Technology Forecasting for Strategic Decision Making
Professor. Bala Ramadurai
Professor. Dmitry Kucharavy
Lecture 1
Introduction to Tech Forecasting for Strategic Decision Making

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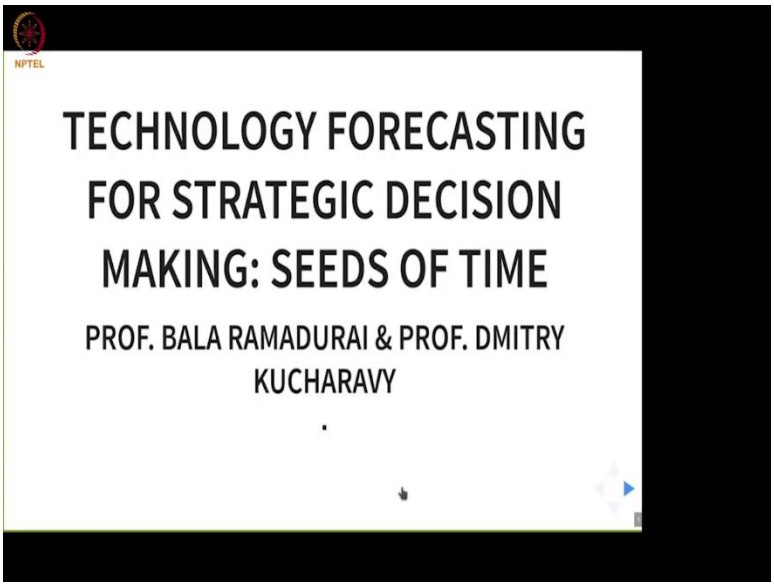

Professor Bala Ramadurai:

Hello, and welcome everybody to this course technology forecasting for strategic decision making. I am Professor Bala Ramadurai and I have with me Professor Dmitry Kucharavy. So, we are very happy to have you on board for this course. We are starting off with the first session, this is going to be the session where we give you an introduction to this course itself, which is called technology forecasting for strategic decision making.

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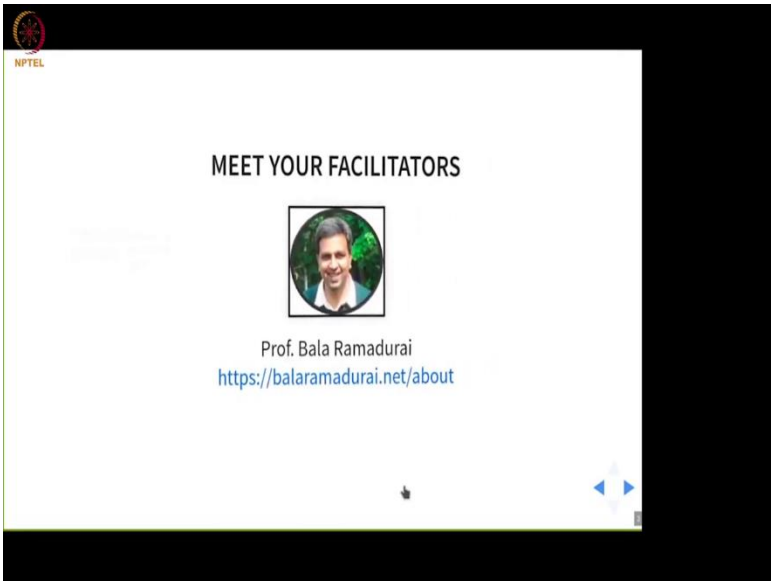

A little bit about myself, I am an innovation consultant and a professor of design thinking entrepreneurship and technology forecasting. I was a Technology Forecasting research fellow, Marie Curie research fellow in Politecnico di Milano, Milan, Italy.

