

Design, Technology and Innovation
Prof. B. K. Chakravarthy
IDC School of Design
Indian Institute Technology Bombay

Lecture-14
Collaborative Innovation Methods Part 3

So, in today's class we will talk about the concerns for innovation. I have been working for the last 20 years in this field, trying to work and see how innovation happens across various domains. I was, you know, also in L&T earlier where, you know, we could see, you know, in the industry, innovation happens because of a number of people in the organization.

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So, when I moved to IITs I also realized that, you know, professors have a lot of research content. Some of them are able to take it to the innovation and others are not. So, then I had to also work on our own projects in IDC to see why some projects go to the market. One of the most common products in the market of our professors' is the voting machine.

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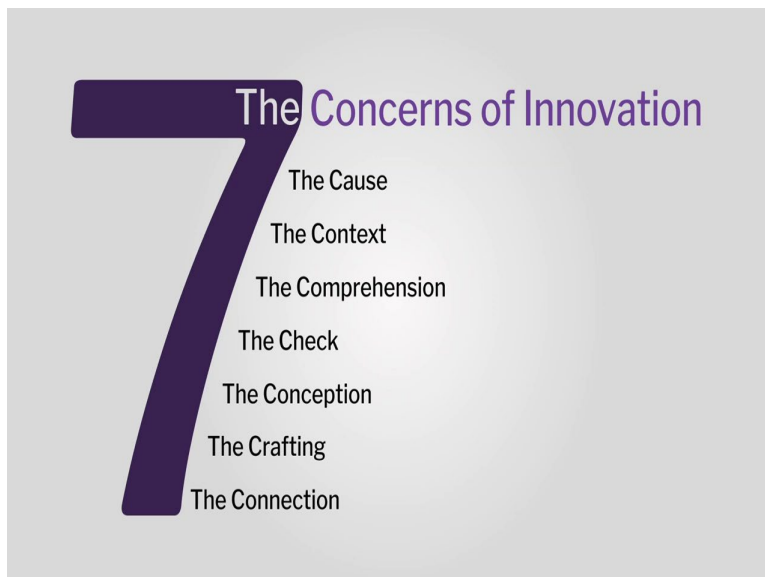
I must tell you, I was a student at that time, 1988 and I was watching Prof. Roa and Prof. Ravi Poovaih, working on these machines, and I will see them, you know, shaping them using plaster mock-up models before they could go for their meeting with BEL to take this to the level of implementation.

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So, there is something which is very very critical in an innovation. And what are these critical aspects of innovation is when I, you know, conceived my book the design of the postbox for India Post is when I came up with the concerns of innovation.

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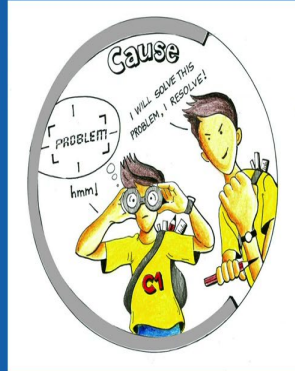


I call them the Chakku's 7 Concerns of Innovation. And these concerns are very critical in the innovation journey. And it does not necessarily belong to only the designer, it could be a professor who wants to go to innovation, it could be an entrepreneur who is doing innovation, it could be an NGO who is working on innovation, but the concerns are there and then only innovation can happen.

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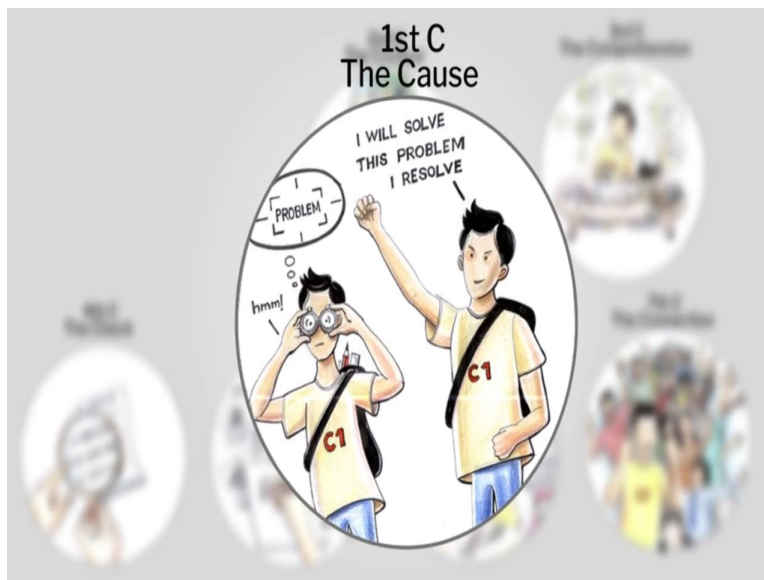
1st C: The cause

The concern to solve a problem



So, let us see the first concern. The first concern is the Cause. The Cause is like an activist, that you are standing and saying that, 'I am going to solve this problem'. So, sure you are really, really standing and saying that, 'I am going to solve this problem and see to it that all the users get the benefit out of it'. If I am just saying that 'I am solving the problem', 'I am' is not going to the market, right?

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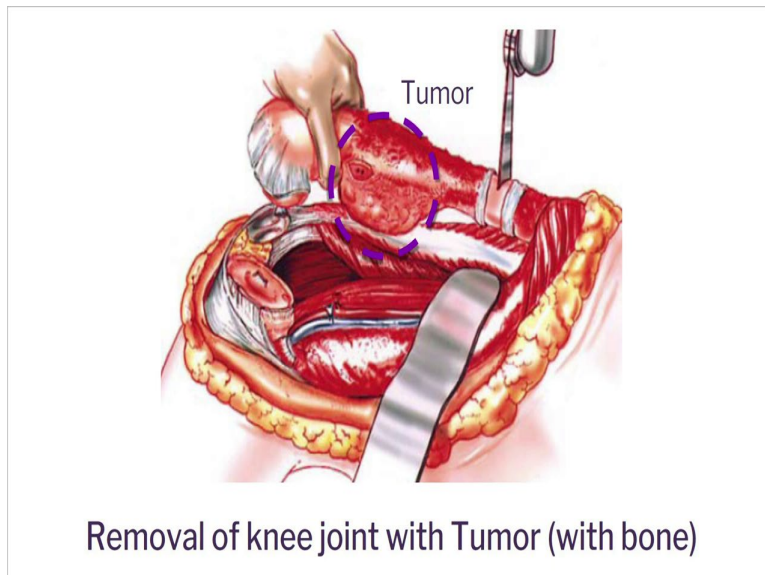
So, here the designer is taking this cause saying that, 'I am going to see to it that it is going to get implemented', and that is what is the most important aspect in my case or in the case of the professors you saw. Professor Ravi, Dr. Manish Agarwal and NFTDC, you know, Dr. Balasubrahmanyam, who decided to take the prosthesis, the mega process to the people at an

affordable cost, so that children and people suffering from cancer do not lose their legs if they get bone cancer, right?

