Technology Forecasting for Strategic Decision Making - An Introduction
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Element-Name-Value Model

Professor. Dmitry Kucharavi: Hello, welcome back to our course technology forecasting for strategic decision making. And today, we are going to discuss interesting question - how do we know unknown or how we will know unknown, and we are going to discuss simple but powerful model which is named ENV model and how can we apply this model in practice.

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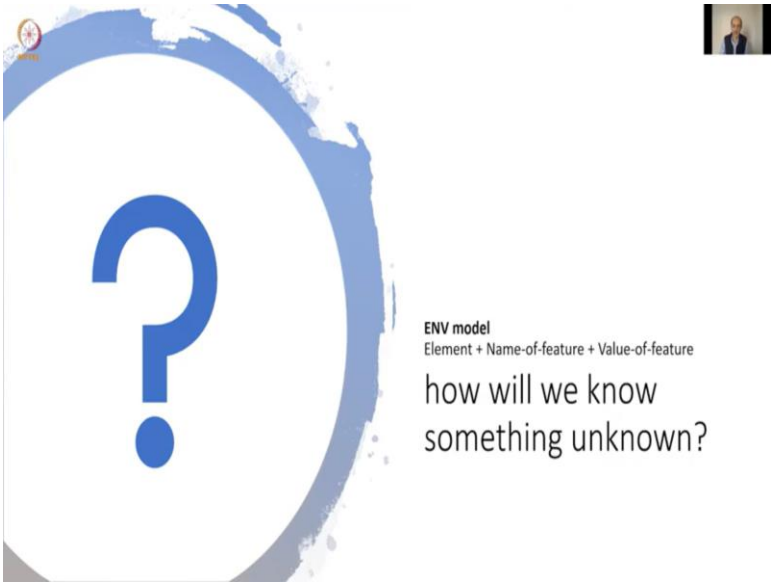

Because, technically speaking, when we try to forecast something, we need to find a way how to know what is unknown at this very present moment. And so, that is why we have to have some bold idea and strategy in order to do so. And the common way of learning can be used but with some limited with some limitation. So, in fact what are we going to learn was in few coming minutes, we are going to learn the element name of feature and value of feature model.

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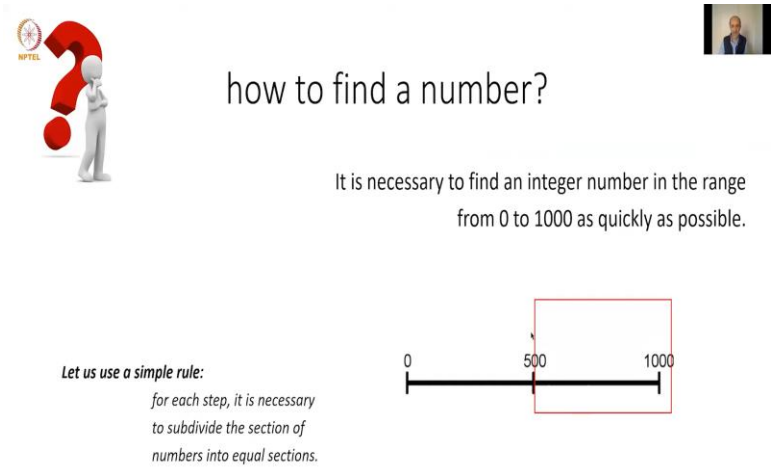

