**Design Practice**
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Lecture – 03
Basic protocols of industrial design

Hello and welcome to this design practice module 3 we will actually start talking about now the basic protocol which is used in the industry for designing actual designing of products.

So, it is actually a stepped process with each step meaningfully contributing something towards the design of the product where a lot of idea, generations, refinement analysis, detailed product layout or specification layout and then finally, manufacturing implementation is carried out before proceeding on this just like to share that.

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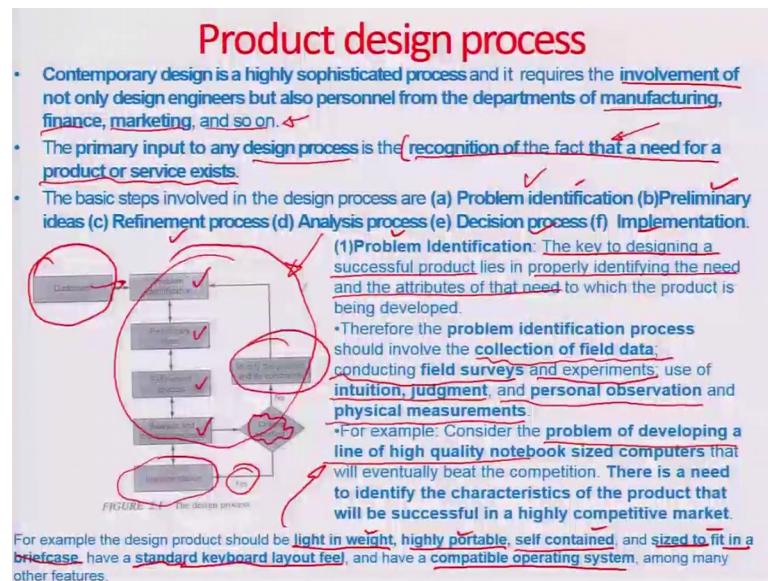
The contemporary design field is really very very sophisticated process and it requires the involvement of many departments as such not only design engineering or design as a matter of fact, but beyond design involvement from finance, involvement from the manufacturing, involvement from let us say the after sale service and also a function like marketing which is otherwise very important for an organization all need to be involved in the process of defining the basic design of the product that is being created..

In fact, this need came up because when individual functions are being met by individual departments at different stages without a proper crosstalk between them towards the beginning it almost always happens to be, it may have several shortcomings.

And therefore, it is always happens to be an incomplete approach to design and therefore, time and again it has been the need has been felt that from step one itself you involve everybody who is a stakeholder in some way in the product life cycle and try to take decisions which are mutually acceptable and which would not result in many iterations of designs or changes of designs which otherwise is a very expensive process for the company.

So, the primary input to any design process as I think we are all aware is the recognition of the fact that there exists a need for maybe a product tangible or intangible and the based on that need then the process of actually the problem identification, the preliminary idea generation, the refinement of all these ideas, the analysis process and finally, the decision and implementation takes place.

So, it is actually a iterative process starts with the customer and the first task here for a designer is to identify what may be a problem associated with the customer look at for example, a blind person who may have this inherent need of using a stick we are carrying this stick may become a big challenge or a big issue and so, therefore, stick could be alternately replaced by small sensors which are embedded into the clothes that are owned by the visually handicapped or alternately you might just be able to carry the stick on a wheel so that all the obstacles and all the terrains which are to be overcome by that blind subject can easily be done.

So, the exact inherent need mapping is also a matter of psychology of the user and therefore, it is important to identify that need for a successful product definition. So, the key to designing a successful product actually lies in properly identifying the need and the attributes which are coupled to the need the product which has been developed..

So, therefore, the problem identification process should typically involve collection of field data by talking to various consumers who are interested to buy the particular product conducting some field trials, field surveys and experiments to understand the psychological mapping, understand the psychological behavior and then use of intuition

or judgment and also the personal observation of a designer and also physical measurements sometimes so, that the proper problem can be zeroed upon or identified.

So, a good example could be that if I consider let us say the problem of developing a high quality notebook, notebook is something that is more carriable there is need to identify some characteristics like light in weight for example, highly portable, self contained systems, sights to fit into a briefcase, may have standard keyboard. These are some of the issues or properties which people would expect typically from such notebooks, the question is when designer starts defining the need for there exists a certain kind of need in the notebook you have to go through all this by virtue of the exact aspiration of the user and then have a compatible operating system may be true on so, forth.