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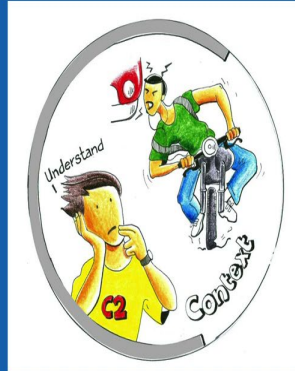
Removal of knee joint with Tumor (with bone)

So, the cause becomes a very critical aspect of the total journey to begin with.

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2nd C: The context

Understanding the user and the scenario



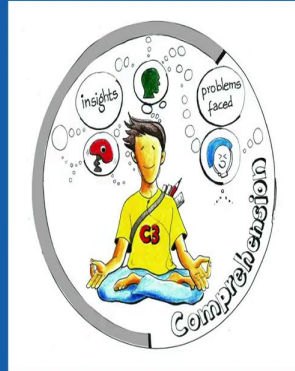
And then the interesting aspect is that the context is as important as the cause. Sometimes we do not understand our context. Our context in our country for helmets is, our country is a tropical, a very hot country. I cannot use helmets coming from England. I cannot use helmets designed for motorcycle racing. Today in our country two wheeler riding motorcycles is a necessity for going to the office, right? it is no longer if, you know, evening ride or a passion ride or a trekking ride. Like 90% of abroad, in Europe it is meant for that purpose, where hardly it is meant for the commuting purpose and a necessity.

So here our contexts are very different from anybody else's context, so the context for any innovation becomes very, very critical and addressing the context and the environment becomes the next important concern for innovation.

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3rd C: The comprehension

Arriving at the design insights



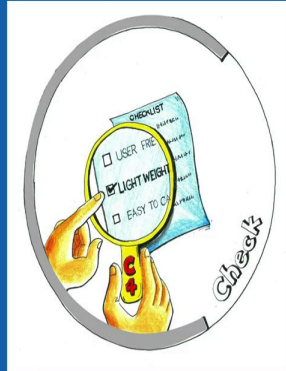
And after you understand the context and you stand for the cause, we noticed that a number of times we lose out on the insights. You will gain insights only when you are completely involved with the scenario and with the users. So, all your issues of user studies. All your issues of ergonomics. All your issues of understanding similar products. All your issues of understanding. What is happening today in the market? Why are people not using or if they are using, what are the current problems in the product? Everything becomes a Comprehension.

And when you draw insight from this comprehension you get a whole list of what is critical. So, without those insights you just cannot go ahead in your project. So that becomes a very important stage where you build insights. Where you document studies of insights. You do videography of users. You do photo documentation of user problems or user situations and come up with a complete list.

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4th C: The check

The blue print for design, a clear plan of action



And then build something called the direction which is the Check. The check is to have a complete list, and you want to stick to all the lists, and all your ideas and development should happen with that check. So, we will come, and then it is something like a product brief and, you know, you are actively making everything happen. Because you should know the direction you are going. Very early in your phase, because your insights are there, your contextual information is there, your comprehension is very, very clear. You need to create a clear direction of how your design should go.

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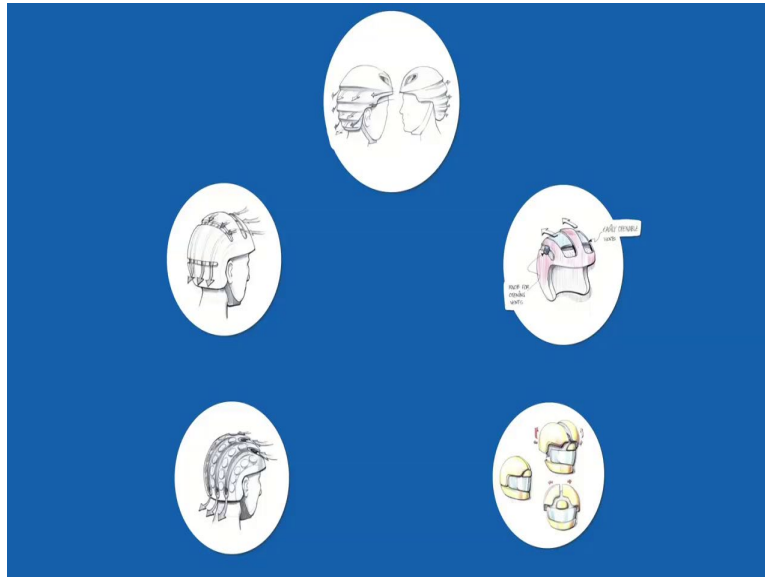
5th C: The conception

Creating multiple ideas and combining them to general concepts



And, you know, then of course, you know, very, very creative aspect of, you know, idea generation and creating concepts, so generating ideas. Are ideas concepts? What is the difference between ideas and concepts? Ideas address a particular problem in a product or in a service.

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Whereas a concept addresses all issues of the, so a number of ideas will form a concept. That is very, very critical in conception. So, you develop the ideas, you develop the concepts and you develop your final, you know, concept, which will match the check. Now that is why we call it a check. We take the check at whichever concept matches the check the most will be the concept which will be selected for your next stage of deployment, which is the Crafting, which is a sixth C.

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6th C: The crafting

Making mock-ups, functional prototypes and pilot production



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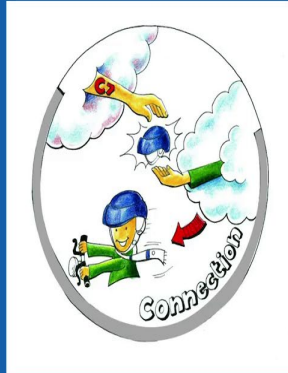


So here what are you doing? You are quickly building mock-ups, 3 dimensional mock-ups. you are quickly building the prototypes, because you can do some user study with markups. You can do some user study with prototypes. And you can of course do a lot of work when you have multiple pilot production.