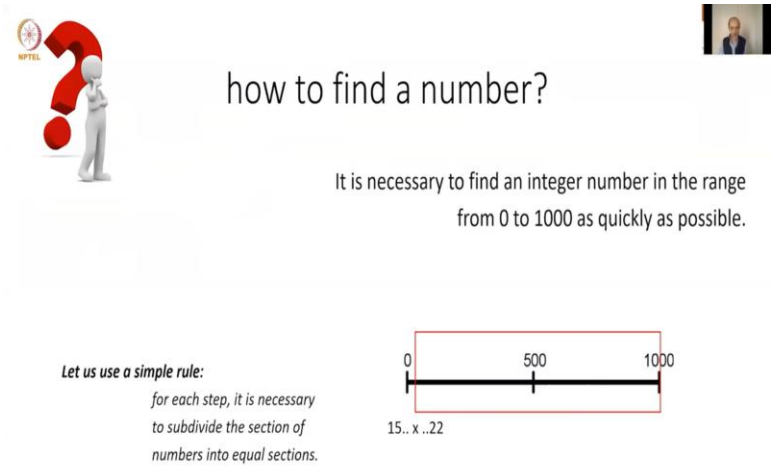

But let us start with a practice. For instance, how to find a number? Just imagine situation that may I have in my mind, the integer number which is from 0 to 1000, and your task is to find this integer number in this range as quick as possible. It means with minimum trial. Of course, if you will start just a guess and ask me the question - is this number is 23? Answer no, if this number is 992? Also no. If this number is 612? Also no. In this case, the number of possible questions can be very close to 990. But your task, for instance, when your task is to find this number as quick as possible, we need to use some another kind of strategy.

This is just for your attention, I would like to suggest for your attention, let us use the simple strategy for each tab when you will ask me the question, you need to divide your search area by half. And what is interesting to see that you can perform this task to find the number that I guess. If you follow this simple strategy, within 11 steps with guarantee and sometimes even faster, in 10 steps, but let us do it step by step. Your job now, will be to formulate the question and when I am answering the next question has to follow - what you learnt from previous one. And let us see together how it works. So, Bala are you ready to ask questions?

Professor. Bala Ramadurai: Yes, I am ready.

Professor. Dmitry Kucharavy: And you will shape your question in such a way that I will answer you for the question - yes or no. Okay?

Professor. Bala Ramadurai: Okay.

Professor. Dmitry Kucharavy: So, what is your first question?

Professor. Bala Ramadurai: Dmitry, is the number you are thinking, less than 500?

Professor. Dmitry Kucharavy: Yes, it is.

Professor. Bala Ramadurai: Okay.

Professor Dmitry Kucharavy: So, we, just a second, in fact what happened, you already cut out some piece of possible answers. In fact, you already cut out 500 alternatives. Right? So, let me see how we are going to advance. Please, next question.

Professor. Bala Ramadurai: Yes. Next question is - is the number you are thinking, less than 250?

Professor. Dmitry Kucharavy: Yes. It is. Okay, what will be the next question? 250?

Professor. Bala Ramadurai: Is the number you are thinking, less than 125?

Professor. Dmitry Kucharavy: 125, and why do you ask question 125? Why not another one? Could you explain me please?

Professor. Bala Ramadurai: In your rule it says divide it equally. So, I picked the equal part and I have done that as, so I am good at following rules, so when you said rule, I said, whaoo yippie! I will do that. Exactly what I did.

Professor. Dmitry Kucharavy: Yes, nice. So, now you try to once again to reduce the area before you reduce it just to 250 and now your question it is even more reduction. Yes, my number is less than 125.

Professor. Bala Ramadurai: Yes. Okay.

Professor. Dmitry Kucharavy: So, what will be the next question that you are going to ask?

Professor. Bala Ramadurai: Is it less than 62?

Professor. Dmitry Kucharavy: Is this number is less than 62? Yes, it is.

Professor. Bala Ramadurai: That is my 1, 2, 3, fourth question.

Professor. Dmitry Kucharavy: Yes, please.

Professor. Bala Ramadurai: Is your number less than 31?

Professor. Dmitry Kucharavy: Is my number is less than 31. Yes, it is.

Professor, Bala Ramadurai: Okay! That is my fifth question. Is the number you are thinking, less than 15?

Professor. Dmitry Kucharavy: No.

Professor. Bala Ramadurai: So, it is between 15 and 30, both included.

Professor. Dmitry Kucharavy: Just a second please, I would like just to make it clear for everybody on the picture. This is, this number is from 15, somehow to 31. Good.

Professor. Bala RamaduraiL So, seventh question is, is the number you are thinking, less than 22?

Professor. Dmitry Kucharavy: Less than 22, yes it is.

Professor. Bala Ramadurai: So, is the number you are thinking, less than 9, I am sorry, 18?

Professor. Dmitry Kucharavy: Is it less than 18, you asked?

Professor. Bala Ramadurai: Yes.

Professor. Dmitry Kucharavy: No. Just a second. Just a second. Before next question, let us see what happened. How many questions did you ask, Bala? How many questions?

Professor. Bala Ramadurai: This was my eighth question.

Professor. Dmitry Kucharavy: Eight question and we already reduce our search area. Now, we have just few alternatives. The integer number that I guess can be 19, 20 and 21. Look what happened, within just 7 questions, by following a very simple rule, we reduce number of alternatives from 999 to just 3 alternatives. This is quite interesting phenomenon. But let us finish the task and let us make summary. What is your next question, Bala?

