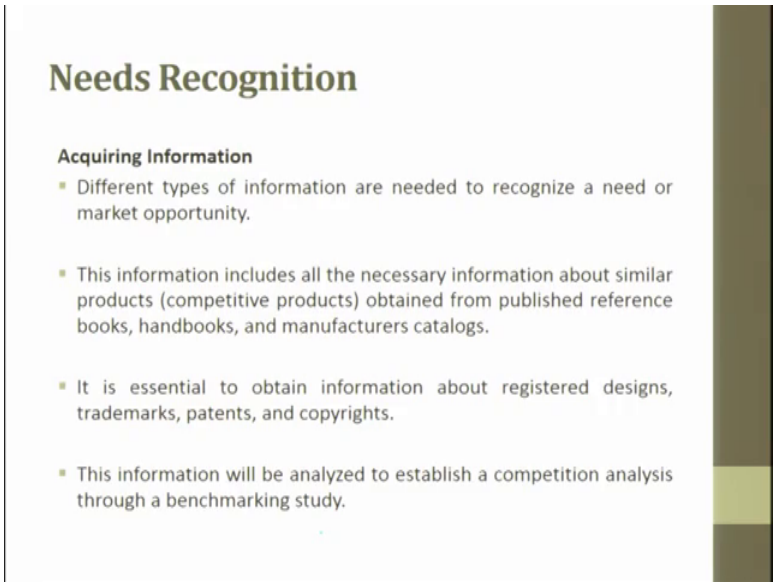

So, acquiring information can be through conducting interviews, can be looking at the existing data market survey whatever is there, meeting people, meeting experts, talking to experts and asking experts view and then start developing a product. So, these are the different ways. So, different types of information are needed to recognise and need or a market opportunity. This information includes all the necessary information about similar products obtained from published reference books, hand books and manufacturing catalogues.

It is essential to obtain information about the registered design, trademarks, patents, and copyrights. This information will be analysed to establish a competitive analysis through a benchmarking system. So, what we do is when we do that need analysis are when we start acquiring the information we also do as a state of the art. So, state of the artist from the literature as well as from the market survey and meeting people. So, all these things we do.

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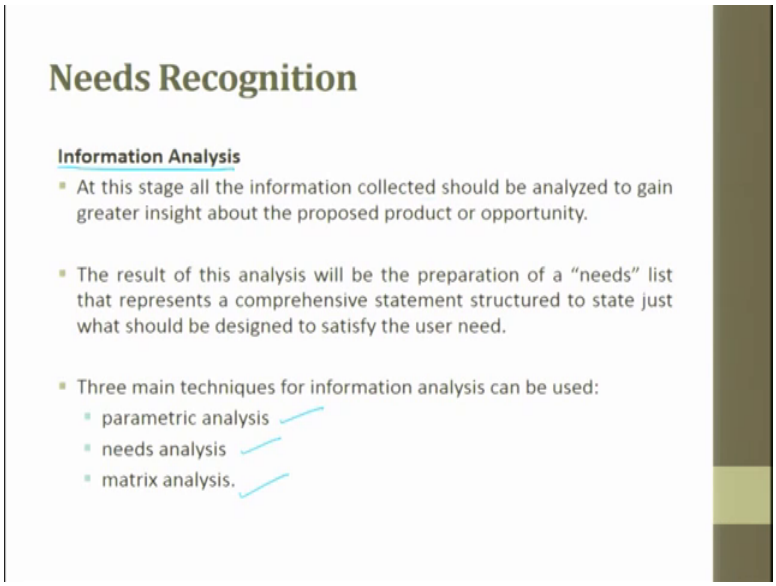

Then what we do, we do information analysis we have acquired data. So, now, this acquired data has to be we have to do analysis. So, at this stage all the information collected should be analysed to gain greater insight about the proposed product and opportunity, ok. So, I will tell you a live example when Nokia decided to come to India because they found out India and China are big companies are big countries where population is very high, if they could make a breakthrough in their product then they can have a better sale and their profit margin will go high. So, they came down and then what they did was they went around the country to do a survey and see what are all the requirements which has to be customised to the existing model such that they can have the runnings.