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7th C: The connection

User testing and feedback



And then comes the connection where you go back to the user and connect with him and check whether all the aspects you started with are matching or not and maximum number of, you know, users are benefited. So that the connection happens.

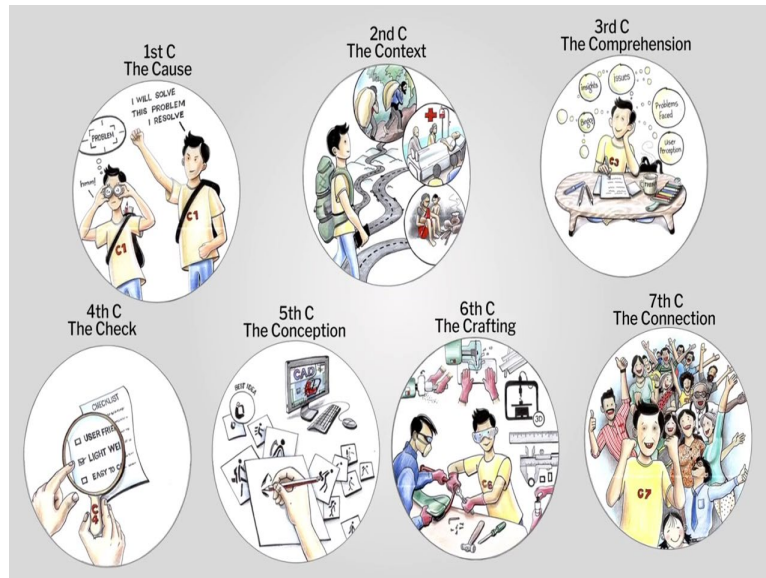
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Innovation methods assimilated from

- Industry experience
- Guiding Student project
- Live projects in IDC and IITB

So, this has synthesized from my industry experience, from my student project experience and from my live experience in the studio and watching other professors all across IIT. So, this is the innovation journey.

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A number of times you repeat these processes. For example, if you have gone to the users at the concept stage and a prototype stage, you failed there, you go back to your comprehension, context and check and come back again with ideas. So this whole thing is a cyclic, you know, till your innovation happens.

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The 7 Concerns of Innovation by Design

- **The Cause:** The concern to solve a problem
- **The Context:** Understanding the user and the scenario
- **The Comprehension:** Arriving at the design insights
- **The Check:** The blue print for design, a clear plan of action

So, the Cause is the concern to solve a problem. The Context is to understand the user and the scenario. The comprehension is arriving at the design insights. The check is the blueprints of design. Remember we talked about it, a clear plan of action.

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The 7 Concerns of Innovation by Design

- **The Conception:** Creating multiple ideas and combining them to general concepts
- **The Crafting:** Making mock-ups, functional prototypes and pilot production
- **The Connection:** User testing and feedback

And then the Conception is creating multiple ideas and combining them into concepts. And Crafting is making mock-ups, functional prototypes and pilot production. Because pilot production also is Crafting because you are spending a lot of time and effort. And then you have the Connection where your mass production and you reached a large number of users and you connect it back with the user and the benefit has reached the people at large till you are saying that you got the benefit addressed to the people.

So let us put this on a very interesting platform. After I finished my PhD and I came to IIT Bombay, I saw this rusted post box just next to IDC.

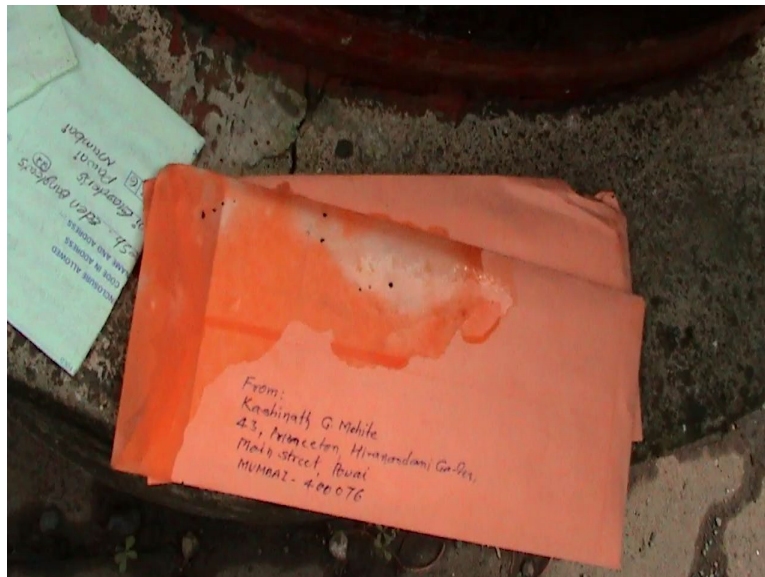
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It was rusted and after some time even the door fell down and I said, you know, we all, you know, sitting in such great institutes, the best professors in materials, manufacturing and management is available here. So why cannot we change one product in the country. So, my cause was, 'I will start this journey and not stop till I have large-scale deployment, and, you know, see to it that I, you know, solve this problem'.

Because it is like, you know, very unfortunate that water gets in, the letters get soggy and I myself watched some letters being very, you know, sort of wet in this box which was, you know, next to IDC under a tree.

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So, that was the first thing the Cause. And then luckily I got a student who said, you know, he went with my call and said, 'I will work with you', and it was a student project and we started our journey of understanding the Context. And we found out that the context is very different from what we thought.

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2nd C: The context

Understanding the user and the scenario



But then we found out 1000s of issues about these boxes. They were difficult to open during the rainy season. The postman could not hold his umbrella when he was taking all the letters and then the box would be wet. So, the letters would be wet. The children cannot reach the letterbox because the height is very high. So, multiple issues and then we also checked, in understanding the context, you have to check the management principles of India post.

So, we went to the GPO to check what are they based on. And then we found out that the lowest division clerk is the one who works on these post boxes. The order post boxes is a tender system where the rates are old, 20 year old rates they give for making the boxes. So, what would people do? How will they manufacture these boxes at a 20 year old rate? They of course recycle material. They use old, you know, those steels that are already rusted.