Professor. Bala Ramadurai: Is your number less than 20?

Professor. Dmitry Kucharavy: No. And this is very interesting point. Because you can see even we didn't ask directly, we already know what is this integer number. Do you have any idea what is this?

Professor. Bala Ramadurai: The number you are thinking?

Professor. Dmitry Kucharavy: Yes.

Professor. Bala Ramadurai: 21.

Professor. Dmitry Kucharavy: Yes, absolutely. This is 21, because this is in between 20 and 22. How many questions did you ask?

Professor. Bala Ramadurai: This is my nineth question. So you are guarantee of getting it within 11 has worked out.

Professor. Dmitry Kucharavy: Yes, within 11 questions, we will always take. But looks carefully, what happen? In fact, when you try to find this X, okay when you are trying to find this unknown, what you did gradually? You collected the features, the features one by one of this

integer number. You see, in fact, when you collected enough features, 7 features, you said - I know what is it. Even at the beginning, it looked like very difficult to imagine just using 10 questions to find out the answer for such a task. Let us try to see another example in order to illustrate and in order to see how it works, our ENV model. Well, I would like to suggest for your attention. Now, a riddle.

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And, just to understand how do we usually ask for the question 'what is it?' And I took this riddle from one of the presentation of colleagues of mine that was developed years ago. But, just to understand how we really find something that we do not know in advance. So, let us go through this riddle. If I just ask you, what is it that looks like a ball? It is very difficult to answer for such a question definitely, because there are many things which looks like a ball. And I add one more feature, but this something stands still and does not fall.

Strange, ball usually is moving because it is very difficult to imagine that it is still, stand still. And this ball has its thin and graceful legs, it can have a leg or legs but this is something that looks like ball, it stays on place and it is has legs. Children like to turn it round, this ball. Rivers, mountains, lakes are found. So, Bala do you have any idea what it can be?

Professor. Bala Ramadurai: I was thinking of, till question, till line number 3, I was thinking of a hedgehog standing on its legs. That is what I thought. Then it said children like to turn it, no that cannot be the case. Then, now I am completely confused - rivers, mountains, lakes are found on

something that children can turn it around. I do not know, maybe a, one of those balls where there is this huge marble ball on a water body and then you can turn it around, all children can turn it around, all children like to play with that, I have seen it in Europe in some places. Yes, I got it. Now, country, state and their towns, it should be a globe.

Professor. Dmitry Kucharavy: Yes, you see how do we discover it little by little. In fact, in order to understand, what is it, we name it an element because this element can be not only physical one but it can be concept also, no material one. We always describe it through its features. And gradually we add feature 1, feature 2, feature 3 until we envelope our element and we define it through its features. Like the integer number, in the previous exercise, when you tried to find the integer number you tried to add features gradually using some rules dividing your search area by half, you arrived to identifying what is it.

And this is a very interesting to see that this model is a very universal model and it works all around the world, for human being, for the discovering of, understanding whatever we try to deal with. Just one more example, from your experience, if you open the dictionary or thesaurus, for instance, Collins Cobuild Dictionary, you can see that whatever term you have in this dictionary, usually is defined through its features.

So, this universal model is very useful for us, for the forecasting, why? Because within a forecasting, we have to answer for the question, what will happen in the future, without knowing this in advance, without having any experience. So, the main idea is that we have to, to be successful with forecasting, we have to collect enough list of features in order to definitely define what is it. So, that is why this model is quite useful. By the way, let us make one more example in order to learn about this in ENV model.

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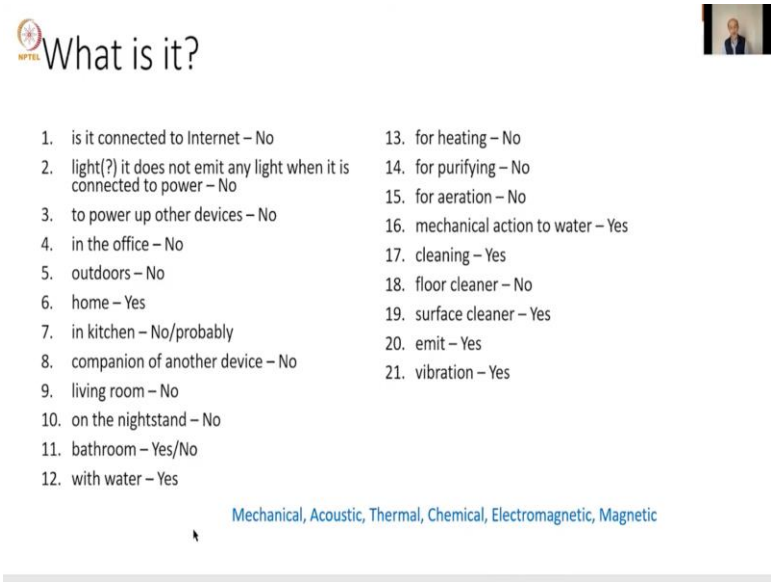