So, they went around did a need analysis, ok. So, they have also acquired information then based on the acquired information they used to do a brainstorming session, ok. So, the information analysis is something like that. So, they do a brainstorming sessions. The results of the analysis will be prepared of a needs list that represents a comprehensive statement structured to state just what should be designed to satisfy the user needs. Three main techniques for this information analysis can be parametric analysis, need analysis, and matrix analysis, ok. This is only going to tell us what should be the product what all should be the different features should exist in our product such that we can have a better sale.

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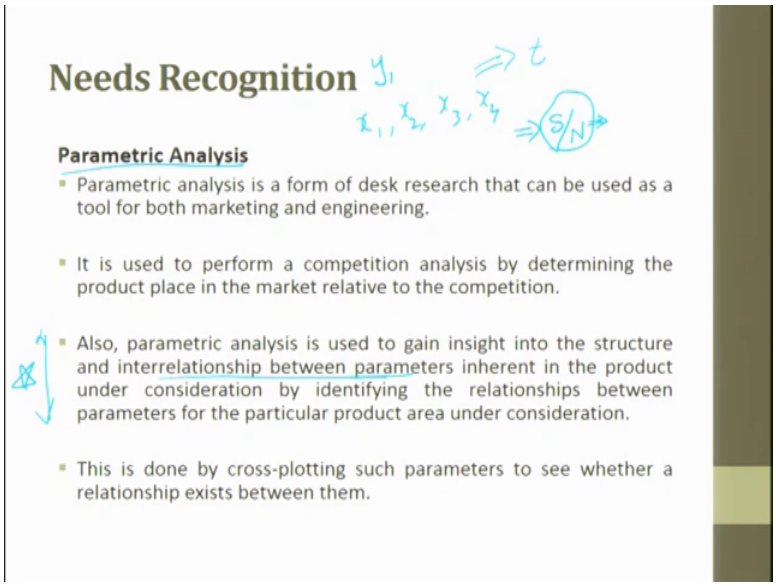

So, then we first in that three first is parametric analysis. Parametric analysis is a form of a desk research that can be used as a tool for both marketing and engineering. So, we tried to parametric means we try to express the entire data whatever we have into an equation form. So, we just know few variables in the equation or in a function, put those function and try to get the answer or and then we can also try to have some relationship between the functions, ok.

It is used to perform a competitive analysis by determining the product place in the market relative to the competition. Also, parametric analysis is used to gain insight into the structure and interrelationship between the parameters. This is what I was trying to say; inherent in the product under consideration by identifying the relationship between parameters for a particular product area under consideration. So, this is very important this is done by cross-plotting such parameters to see whether a relationship exists between them.

So, if you have functions like x, x 1, x 2, x 3, x 4 and you have outputs as y 1. So, now you try to give a relationship between x 1, x 2, x 3, x 4 to y 1 by defining one parameter called t, ok. It is full of mathematics, but all the data whatever we collect has to be logically interpreted. So, you cannot say I will not involve mathematics is just by talking to 10 people you get a data what you get a data will always have something called as signal and noise. So, you will always have to find out the signal to noise ratio; that

means, to say the spurious data information which is getting into your market serve should be eliminated and you have to do it. So, for that we always try to do a math behind the data whatever is collected and then we try to express it into a simpler form such that this can be used for analysis.

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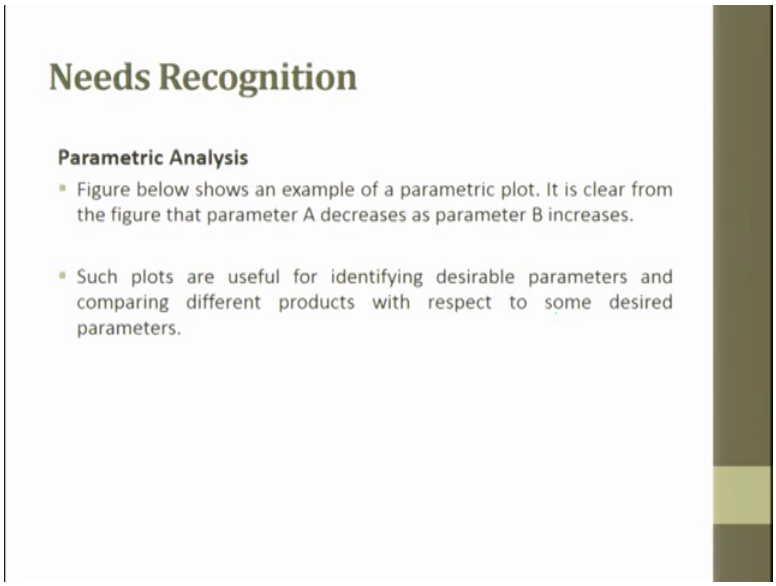

So, figure we will show you the figure. Figure below shows an example of a parametric plot. It is clear from the figure that parameter A decreases as parameter B increases. Such plots are useful for identifying desirable parameters and comparing between products with respect to some desire parameters.