So what happens when you rusted, already rusted steel and painted it? Will the rusting stop? Paint gets, go off because the rusting will start to progress a little bit and the paint will chip off and further rusting will happen. Now we are on an innovation journey right? I am just not making a fancy-looking nice, you know, post box and, you know, saying my job is done. Here I am saying that I am going to look at the total context of what is happening in this scenario.

So that I can make an impact and change all this, so now I have to involve the management of India post also in this. Who is the head of the India Post organization? It is a Government

organization right? It is the Ministry. Ministry of Posts right? Who is the head of the Ministry of Post. Minister! We will have a minister as the head right? Minister calls the shots. After the minister, who is there in the ministry, the Secretary, the IAS officers, right?

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The highest level is the Secretary, and then comes the Member Secretaries, and then comes the Postmaster Generals or the Chief Postmaster General and then the Postmaster Generals. So, where did we reach first? My student reached the Postmaster General in GPO. He reached somewhere around 4th level already. Till the time I reach the top level, you know, what will happen? Implementation will not happen. And you need to understand the problems of all the levels otherwise things would not happen.

So the context becomes very important. And then we understood the insights very closely and all the things I was mentioning was the insights of the context together.

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3rd C: The comprehension

Arriving at the design insights



So, here we came up with very, you know, even the postman does a lot of interesting things, you know. He puts plastic inside so that the letters are not wet. And they have flat tops in some other boxes. This is not rocket science, the flat top will always rust right? Water will stay over there and rust more and, you know, we built a lot of insights in this and that is called the Comprehension and came the Brief. The brief is very clear. What is the cause I stood for? Maintenance free postbox right?

It should not rust. Why did I start the whole journey? I should not forget that. Generally, people forget and I am no exception. So, you see how we failed a little later.

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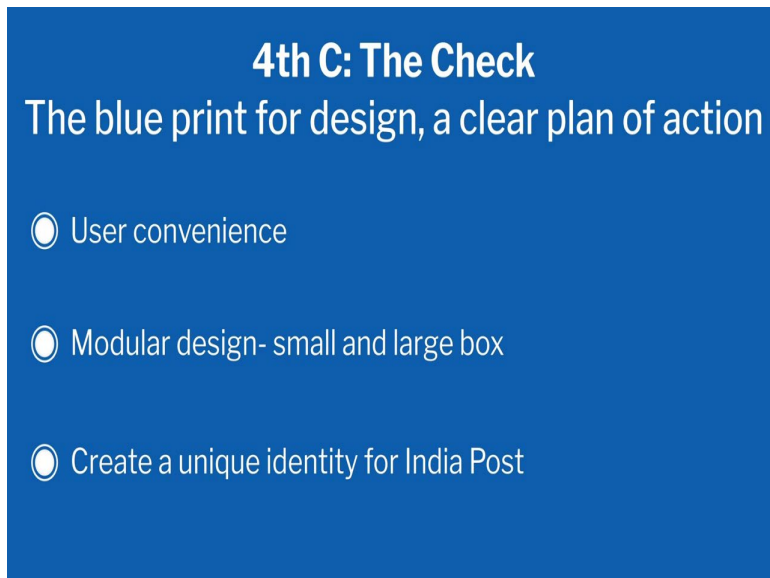
4th C: The Check

The blue print for design, a clear plan of action

- ☐ Maintenance free for 20 years
- ☐ Long life
- ☐ Use of contemporary materials
- ☐ Robust manufacturing

So, we said maintenance free for 20 years, that is the checklist. Use of contemporary materials. Standard phenomena of innovation, use current materials, do not use dated materials. Robust manufacturing because I knew these boxes have to be really strong right? Because in the field there, it should have robust manufacturing.

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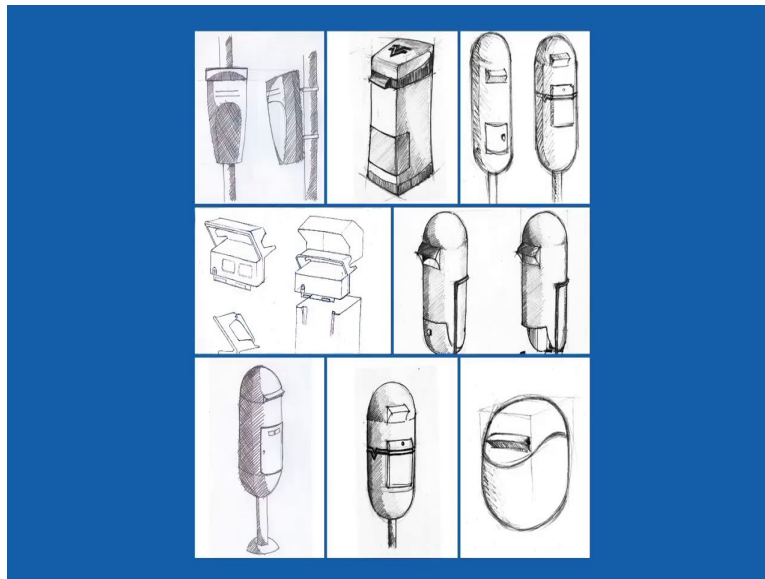


It should be user convenient. People should be able to easily post, because in our Comprehension, we realized that children are not able to post, that it is too high, some of them are on pedestals, so we said this. Modular design, there should be a small and large box because the volumes are changing. So, we need, you know, two designs. And create and identity for India Post. That came last.

Generally all my design assignments, creating aesthetic identity will become number one right? Now in our innovation journey design and aesthetics, you know, came last. But to my surprise when I offered this brief to the Post Master General along with the student, they said, ‘We are a growing organization. We have also bought a jet now for transporting our letters. They bought a jet. They have a jet now, you know, private India Post jet.