And now, I am going to suggest to guess for you what is this, can you see on my screen? We have a certain something in my hand, okay, you can observe it. This something, can you see? Yes, you can. Yes, this is a, it can be connected to the power socket, definitely. Well, and now, we will try to, using questions that I can answer yes or no, the idea is to build the answer gradually and to guess what is it. For this purpose, after each question, I will add feature that we learn. Did you observe it well?

Professor. Bala Ramadurai: Yes, I did.

Professor. Dmitry Kucharavy: Good, so what is your first question?

Professor. Bala Ramadurai: Is it connected to the internet?

Professor. Dmitry Kucharavy: No, it is not. No, it is not connected to internet.

Professor. Bala Ramadurai: Can it, does it emit light when connected?

Professor. Dmitry Kucharavy: Light, no, it does not emit any light when it is connected to power

Professor. Bala Ramadurai: Can it power another device? Does it, as in does it, like a power bank, so can it be used to power up some other device?

Professor. Dmitry Kucharavy: To power up, no. To power up, but this is a good idea, this is usually how we try to understand, we try to define the function? So, power up other devices, no.

Professor. Bala Ramadurai: I have never seen this device so I am not going to be able to guess it.

Professor. Dmitry Kucharavy: Yes, absolutely. This is exactly how it works. Let us try to reduce your search area with each question.

Professor. Bala Ramadurai: Yes, is it used in an office?

Professor. Dmitry Kucharavy: Just a second. No, it is not used in office.

Professor. Bala Ramadurai: Is it used outdoors?

Professor. Dmitry Kucharavy: Just a second. I need outdoors, in the office, in the office - no. Outdoors - no.

Professor. Bala Ramadurai: No also, wow I have so many things it is not.

Professor. Dmitry Kucharavy: Yes, tht is good, that is good, it means you reduce your search area. Like you remember, like we discussed with the integer number, the answer no, no, no no, but you reduced search area. What can we learn right now from your questions, first of all, it is not connected to internet, it does not emit any light, okay, it does not power any other devices, it is not useful in the office and it is not useful in the outdoor. So, one of the..., interim conclusion - where it is useful? If it is not useful in the office and if it is not useful outdoor, where it is useful?

Professor. Bala Ramadurai: Message to the learner who is watching this video, I have no idea what it is. So, Dmitry did not tell me what it is. Honestly, I am trying to guess this. I have no clue.

Professor. Dmitry Kucharavy: Absolutely, absolutely, absolutely. Just a second Bala, try to sum up. When it is not used in the office and when it is not used outdoor, where it is used?

Professor. Bala Ramadurai: Yes, so is it usable in the home? That is the only place I have remaining.

Professor. Dmitry Kucharavy: Yes. Home, so it is kind of home appliance.

Professor. Bala Ramadurai: Home appliance. Is it used in a kitchen?

Professor. Dmitry Kucharavy: No and yes. It can be but it is not main idea. In kitchen, good.

Professor. Bala Ramadurai: Maybe kitchen, maybe not. Is it, somehow it is a companion to another device? Or it is an add on to some other device? Can it be like that?

Professor. Dmitry Kucharavy: What do you mean? Could you explain a question a bit? What do you mean companion?

Professor. Bala Ramadurai: Add-on meaning that like pen-drive is an add-on to my computer or a USB.

Professor. Dmitry Kucharavy: In this case no. It is not companion of another device.

Professor. Bala Ramadurai: So, is it usable in the living room?

Professor. Dmitry Kucharavy: Another device, no. Is it usable in living room? A living room, definitely not. This is very nice what you are doing, because in fact you try to reduce your search area, you know that it is used in home, good and now, yes which room, which functionality in the room.