So, we will see the figure in the next slide.

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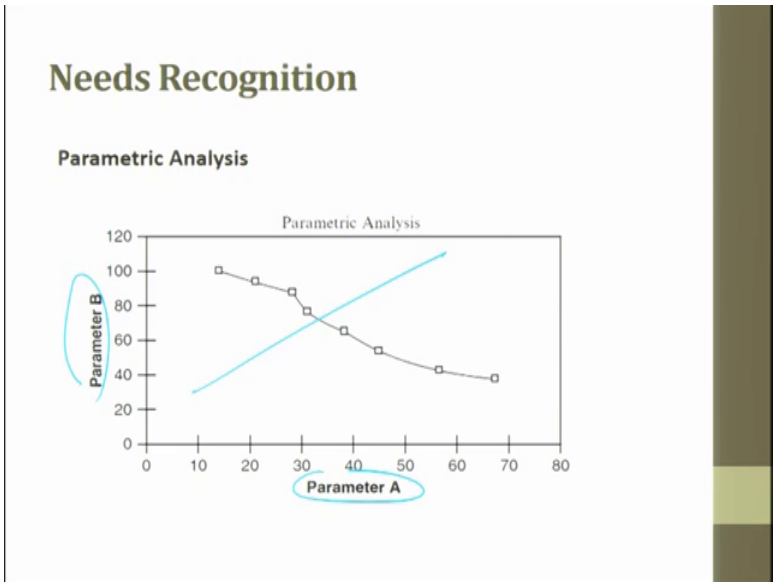

So, this is parameter B this is parameter A as and when you start increasing the parameter A you can see the parameter B there is a reduction. So, it is an inverse relationship between A and B. You can have positive and here it is only relationship between two parameters. If you have 10 parameters, so, it is very difficult for you to draw a 10D graph; up to 3D you can easily go, 4D also people today now represent. So, if you want to put all those things in a data in a graphical form, then the understanding of the problem and the relationship between the parameters becomes very easy. And, if I can express all the relationship using one variable so, that is excellent. So, that is what is parametric analysis.

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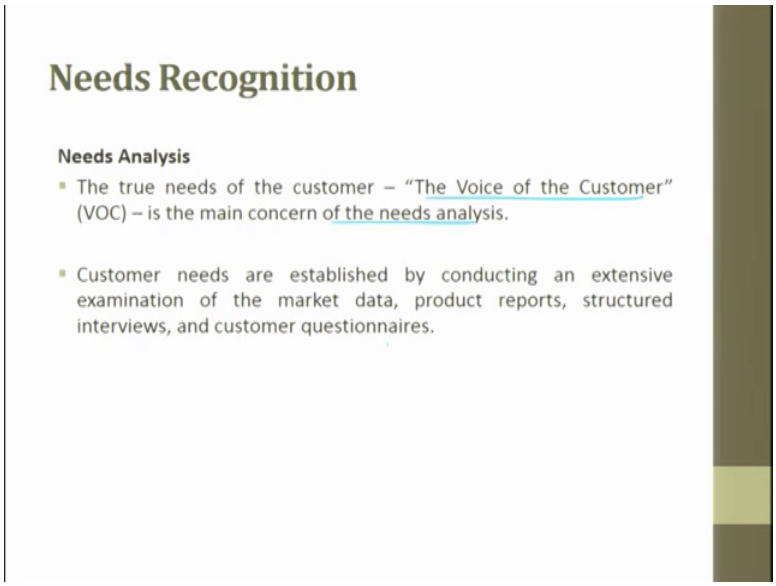

So, the true need of the customer the voice of the customer is the main concern of the need analysis, ok. Need recognition what we do. The customer needs are established by conducting an extensive examination of the market data, product report, structured interview, customer questionnaire all those things we start doing it and then we come up with some useful analysis.