We developed a, I am sorry technology forecasting methodology called FORMAT, and this is a Industry-Academia Project funded by the people Marie Curie Actions, IAPP group, European Union funding body. This is where I met our co-teacher for this course professor Dmitry Kucharavy, we worked together on this project and I have learnt a lot from him through our interactions during the project and after that as well.

One day we were talking about NPTEL and Swayam and he got very intrigued about the platform and the number of users there are in this particular platform and we said we got talking and we said I was describing to him design thinking the course and how teachers, learner students, have adopted this methodology embraced it from various walks of life, various disciplines they have taken it.

But then we thought about what is really ahead, how do we look at something at the road ahead or the course ahead what is going to happen next, so that sort of led us to the question of how do these learners - the people who have gone through say problem solving methodology like design thinking, how can they take current decisions on innovation itself in a business context.

So, that sort of led us to this course itself, how do we make our decisions on current technology, so this is the main question that we asked ourselves, so that led us to the creation of this entire course that you see right in front of yourself, and it definitely gives me great pleasure to introduce today our co-teacher for this course professor Dmitry Kucharavy, I am indeed very, very fortunate and happy to have him for this course on Swayam or NPTEL. So, Dmitry over to you, can you please tell us about yourself or introduce yourself about to our learners.

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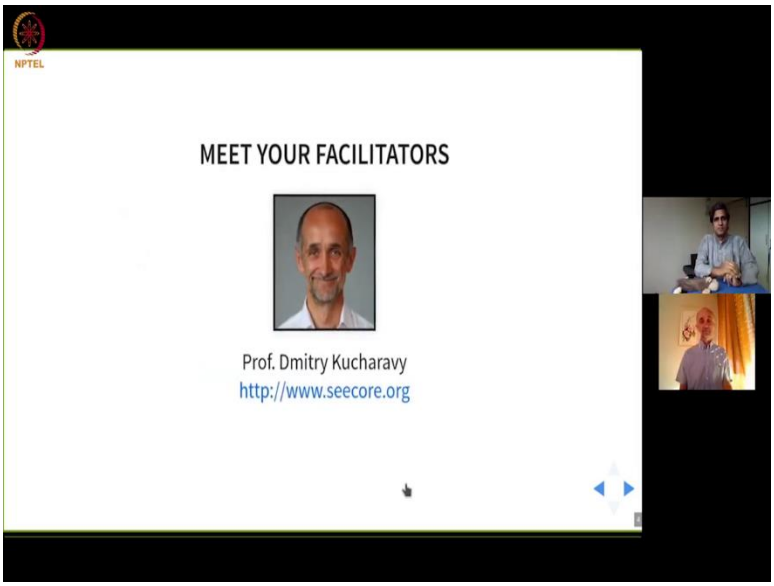

Professor Dmitry Kucharavy: Hello everybody, hello from Strasbourg, France. I am Dmitry Kucharavy, currently I am working at Strasbourg University, particularly now I am a researcher in HUMANIS laboratory at the EM Strasbourg Business School and I am also teaching technology forecasting, knowledge economy and innovation and strategy courses in France and in Italy and my research interest now for the last sixteen years are focused on technology management and in particularly strategic forecasting of technology change and on logistic warehousing design also as a practical application. Well, Bala could you explain a bit about the course.

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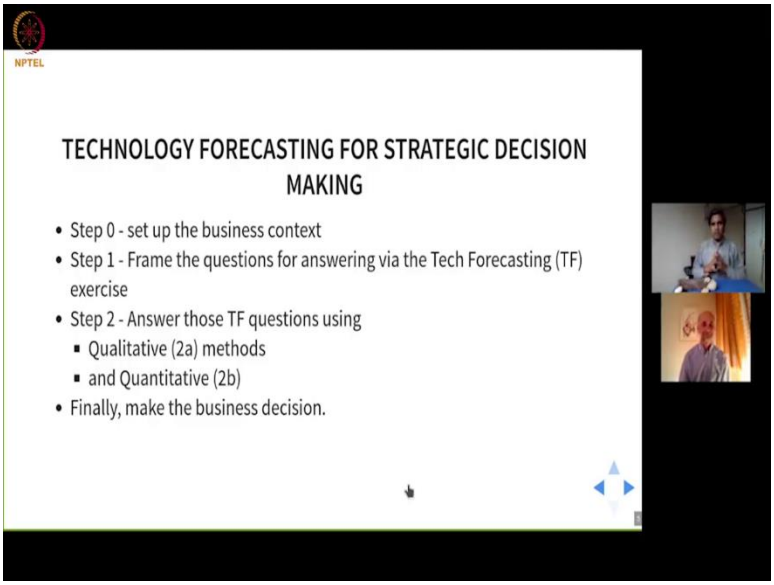