So, this gives you the basic problem statement that you would like to develop a laptop which is confined within the domains of a small briefcase and which gives all other benefits to a consumer is internationally acceptable in terms of the language of the keyboard that is being used with the operating system that is being used and also in terms of portability or maneuverability is much easier, probably there is also a need that the laptop should work for a longer time and. So, the charge duration of the battery which is there and the laptop should be higher. So, people could typically work in between you know traveling to work places etcetera which may give up some additional aspirations that the customer might otherwise have with a notebook size PC.

So, this is the first step the problem identification step once that has been identified now there are many ideas.
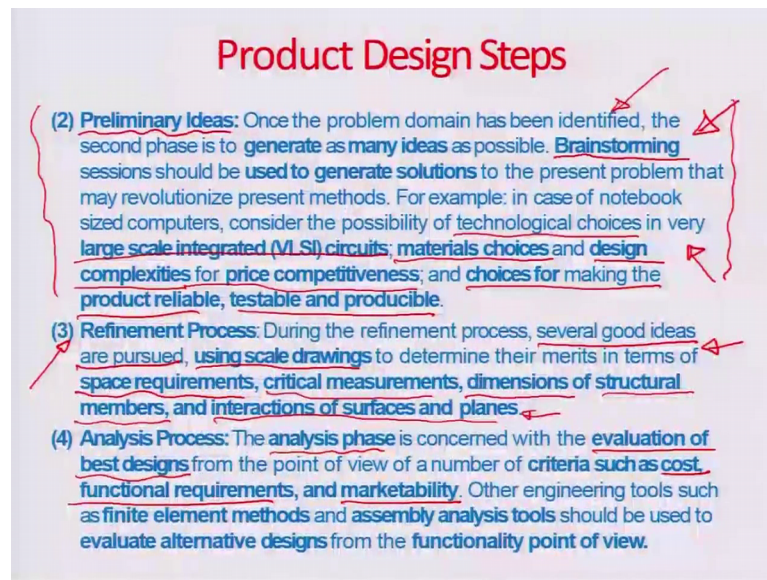
Which design theme typically would generate based on what is the inherent problem that has been identified and there are many routes of doing it, one very useful route which is used in most of the cases are these brainstorming sessions where people just start ideating about what all would be the requirements which would go into a preliminary design process and such sessions should be used to generate solutions to the presently identified need of the identified problem.

For example in case of notebook sized consider notebook size laptops consider various possibilities like the choices technologically which are available in terms of what circuits are being used within the laptop or what are the materials which would make the laptop overall become much lighter in weight, what are the other design complexities which are needed probably a better interface which is more acceptable internationally with the consumer who is trying to work on this module and this also for price competitiveness and then of course, choice for making the product reliable testable producible all these issues generate or get resolved through the preliminary ideation process.

Where all this would be added on to the final design that is going to be in place. So, once all these preliminary ideas are generated it may be not necessary that all the ideas would work out and. So, generally this is a step where you need to work mostly on a large size team remember it is not really about gathering because gathering could be very well

defined it is all about we call it hunting in the designers language that you hunt for that big idea.

So, therefore, thinking out of the box is a very good practice, idea is there are certain rules associated with the brainstorming may be in one particular module on this course as we go along I would point out some of the requirements that are therefore, a very good brainstorming session to get executed. The basic premise in brainstorming should be that do not kill each other's ideas in order to get as much on board for the basic idea rack which translates to a bunch of very very out of the box as was in place or more infeasible kind of ideas.

The next step therefore, once this ideation process has been done is a refinement step where realistic decisions have to be taken. So, here is the refinement process through which several good ideas are pursued out of whatever idea rack has been generated in the last step and the refinement can generally happen using scale drawings to determine merits of different ideas maybe give a quantitative scale to the merits, it can be in terms of let us say space requirements if we talk about laptops or critical measurements or dimensions or structural integrity of the members which are associated in building the laptop..

So, that it can be confined to the briefcase size space which is one of the main requirements generated during the problem identification step and then of course, the interactions of various surfaces and planes which are associated to give the overall form and size and aesthetics to the product that is in question.

So, generally the refinement would happen with all these important details in place and then once the refinement of the very best id or the very best ideas are selected or refined then there is an evaluation or out of these ideas what would actually go into the final design. So, it will actually involve some analysis where we talk about evaluation of the best design from the point of view of number of criteria such as probably cost, functional requirements, marketability. So, these are some quantitative basis of selecting the final set of ideas which would be ready to go which would necessitate blueprints and subsequent manufacturing processes to be incorporated.

And this phase is typically the finalization phase of the actual design which would be so, succeeded by another phase which is the decision base which is basically.

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The stage where the out of all the designs and the analysis for the various designs which have been generated which are actually shortlisted to go into the final product, you get a further selection or a decision about what exactly would be the best design which would go into the product which is actually at probably a minimal manufacturing cost or with some quality standards which are built in as per the aspirations of the market.