Professor. Bala Ramadurai: Not. Which room in the home. Is it left on the bedside stand?

Professor. Dmitry Kucharavy: Could you explain me the question? Probably elaborate.

Professor. Bala Ramadurai: So, you have a bed and right next to it is something that you would normally keep your, whatever phone or stuff that, or a book that your read or your reading glasses.

Professor Dmitry Kucharavy: No. Could you repeat your question? In this case I can take notes.

Professor. Bala Ramadurai: Is it on the night stand?

Professor. Dmitry Kucharavy: No, on the night stand, no.

Professor. Bala Ramadurai: Not on the night stand, is it used in the shower? Or in the bathroom? Bathroom in general.

Professor. Dmitry Kucharav: Is it used in the shower, good. Bathroom. Yes, bathroom - more yes than no.

Professor. Bala Ramadurai: More yes than no, okay. This is mysterious. Kitchen you said more no than yes. And in bathroom it is more yes than no. Is it something to do with water?

Professor. Dmitry Kucharavy: Yes, it is. It is water.

Professor. Bala Ramadurai: Something to do with water.

Professor Dmitry Kucharavy: Yes, now we are, we will see how it works. Good.

Professor. Bala Ramadurai: Getting warm. So, it is something to do with water, yes. Near the bathroom yes. And it is electricity powered. So, do you have to leave it on all the time?

Professor. Dmitry Kucharavy: May I show you once again this stuff? Look, we use it in water and after that we put it into the socket.

Professor. Bala Ramadurai: is it? Yes, sorry.

Professor.. Dmirty Kucharavy: Just a second. Yes, go your question.

Professor.. Bala Ramadurai: Is it capable of heating?

Professor. Dmitry Kucharavy: Heating? Heating, no.

Professor. Bala Ramadurai: No? Okay.

Professor. Dmitry Kucharavy: No heating.

Professor. Bala Ramadurai: Is it capable of purifying? If it has something to do with water, then I am guessing either you heat water or you purify it.

Professor. Dmitry Kucharavy: Okay. For purifying. Good. For purifying - no.

Professor. Bala Ramadurai: No, is it, okay! then it should have been a kitchen thing no, that could not be it.

Professor. Dmitry Kucharavy: What can we do? Look it is necessary, let us make a kind of sum up because our brain is always limited by 5 plus minus 7 entities that we keep in our brain, okay! in a short memory. So, that is why it is necessary to make kind of summary. Do you remember we make a summary after first 5 questions and we found - good, it is at home, where it is used because not in the office, not indoor and not in the internet!

After that, we tried to see where at home we can, in kitchen probably? In living room no, companion on another devices, not in the room where do we sleep. And in bathroom probably and we use it with the water. And when it is used with the water, what we can do with the water? And now, we try to see the functions what we are doing with the water - to heat water, to purify water, this device, this is something that works with water and as it is used, works with water, it can be used in a kitchen and in a bathroom. So, this is a summary. Let us go ahead. What other functions with the water we can do?

Professor. Bala Ramadurai: With water. Clean it, heat it, how about aeration?

Professor. Dmitry Kucharavy: Aeration, no. Not aeration.

Professor. Bala Ramadurai: No also. Not aeration. It is, can you stir water? Can it be mechanical action?

Professor. Dmitry Kucharavy: Yeh, mechanical action to water.

Professor. Bala Ramadurai: It is yes. It is something to mechanical action. Just water, what function would it serve to just interact mechanically with water? You could stir it, but then you could use it in the kitchen. If I were to, I am thinking, I want stir say sugar in my coffee, that is one functionality but then that is more kitchen, bathroom definitely no.

Professor. Dmitry Kucharavy: Yes, let us see what we are doing with water, what we are doing with water? We use water, in your home, you drink water of course, otherwise how do you use water? What are the.?

Professor. Bala Ramadurai: Yes, cleaning.

Professor. Dmitry Kucharavy: Cleaning, yes cleaning.

Professor. Bala Ramadurai: Ohhkay.

Professor. Dmitry Kucharavy: We use this device for cleaning.

Professor. Bala Ramadurai: Wow! Okay. Is that a? How can it? I do not know, I want to see how it works. Cleaning. So, it is a surface cleaner or a floor cleaner.

Professor. Dmitry Kucharavy: Floor cleaner no, surface cleaner yes.