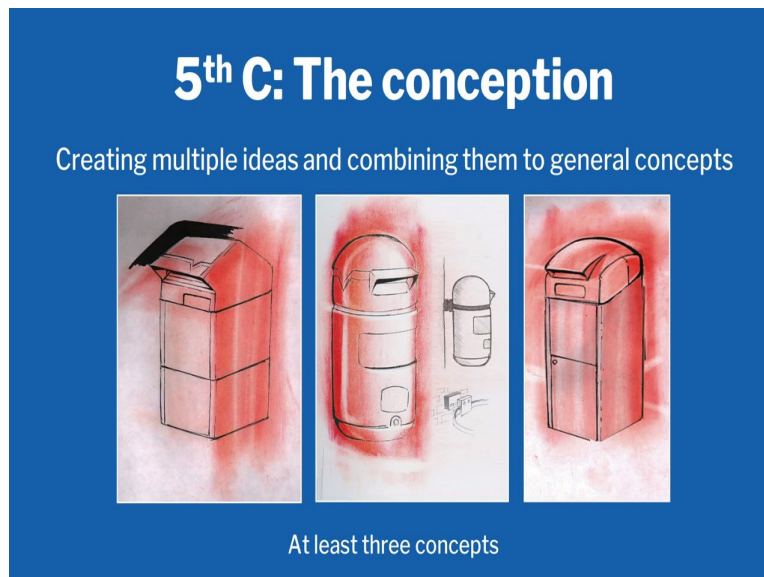
And we want to have a new identity. So he himself asked for a new identity for the postbox. And then we said yes, we will work on that. But, you know, our checklist is very clear, you know, the direction is happening from wherever it is happening.

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So, here we have the 5th C, the Conception. So we then generated a lot of ideas. You will see online, you know, more details. So, lots of ideas were developed.

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Then 3 concepts were built right? And by applying the check, the first concept was, you know, the most, you know, close to the requirement list from all aspects of the, you know, like maintenance-free aspects, the manufacturing aspects and the aspects of easy installation and multiple aspects.

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6th C: The crafting

Making mock-ups, functional prototypes and pilot production



The first one was the best and then we went into Crafting, where a prototype was built by hand. And then using CNC machines, a small pilot of 5 were built. And then a large pilot production of 20 were built. And they were put in or put all over the country in 5 different places, Delhi, Bombay, Patna and Chennai. And very, very happy feedback. The papers were having articles saying, ‘Past imperfect, future good’, you know, multiple things like that they were saying, you know.

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And then they were saying, ‘New box changing the whole landscape of India post’.

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And then the India post celebrated their 150 years Celebration, and they launched the box,
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during that celebration.

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7th C: The connection

User testing and feedback



This is the first prototype they launched. So there we just reached the stage of, this was the pilot stage right? We reached the pilot stage of production and they launched the box. And then an interesting thing happened. Suddenly we found a lot of money in IITs bank. They (India Post) said we have given you this money, now manufactured 200 number and give it to us, and I told them, 'I am no manufacturer. I am a professor and I can go till pilot'. They said 'No, no. We cannot help it, we need this badly. Now the ministers, who were these guys who are sitting over there.

The Secretary of India Post. So we reached the highest authority now. So, the Secretary has inaugurated it. So now they want 200 numbers and then our journey started. We manufactured 200 numbers by collaborating with 5 different industries. We collaborated with Jindal manufacturer, Jindal stainless steel for the stainless steel, Jindal architecture for the architecture, you know, there are the manufacturing and the prototyping. Locks, whom did we go to? Godrej. Very good, Godrej locks. We went to Godrej because the locks should not rust right? We used the non rusting locks.

For bolts we went to Hilti, the bolts. Because we have a new design which is bolted to the floor. The earlier design was, you know, casted. it would go into the floor. So, we wanted a bolted design and we went to Hilti. So we went to, and then for the plastic top, we went to the best manufacturer at that time called GE Plastics and we used gelay which is a combination of polycarbonate and ABS. Very, very good material for the tops, and we manufacture 200 numbers.

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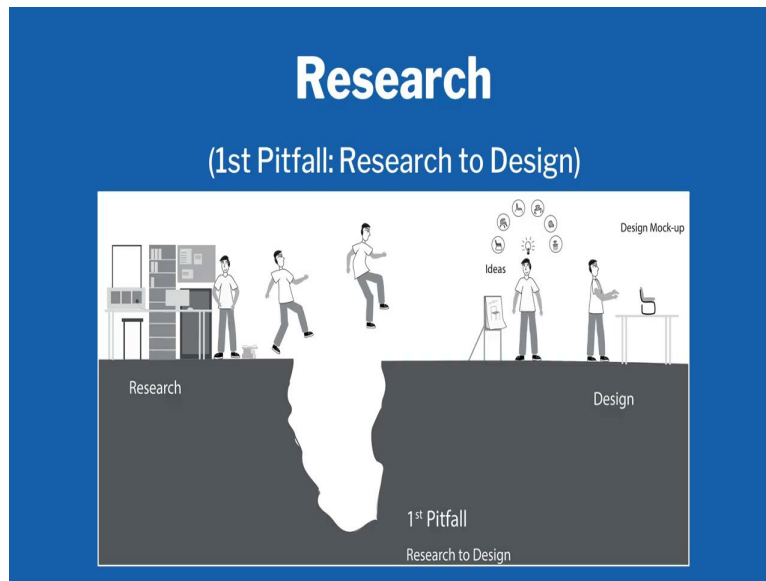
So, this was made out of geloy. Very, very good opening, very easy to post letters, height is also, you know, perfect, a lot of space was there for advertising on the side so you can make revenue out of advertising. Stainless steel box, ‘scrotch-brite’ finish. We also insisted on ‘scrotch- brite’ so that no light, if you have a headlamp it should not shine back right? in the cars. So, you know, that was given in. And then we had a nice change of timing schedule. And the location addresses and all done well. And then, you know, I like to now take you to a new journey to show you what exactly happened after this.

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Pitfalls of Innovation

So, let me now take you to the pitfalls of innovations. We have done so many cases right? On design, technology and innovation.

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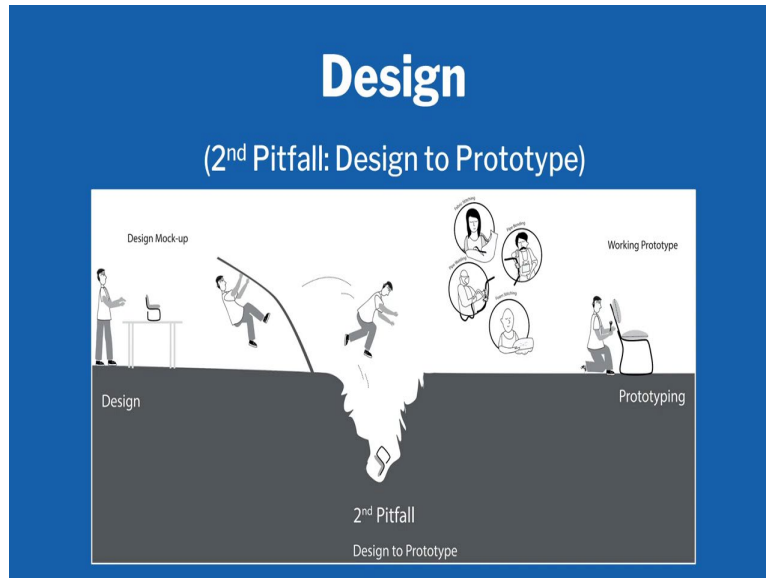


So, were all do we have the pitfalls? Let us start with the first pitfall. A lot of my professors in IIT, we have got around 500 professors, do research. When you do research you need to write a research paper. Research paper is the outcome and the research paper is published in research journals which are very noted and the IIT professors are given promotion if they have so many research papers in so many journals.