And again the idea would be that people will go for those designs which can be quickly manufactured to make a product available to the customer faster. So, therefore, very less lead time associated with the product so. In fact, cost lead time and quality are the 3 aspirations which are almost a natural instinct for all customers to look for an a product there is of course, a fourth which now has become very attractive which is about the customization where it talks about exact mapping of the needs and. In fact, if the product were such that at the very beginning the needs were mapped properly then you can just go ahead with the decision process here and trying to make a suitable design finalized in terms of implementation where you draw out the detailed design document.

So, that involves what are the involve materials what are the involved dimensions tolerances which are needed for the final design to be implemented what kind of surface roughness are involved in the participating roughnesses. So, the idea here in this implementation process is to really make the final blueprint of the drawing to be directly used for manufacturing and process development etcetera. So, that is how in a step by

step manner the design phase or design process has to be implemented if I just look back into flow chart it could start with this identification step with again preliminary ideas, refinement process, analysis and decision process. So, this process actually is on certain criteria's.

For example are we manufacturing at a very customized manner or at a low cost or at a high quality and so, if the answers are yes only then there is a question of implementation otherwise you keep on iterating. So, that the problem can be suitably modified and so, can it be can it is constraints so that the cycle here in the top continues many times because before a refined drawing or design comes up which satisfies the required criteria so, that you can implement.

So, it is really an iterative process as far as this part of the loop is concerned in the whole steps of product design. So, if I were to look at how to broadly classify this whole design process you can just marginalize them into 2 broad categories, where one would be related to the actual need mapping which is actually a very big domain as I think I have illustrated many times from the very beginning of this lecture and the other is actually the specification map. So, therefore, the design can really be split up now into 2 very broad domains or overview where in one domain what you also call the conceptual design phase.

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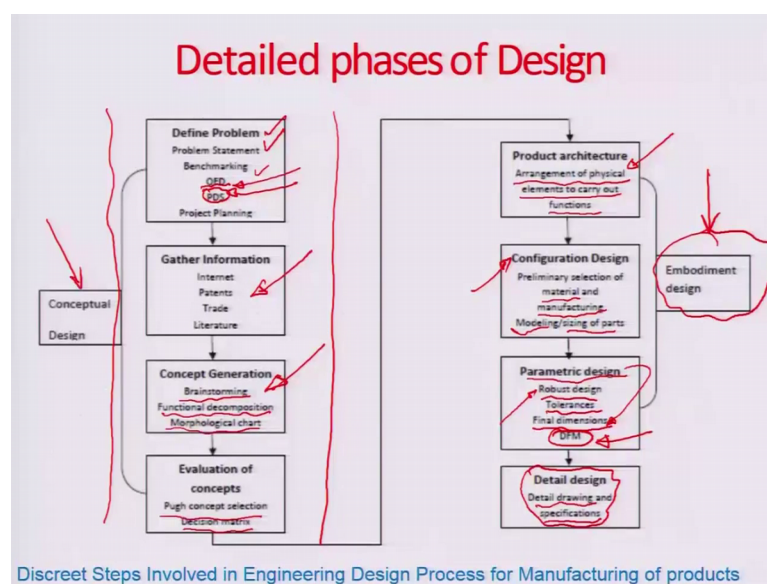
There are various steps like how do you define the problem? How do you formulate the problem? Can you benchmark corresponding to whatever is existing as product lines in the market? Can you also talk about what are the other competitors who are present in business who are manufacturing the same product or service? And how do you rate your system in comparison to those competitors? So, this very interesting quality function deployment area couples to be you know before that estimation or that purpose.

And then you basically do a sort of detailed specification so, related to whatever needs are being mapped so, it is called product design specification. So, in this particular step then you start also gathering information about what are the concerned IP's which are involved in the process of the design.

So, that there should not be any overlaps with existing you know intellectual property in the particular domain that you are working in and then finally, you do a concept generation with all these needs together and all the ideas that you have been able to brainstorm or generate and the concept generation could be done through several tools like functional decomposition or morphological charts we will look at some of these issues in details probably later.

And then we evaluate so, whatever concepts have been generated and there are certain support systems like decision matrix systems or concept selection approaches which are used for doing this evaluation of the concept and then finally, the idea is that there is the second broad domain of embodiment design where you talk about now carrying out a functional analysis of the product with the detailed concepts which have been generated up to this stage of ideation and need mapping..