Professor. Bala Ramadurai: Surface cleaner. What surface? Now next, now we found out its functionality; why we need this. I mean what it does. It interacts with the surface through the action of cleaning.

Professor. Dmitry Kucharavy: Absolutely.

Professor. Bala Ramadurai: Something that is inside the device, I do not still know what is there inside the device that does that cleaning.

Professor. Dmitry Kucharavy: Inside of the device, you have nothing because there is no access inside of the device.

Professor Bala Ramadurai: Really, you cannot open it or anything.

Professor. Dmitry Kucharavy: No. You cannot.

Professor. Bala Ramadurai: Can you fix out? No?

Professor Dmitry Kucharavy: Yes, this is a very fixed one.

Professor. Bala Ramadurai: Can you, so, does it emit some kind of a ray or?

Professor. Dmitry Kucharavy: Yes.

Professor. Bala Ramadurai: It does, okay. It emits something. But what does it emit? Ion? No.

Professor. Dmitry Kucharavy: Look, you use it for the cleaning. And it emits something. And it does not.

Professor. Bala Ramadurai: UV light.

Professor. Dmitry Kucharavy: We already discussed about light. It does not emit any light.

Professor. Bala Ramadurai: Yes, does not emit any light, so our possibilities are - one is like a hand-held blender comes out of it, you said no. So, nothing comes out of it.

Professor. Dmitry Kucharavy: It makes mechanical action to the water. Yes, this is what you learnt. The problem when we work with ENV model is to sum up, to synthesize. Because all the answers are correct, okay. But we need to find out which thing will satisfy all the answers.

Professor. Bala Ramadurai: So, it is a surface cleaner with nothing. Does anything come out of it? As in something leaves the surface? Yes, it does?

Professor. Dmitry Kucharavy: Emit, you already did.

Professor. Bala Ramadurai: Yes, it emits something. So, what is it?

Professor. Dmitry Kucharavy: What can be emitted if it is not light? And if this is a mechanical agitation. What can be emitted?

Professor. Bala Ramadurai: Vibrations?

Professor. Dmitry Kucharavy: Yes.

Professor. Bala Ramadurai: Okay.

Professor. Dmirty Kucharavy: So, it need vibration, make mechanical action in water and it clean the surface but not floor. It cleans the surface, what kind of surface you can clean? In kitchen and in a bathroom?

Professor. Bala Ramadurai: glass cleaner!

Professor. Dmitry Kucharavy: It can be glass cleaner; it can be cloth cleaner also. You know this?

Professor. Bala Ramadurai: Clothes cleaner. Really? Is that the device?

Professor. Dmitry Kucharavy: Do you have a name of this one? You already got.

Professor. Bala Ramadurai: I do not have a name for this.

Professor. Dmitry Kucharavy: Yes, yes, yes. What is machine that you used in order to clean your clothes is.

Professor. Bala Ramadurai: Washing machine.

Professor. Dmitry Kucharavy: Yes, this is a washing machine. Absolutely, this is a washing machine. This is ultrasonic washing machine. You put your clothes into the water, you add some detergent, you put this one and it start to emit ultrasonic waves. An ultrasonic cleaner, this was a cleaner, these are the cleaner which are used for cleaning even dishes, it is used in industry to clean things. There are very big machines, but this is a small one which is useful at home.

Professor. Bala Ramadurai: Woww! That is amazing.

Professor. Dmitry Kucharavy: This is a washing machine, absolutely, it is absolutely difficult to imagine that this is washing machine when I first showed this? But you got it, absolutely got it. For us, it is interesting to find how did you got it. Because in fact, you collected, you know let us see how many questions did you ask. You asked about 21 questions and you reduced this search area such a way, but absolutely unknown from the beginning. You found out what is it. Can you share your experience with this exercise?

Professor. Bala Ramadurai: Yes. Initially, I thought it is one of those, I assumed that it is going to be one of those Google or Alexa type of voice activated thing, so that is why my entire set of questions were towards electronic gadgets which are internet based or something to do with that, because that is the first thing that came to my mind. Then I said, this is a 'no' on most of these, the ones that I know of, so now let me, then I am clueless now, now I am completely clueless because I do not know what these are.

So, I said let me at least find out where it is used. If I can zero in on a location, then possibly it could give me some clues as to, once I figure out where, then it is probably a lot easier to do that. Then, when we came down to geography of, I got some more clues that it has something to do with water. At the end of the eleventh or twelfth question, I knew it had something to do with water. Now I said, I know what it interacts with, I wanted to find out - what for? Right, what is the function that it is trying to do, with water there are few things that you can do, let me see.