And the journals are also created. I cannot put in a Tom, Dick and Harry journal. I had to put only in the journal which is reputed. So, a reputed journal will have another 10 professors on the panel. They will not accept the paper till it has got quality research. So, that is the whole yardstick on which you survive in IIT Bombay right? So that is the whole level of research. So, what happens when some new material for a chair is developed?

I developed a new plastic for manufacturing chairs or a new metal for manufacturing chairs. I made a research paper and I did not use it so it has got to the pitfall.

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If I leap-frog from the pitfall, what happens in the second stage? Comes a design. So what have we done? In the design stage, you make a mock-up of the chair. See, small size. You use the new material, which is a very thin and very like, lightweight and which is very low cost, not rusting. Whatever research you did, you use all that research to make a chair. And then if you have not taken it anywhere else, which is most of our, 99% of the projects at our IDC, are in this pitfall, right?

So, if you take this pitfall, look at the, you know, pole-vault. You need to do a pole vault, pole vault is skill-based, right? So, you need a lot of practice, a lot of skills, a lot of knowledge to take any mock up to a prototype stage to leapfrog this, right? So, now, you know, and for taking the prototype stage I need a lot of support structure. I have special people who know welding. I have special people who do fabric stitching for the clothes and, you know, special fabrics.

I may have people who are doing fixtures for main, building the product and I just built one prototype. What is the cost of a prototype in compared to the final product any guess? 100 times, very good, 50 to 100 times easily, or 20 to 100 times. Because you are making one and you are putting in a lot of effort because it was not existing and I am getting that material from the research. What happens then I get material from the research, tell me?

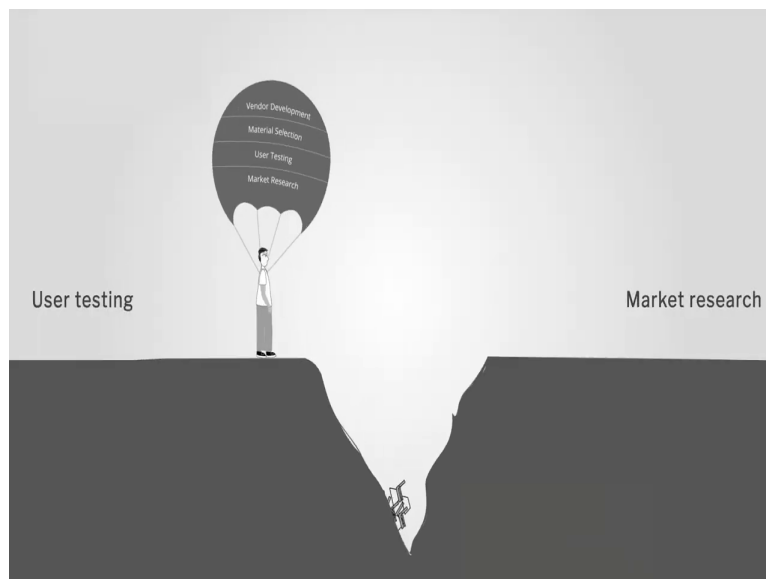
No manufacturer is manufacturing. So I will do all the production using a plant and a rolling mill to produce that pipe. Now we come to the working prototype. So what happens when you have a working prototype?

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You can test it right? You can get a lot of users who can sit on it, check whether it is good, not good, all the things. And then you take to a pilot production.

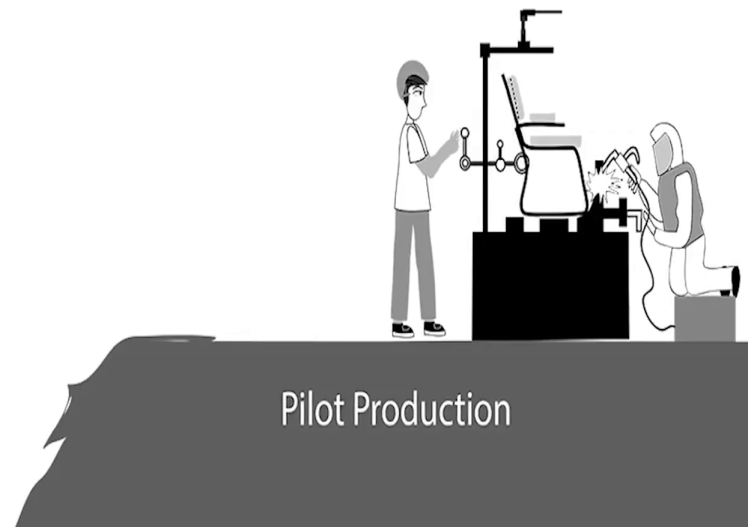
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And here you are flying on a balloon and you have a lot of support structures from various, you know, departments like, you know, you can talk to market research people, you can talk to manufacturing experts in tooling, you can talk to people who are experts in pipe bending for the