So, you basically can talk about laying out the product architecture, which is about the arrangement of physical elements which are involved in the product to carry out certain functions, you look at a configuration design which is about the material which is going into the product the manufacturing method or the modeling or sizing of parts all these preliminary selections at this stage about the rough drawing or the configuration of how things would be put in space together side by side and what would be the level of interaction is made and..

Then of course, there is basically the parametric design stage which talks about how you can introduce robust design by learning processes, how you can actually carry out to

define the tolerances the final the dimensions and are very important you know at this particular stage of parametric design is also that whether the design is suited to a manufacturing process or what we call design for manufacturability.

And then finally, you get everything together into a detailed design or a drawing or a specification which comes out as the various phases of this overall embodiment design. So, on one hand there is a broad domain of conceptual design which is about the ideation, the need mapping as well as sort of preliminary evaluation of some of the ideas and on the other hand talking about more well defined layout of the whole product, analysis of the functional requirements of the product and then trying to increase robustness through experiences or set up various evaluation parameters.

So, that the best design gets selected through this process which is laid out finally, in terms of detailed dimensions and tolerances and also evaluated from a aspect of manufacturability before setting up as the final design into a process plan or later on probably the subsequent manufacture.

So, we will try to gauge the engineering design process into these 2 broad steps or categories and move ahead with some definitions or some small information's which are needed for you to understand these.

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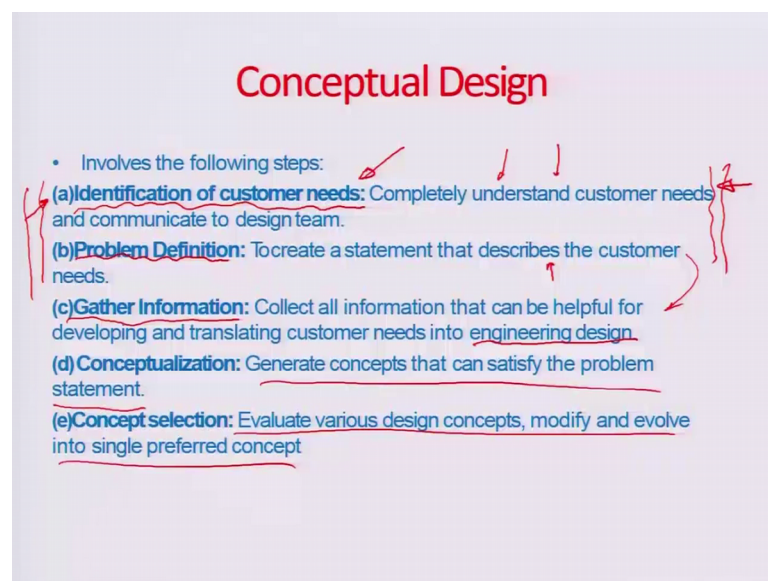
So, the conceptual design involves the following steps so, one is of course, the identification of the customer need and I am going to actually talk about model just following this which is very widely accepted in the world it is called the Stanford model of design thinking. Which talks about there are certain specific routes which are existing very well identified routes for understanding the need perception of individuals.

So, from the needs emerges the problem definition so, this step is in fact a very big step and in fact, we need a lot of understanding how to go through the different routes which are available for different design philosophies which exists around the world from identification of customer needs to the problem definition then of course, we talk about gathering all information..

So, it is about all the engineering design info which is available in terms of existing intellectual property and trying to see if we are by any chance crossing domains with any of those which are already laid out and then finally, you generate concepts that can satisfy a problem statement which you have sort of identified in the step one here. And then finally, evaluate various design concepts modify and evolve into a single preferred concept for which can be applied further for actually the product layout, the architectural planning, the more detailed specifications, the functionality mapping etcetera.

So, I am going to now go ahead and talk about a slightly different aspect of how these 2 steps in great details can be done following an ideology or a map. So, we are all aware that the design thinking is really a human centered approach these days I think I have made sufficient case for you guys to seep through this for the last about 2 or 3 lectures where this human centricity in the approach to design thinking leading to innovations has been the main talk.