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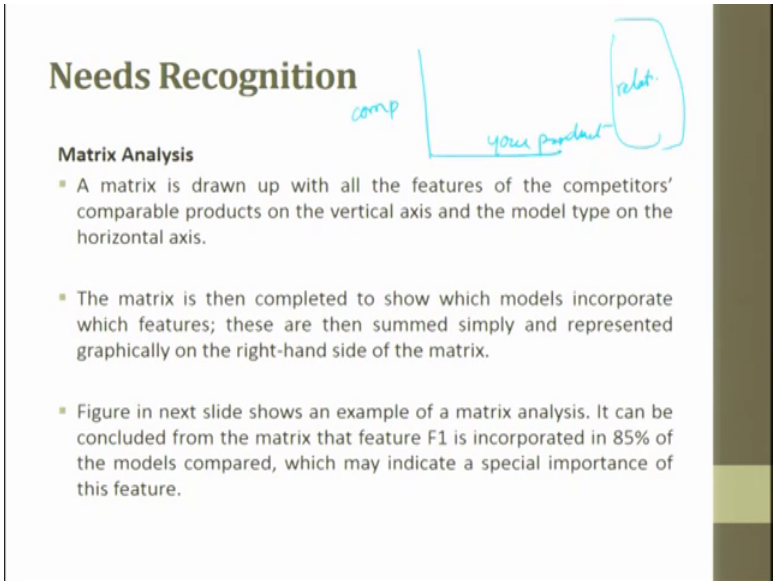

Matrix analysis is drawn up with all the features of the competitor comparable product on the vertical axis and the model type on the horizontal axis. So, you put here and then

you put here. This is competitor and this is your product and then what you do is you try to see how are you better or your proposed product better then the competitor. The matrix is then completed to show which models incorporate which features. These are then summed simply and represented graphically on the right hand side of the matrix. So, somewhere here you give the relationship; this is a relationship and then you try to get more informations.

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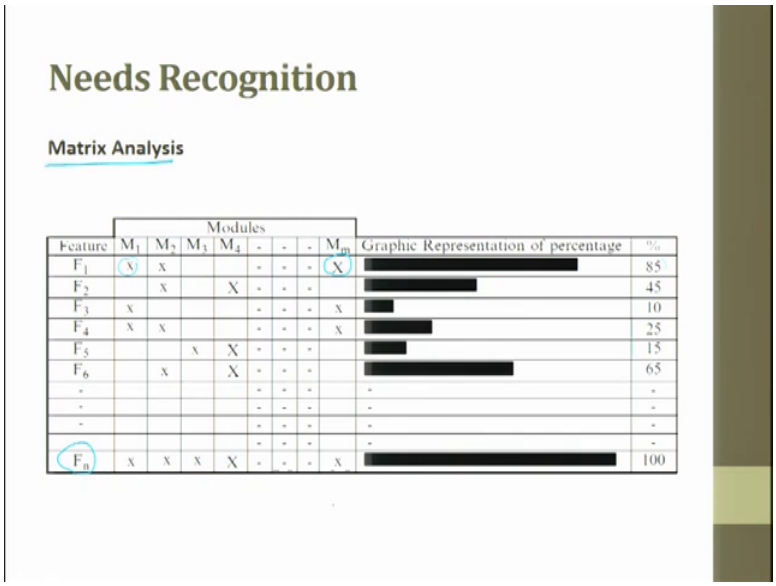

So, this is what is the matrix analysis. So, these are the features, these are the modules. So, feature 1, module 1 there is a relationship; feature 1, module 2 there is a relationship; you can just for understanding you can make this as models also or companies also. So, feature 3 model 2 does not even have are modules 2 does not even have, feature 3 there is nothing you can have and when I sum of all these things I when I do this relationship you can say this and as well as you can start giving a number for it, and then what we get is the weightages and then when we converted into a number game we try to get all these numbers here in terms of percentage, ok.

So, f n will be the n-th function, what is their relationship with model 1, model 2, module 3, module 4 and etcetera you can do. So, this is nothing, but a relationship analysis.