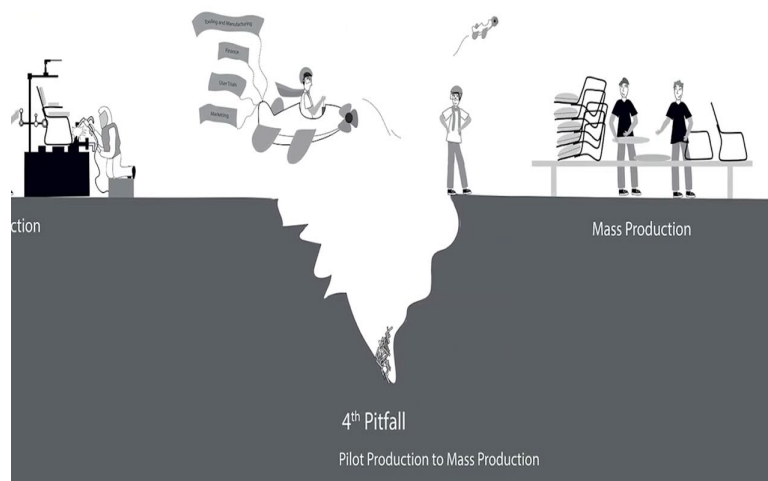
chair. So multiple things are there and you then leap up to pilot production. And in the pilot production you can look at,

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see how now it has become a special-purpose fixture, to now make the pilot of 20 or 200 numbers. And what is the cost of pilot production, 20 times to 50 times, if that is 50 to 100 then this will be between 20 to 200. So piloting is also expensive because you are not producing too many and you need to have a lot of skilled people working on that.

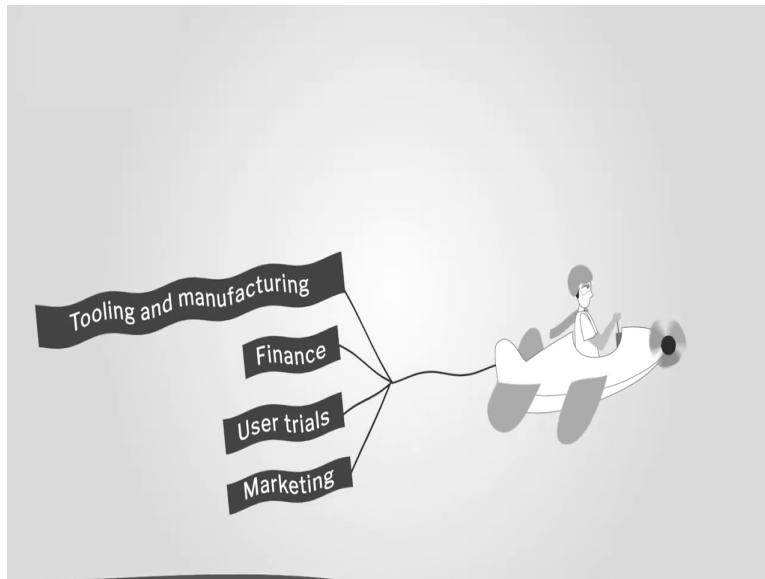
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And then comes the next stage from pilot production to the mass production, and this is the most difficult stage. Lot of people fail over here. Most of the IITs startups are all stuck over here. From

start-up they did a prototype, from prototype they can somehow garner the money to do the pilot and after the pilot, is the biggest leap where you need to reach large scale to make innovation happen.

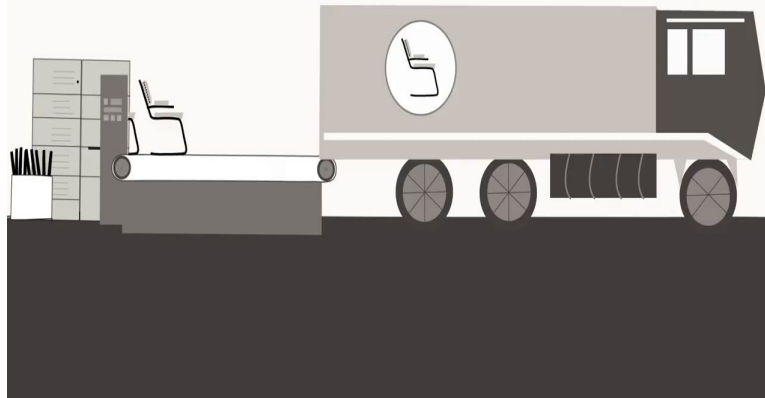
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And for that large scale you need tremendous, you know, you need an aeroplane to fly, right? See, here you are, it is like, you know, much, much more difficult, much more expensive, right? So you have the, you know, specialists in manufacturing, specialists in tool makings, specialists in understanding user needs and aspirations because you are looking for a large number of users. For a large number of users you need to have social research, socio-economic structures coming into picture. Whether this product will run or not? They will do a lot of benchmarking. They will go and do user studies in locations, market research in locations to come and say you can invest this 100 crores in this business. I think it is a good product.

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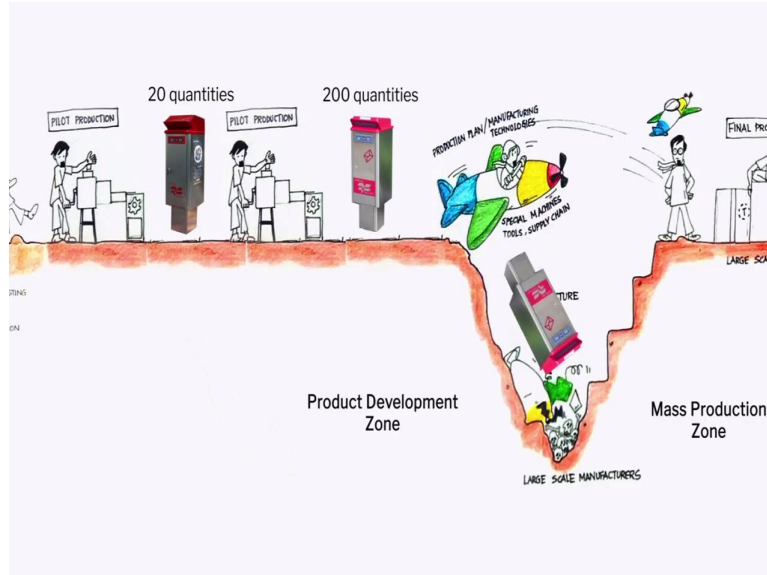
Mass Production



And then only it will go to mass production because mass production needs a lot of tooling. And then you have, you know, multiple pieces assembled and, you know, take it for production. So, this is the whole, you know, journey which I wanted to show you. So, in this stage when we did 200 numbers on it went to all, the first 20 went to where? The Metros' (cities). All educated people, you know, it was big, and the journalists were happy. And when the 200 were made, the pilot was made, it went to all the areas which required post boxes and most of them were rural areas.