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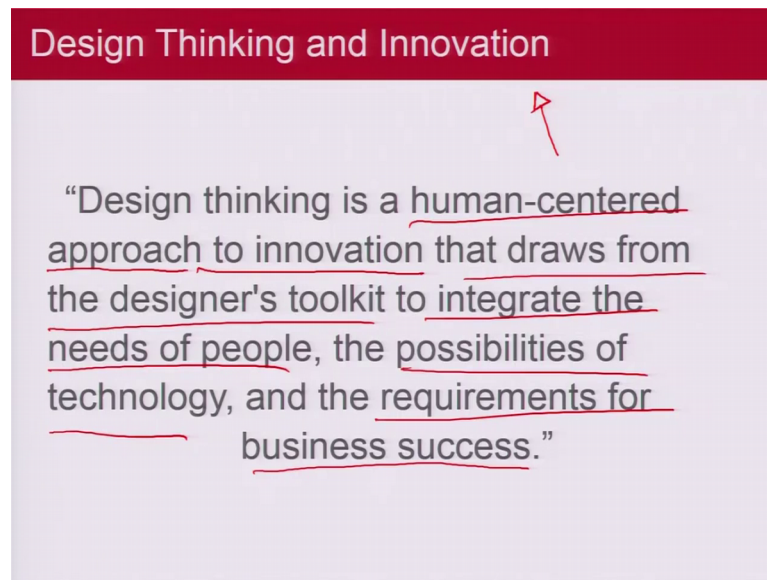
So, design thinking is really a human centered approach to innovation.

And it draws from the designer's toolkit to integrate needs of people the possibilities that technology has to offer and the requirements for success of businesses. So, that is how you would like to interpret the design thinking purpose.

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So, in order to do that obviously innovation cannot come out without a well defined methodology and innovation happens because of innovations are breakthroughs by the way they happen because there is an identification of a need which is underlying, but is

not well evolved and somehow it comes to limelight and there is a solution which is brought forth to satisfy that particular needs.

So, that is how the innovation would be defined. So, basically all what we need to do here is sort of go for hunting, it is not for just gathering and I am going to just define both these concepts of hunting versus gathering and what they are just in the next slide, but today's approach of innovation is to actually think very wild and go for a situation where you actually go in hunting. So, if you look at hunting for example.

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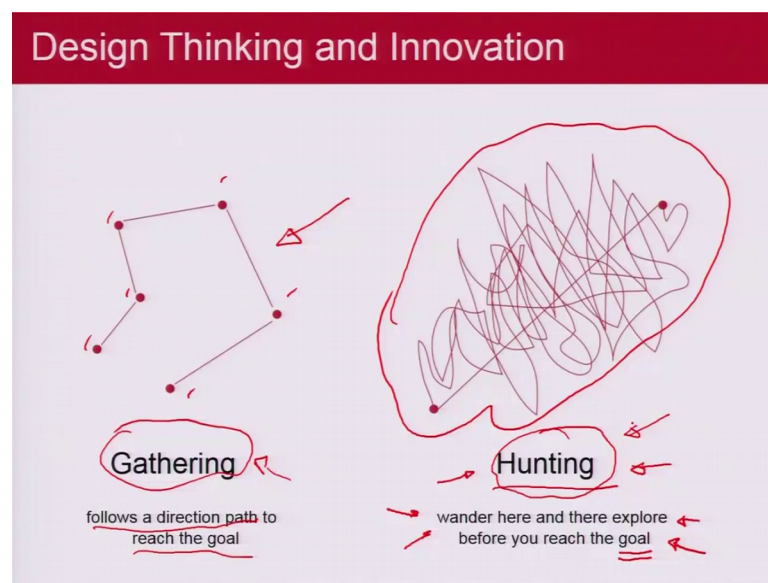
Hunting is sort of an experience pretty sure at some point of time you have been exposed to different hunts.

So, you basically wander here and there and explore before you reach the goal so, goal in this case is probably that big idea or the next level innovation which is not there and which actually can be qualified to be called an innovation. So, one has to really wonder quite a bit as you are seeing in this toppy curvy path that is being taken by the team which actually does hunting as opposed to gathering which is very well defined it follows sort of a directional path to reach the goal you could think of this as the food gathering habits of the primitive man where they exactly knew what has to be done where it has to, when the group has to move in order to find something which can satisfy the appetite and also in the process they already had a lot of knowledge base from years onwards.

So, that they do not have to spend more time and you can actually go from point to point satisfying all your objectives in that kind of a situation. But, this is really not a very good approach when we talk about innovation really comes from all this wandering here and there which means that you really need to think out of box you need to think about that idea which probably may at the face of it not even look feasible, but has a potential to answer a very pertinent question which can give you the definition of a product or a service.

So, that is what design thinking and innovation should mostly involve that is hunting. So, when you go hunting for the big idea there are certain rules which need to be followed and the first rule that needs to be really followed is that you go in a team you do not go alone because there are risks there are consequences if you go alone then there may be a problem of you getting killed sometimes on the connotation physically means that if you will not be able to survive in the business in the competitive business. So, you have to always take a good team with you when you go for hunting. So, that is the first learning experience that a person would have when you hunt for big ideas.

So, I am going to close this lecture here, but in the next module I will go into a little more detail and look into how you actually do the need finding and the problem identification.

Thank you very much.