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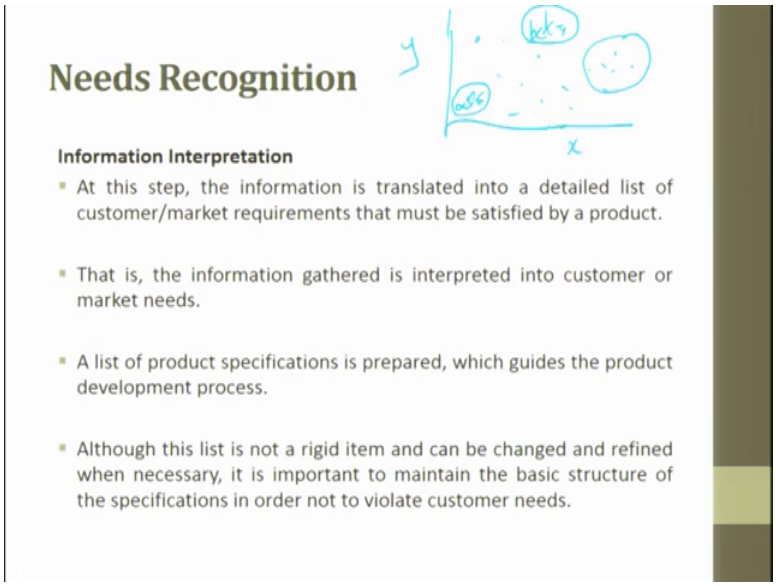

Information interpretation: so, interpretation skills are something which is very much required when we start doing a product development or product design. Information interpretation, why is this trend coming? Is this trend whatever we are getting is it logical or if you see many a times they do clustering of data; data clustering they say some points will be here, some points will be here, some points will be here, some will be here. So, then the data interpretation this will be y, this will be x you plot between two. So, then quickly what people do is they try to put circles and they say ok, there are small clusters which are getting formed. These clusters are groups where and which this is what is a interpretation happening and you can see many other points these points can be a noise point or these points can be fictitious point; that means, to say duplicate points,.

So, we can try to do; for example, if I go show ask my son who is in 10 years old to have a taste of tea and try to give the taste of the tea in terms of numbers which will be very difficult, but if I ask him to give for boost it will be it will be easy he will give the boost or some other additive which is added. So, he will be easy to tell him that this taste is much better than the others. So, if I try to take a wrong person; that means, to say who does not fit into my spectrum, if I have an odd man out and if I collect the data from the odd man out put it in the interpretation and if I do this cluster analysis I can quickly find out these are all noise datas which should not be considered, ok.

So, information interpretation is a big skill and it is huge it involves huge science understanding and technological interpretation. So, you have to have a blend of all. So, the information interpretation, at this step, the information is translated into detail design or detail list of customer market requirement that must be satisfied by the product. That is, the information gathered is interpreted into customer or market needs. The list of product specification is prepared from here which guides the product development process. Although this list is not rigid item and can be changed and refined as and when it is necessary. It is important to maintain the basic structure of the specification in order not to violate the customer need.

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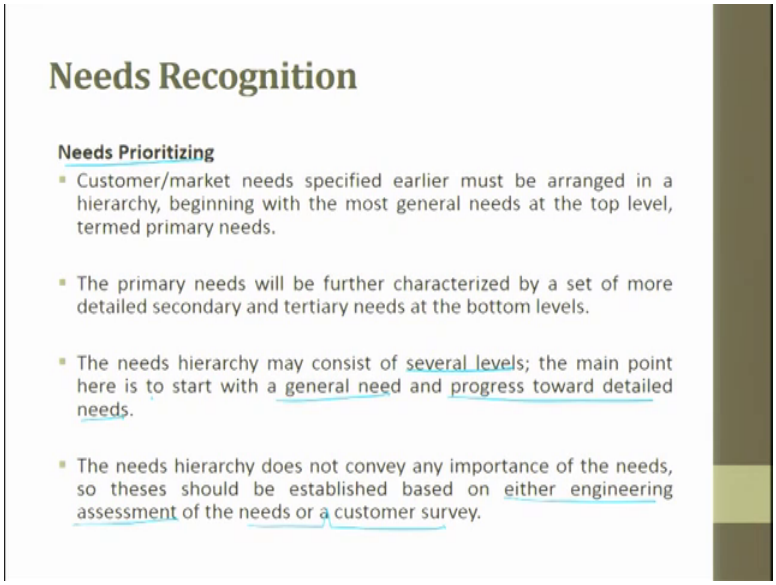

So, then we do need prioritization. Need prioritisation or prioritising means customer slash market need specified earlier must be rearranged in hierarchical, beginning from the most general need at the top level, to that which is called as primary needs have then it keeps going down secondary tertiary you will keep adding it. The need hierarchy may consists of several levels. The main point here is to start with general need and progress towards detail need, ok.