And of course, I tried the usual ones that you do with water. And I again, my brain was not shifting to, of course, then I remember from our interactions that we can use mechanical, chemical or other fields, so I tried to come up with those and last trial for me was to get into mechanical, which is the field that we apply. And then I got to mechanical. But I still could not make the connection. So, I said now I have to get down to what does it do with the mechanical action because I had still not figured out what the function is.

Once I figured out the function, then you told me it is a surface cleaner. I still could not make sense of it because inside a bathroom, yes you said more yes than no and kitchen you said more no than yes, that was totally not gelling with what I had in mind for that kind of device. Then then emission possibly got me to vibration, because you clearly said no light is emitted. What else could this tiny gadget emit? Then the vibration came up, which is interesting. So, I would never have guessed it in the first even 5 - 6 questions what it possibly was. Interesting, thank you so much for this exercise. This is very nice.

Professor. Dmitry Kucharavy: Yes, thank you very much Bala for sharing your experience. And that is normal. One of the barriers that we face when we try to discover a new that we already have preconceived ideas. Do you remember, at the beginning, while he thought that it is something like Google device to have access to internet and something like that. But, we need to gradually clean up our preconceived ideas but advance by reducing search area and it was very nicely done. Almost, an unimaginable device that Bala has never seen in his life. He found out finally what is it. He found out finally what is it. And let us try to make generalization right now.

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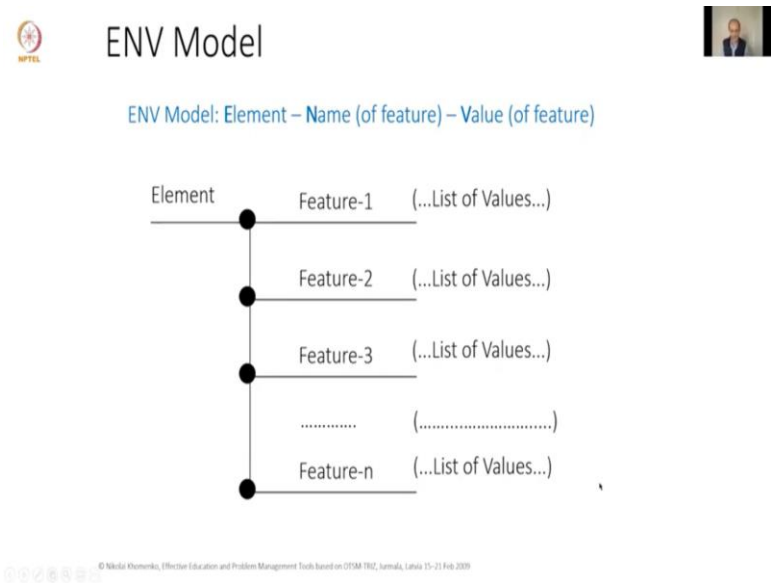

In fact, the ENV model which is stay as acronym for element, name of feature and value of feature. This is a model which is very useful to describe the element through gradually adding feature and list of values of feature. It can clean surface, what kind of surface? What is the softness of surface and so on? It can emit certain field, what is energy that it really needs? And we add these features, it will be sometimes 7 features, sometimes more that we need to reduce our search area but whatever element we take, it can be discovered through description of its features.

So, mode of forecasting in order to answer to the question, 'what' because do remember our technology forecasting has to explicitly ask for three questions, what, when and where. Okay! We can use this model and recollect list of features. This something has to have this feature, that feature and that feature at the end. But how to drive us to discover these features, we will learn next sessions when we will introduce map of contradiction model to you. But at this very moment, it is very important to keep in mind that it is not so difficult to discover what will happen even with very distant future if we will apply this very powerful model that already embedded in your thinking process.

You already use this because whatever language you use in order to learn new words, you describe all of them through their features, okay using your mother tongue or later using the same link which you are learning but the procedure is always the same. The procedure is always

the same. This was a part what I would like to share with you in the model and of course, if you are interested to practice it, we can continue it with our next course, advanced course about technology forecasting. But for the introduction, that is all that we would like to share with you. Thank you.

Professor. Bala Ramadurai: Thank you so much Dmitry, that was fun. If you have more of those gadgets, we can play games all day.