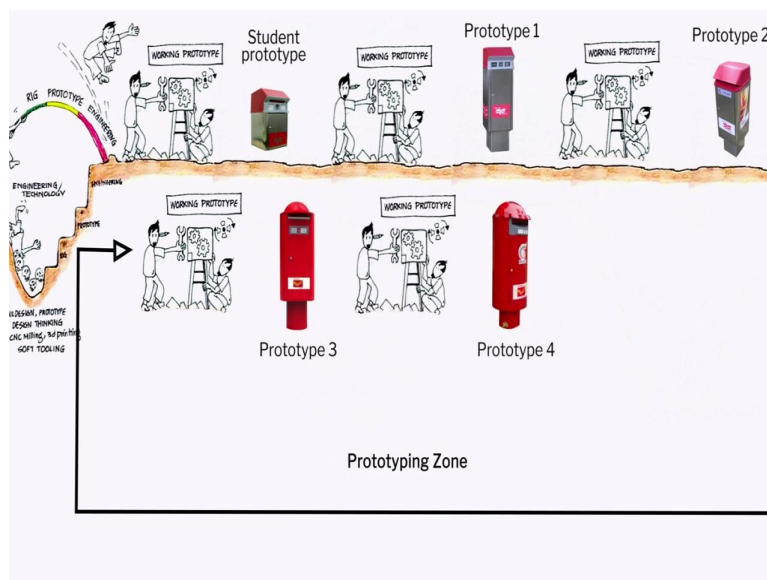
And what happened with the boxes? Nobody recognized the boxes. They thought it was garbage bins. We said a red color top is enough, it was not enough. They wanted a rusted box but red color. They wanted a rusted box but round top. So, what was the most important thing, user perception of the product. Because this is a legacy product. This product was there for ages right?

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So, we fell flat on our face. We failed, we fell into the ditch again, that pilot ditch, and we had to go back to our drawing boards.

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Make the sketches again. Now we had a new brief: Marry the old and the new, right?

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There is an old form. My form cannot be novel and completely out of box. It has to be coming out of the old form, so that people can recognize it and then came this round top and red color. And then, you know, they said, 'Oh yeah, this is recognizable and then we did an actual user testing to find out whether people have accepted it as a box and they said yes.

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So, here we have, you know, and now by this time the project moved to IIT Bombay here at the Design Innovation Center. So, that is the Secretary of MHRD now. My Secretary post, already retired and a new Secretary came in and he (the former Secretary) was very unhappy when we failed. Unfortunately Ministries do not know that failure is good for design or failure is good for innovation. Once you fail you do better right? They would not let me stand in front of them.

They would say, 'How did you do this? How can you fail?' I said, 'I am also a human being although I am a professor in IIT' so I got so much criticism at the Ministry that, you know, I had to keep quiet for a couple of months and then start working on it again and here we have the job. So, now the project is from the Secretary Minister of Human Resource the Innovation, the Design Innovation Centre is from the, it is a project by MHRD. So we took it under that, we developed the prototypes.

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And we now are, you know, in the race and then, you know, then we showed it to the Prime Minister saying that this is the box which is going to work. He was in, you know, IIT for the Convocation a year back and then we showed the box to him and he liked the box. So, now we are back in the India Post with the new Secretary, asking him to take him to take it to the market. So, the Cause remains right? We thought we nearly succeeded right?

So that is the interesting journey of innovation that till you do not do user testing, you can again fall into the pitfall of, you know, of the innovation cycle and things will not move. So, that is the whole journey of the, you know, the Pitfalls in Innovation and the Seven Concerns of Innovation. So, if you look at the 7 Concerns, it happens in all the aspects. Here also when the concern is there, you will be able to leapfrog the pitfalls.

If the concern is not there it dies. And the concern can be from various quarters. It could be from the Ministries concern, it could be the concern of the funding agencies. Here for example in the case of the prostheses (Total knee prosthesis), the funding agencies were also concerned that the product should go to the people. Yeah

Student 1: Sir, so how did you prevent rusting?

Sir: We used stainless steel and we powder-coated it. We had to, it looked foolish right?

Stainless steel, that is why we did not paint it. We said stainless steel is a good material. It shines, it looks modern, because remember, even though, you know, who will mislead you the most? The clients. They wanted a new identity also. They said, 'We should look new. We should be..' that's what I said this is your new identity. Yeah.

Student 2: Is there something on the inside of the box as well which helps take out the letters easily.

Sir: In fact that is a very interesting, you know, point that point actually came from the users.

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They actually said, 'Why don't you tie a bag inside?' The users gave this suggestion in the first meeting itself. The PostMaster Generals across Maharashtra came, so they just grab the bag and they take it. So that suggestion was theirs, not ours which is wonderful. So we put a bag inside with four hooks and, you know, the letters fall directly into the bag and they just grab the bag and put a new bag and go away. And the bag was also recyclable so it does not, you know, affect us in any way.

Student 3: What was the reaction when they saw the red box, like, the post office people?

Sir: In fact, you know, I must tell you, you know, that after we failed once. They were not ready to accept anything other than a round (shape). And as new manufacturing techniques developed, round was earlier the manufacturing technique. They used this in everything, they were using the rolling processes. Today everything you see around are boxes. Our washing machines, the cupboards and all. So we used a folding process which is much more cost-effective in manufacturing and saves a lot of material.

And then it also, you know, helps us put more volume of letters inside than in a smaller volume. Round (cylindrical shape) takes less volume of letters. So, you know, like after showing the red one, you know, because of the older reaction, they were not very keen in taking it forward. Even after making it red, even after giving it a round top. So, I had to go to the Prime Minister to make him like it, hoping that, you know, they would, you know, they would go forward.

Because the first box which was designed, was designed by my professor, Prof. Athavankar. And at that time the box was put opposite Indira Gandhi's house, the Prime Minister's house and she liked the box and that went into production.

Student 4: At what stage are you now in, in the sense, like, are you still taking this forward?

Sir: Yeah we are still taking this forward. We are, like, you know, again requesting them, 'Please give us the pilot order'. And if they give us the pilot order then we will put a pilot.

Then we will again go for mass production which is much, much larger. This time the pilot itself will be 200 and then the mass production will be 20,000. Because we need around 5 lakh post boxes in the country and in the meanwhile what is happening is technology is going forward. You need more, you know, more things in the box maybe. So, we still do not know how things will move but, you know. But this is a landmark product for them. This is a, you know, total pole on the wall.