The needs hierarchy does not convey any importance of the need. So, these needs should be established based on either engineering assessment of the need or customer survey. So, these two are also important in the coming way.

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So, need prioritisation; the establishment of need importance is critical in making a trade-off analysis and allocating design resources later on in the design process. The importance of needs is usually expressed using an ordinal scale in which the most important need are placed at the top of the scale and the least at the bottom of the scale we start doing the prioritising.

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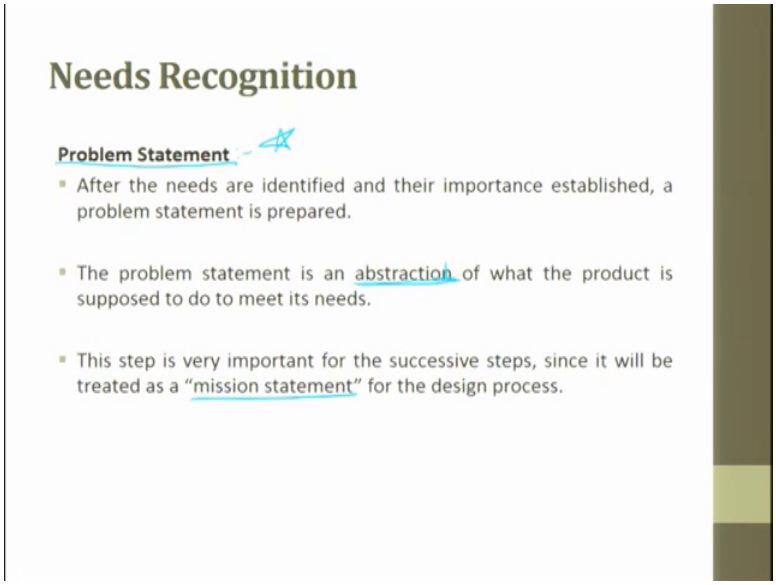

Then, comes the problem statement. Now, you see problem statement just not just come from customer voice alone. It has to undergo so many sequence of operations. After the

need are identified and their importance established, the problem statement is specified. Writing the problem statement is also a very difficult task. It is not like writing a mathematical equation or a mathematical problem. So, for why is that? Because you are going to write a problem statement where in which can have constraints which are bounded, you can have constraints which are unbounded you have multiple solutions for the same problem all those things I have to be brought in thought of and finally, we come with the problem statement.

For example, I feel cold. So, the solution is wear a sweater. So, you can always say the customer feels cold we have to look for alternatives which is cost effective which could protect him from the external environment. So, your problem statement should be written like that and if for example, if you say that the customer would like to have a cold item. So, you can you have to now say that the customer is thirsty, he needs to quench his thirst by a liquid which is cost effective and which does not induce any health hazards problem. So, you see the statement it is very generic because if you put a very generic problem statement then only you can evolve multiple ideas, ok. So, that is what problem writing the problem statement is a big challenge.

After the needs are identified and their important established your problem statement is prepared. The problem statement is an abstraction of what the product is supposed to do to meet its need. It is an abstraction, it is an abstract thought. You cannot nail it by saying that the temperature of the human body should be maintained at 27 degrees do this and or the cold item or the cold drink whatever I am it has to be around minus 2 degrees or it can be 12 degrees, you cannot specify it. You have to keep it as abstract as possible so that by looking at the abstract things many concepts get evolved.

The step is very important for successive steps, since it will be treated as the mission statement for the design process. So, problem statement farming is very very important.

So, if you go back this is a very very important cycle which we have gone through is the need recognition. So, the need recognition we had acquiring information, then information analysis, information interpretation, need prioritization and problem statement forming. So, we were they stop here. We will continue in the next class and I am sure you will start enjoying this course more and I would request you guys to do as small need analysis for some product which you feel it is important ok. You feel it is

important, identify ten customers, talk to them and then try to prioritise and then try to make a problem statement, you will see how challenging is it.

Thank you very much.