Professor Bala Ramadurai: Sure, so thanks Dmitry for your introduction, I am sure we have a lot to learn from you during the course of this few weeks that we are going to be, you know, presenting this course to our learners. When we thought of delivering such a course to our NPTEL audience we said that we will start by setting up a context in which this technology forecasting actually works.

So, we set it called strategic decision making that is where the broad context in which we operate, so that may sound like a mouthful, however it is the context in which the technology really operates, so in which we have the need to look at what's coming up ahead, the forecast that we need to do. This is the business context that we look at, you know business really needs decisions made today or in some cases worst cases, they will have to do it yesterday. So, it is very urgent that they make decisions in the near term for something that may happen in the future.

So, we as technology managers or business managers may not be certain about what may really happen in the future, so we are taking educated guesses based on our own instinct, our own experience or the voice inside us sort of guides us towards a certain decision. This is a good idea, this definitely you have accumulated experience you accumulated all this wisdom from what has ever happened so far, which is a good idea. But sometimes we ourselves may not be a 100 percent sure, we will not be 100 percent sure at all about what is happening.

So, in this course we sort of think that this method will help in making this decision, make it a bit easier on you the decision maker or on people who are working with such decision makers to help them saying that this is what we have come out with, so we have a sort of stepwise approach a process based approach for this, we will guide you to through these steps of course. The step zero as we call it is setting up the business context in which the decision has to be made, so step zero is setting up the parameter, so to speak of the business context itself.

Then the next step, step 1 as we call it is to frame what is the question to be answered, why are this technology forecasting exercise that you are willing to carry on here. So, we call it TF or for short, TF is technology forecasting. Then once you have made the question clear, we need to answer those questions that is the heart of this technology forecasting methodology itself is to answer these questions using two methods, you can see, one is the qualitative again using your instinct this is where your instinct, your experience, your wisdom comes in you can use your imagination creativity as well, this is all part form, form the part of the qualitative methods.

And lastly, we use quantitative methods where we crunch numbers take numbers data from out there or data from if you are within a company you take those data and we will suggest certain models that can be applied, so that you can make sense of the data look at how things pan out in the future based on data.

Then finally you sum it all up, through the qualitative methods and the quantitative methods and now apply it back to the business decision itself. So, you take start with the business context, make the questions, use the qualitative methods and the quantitative methods, combine it, and now make your business decision. So, this is sort of the broad structure in which we are going to operate.

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Just to help you, I am going to show you a picture before we get into the specifics of what all we are going to discuss in the course, I just want to show you this picture, just take a guess where could this picture taken from? What does this depict? Any guesses? Just guess it! Some of my students take their phone and and take a snapshot of it and search on the internet, you can do that too, it is okay with us, you can you can freeze the video take a picture of it and look up on the internet.

Yes, some of you may have figured it out for yourselves, this is a scene from a play called Macbeth, written by William Shakespeare. This is a particular painting, now it is in Musée d'Orsay in France, a museum not so far from where you live Professor Dmitry, so well three-hour high-speed train ride away. This is from Macbeth act 1 scene 3.

Professor Dmitry Kucharavy: One hour 45 minutes.

Professor Bala Ramadurai: Hour 45 minutes. Ok, I stand corrected.

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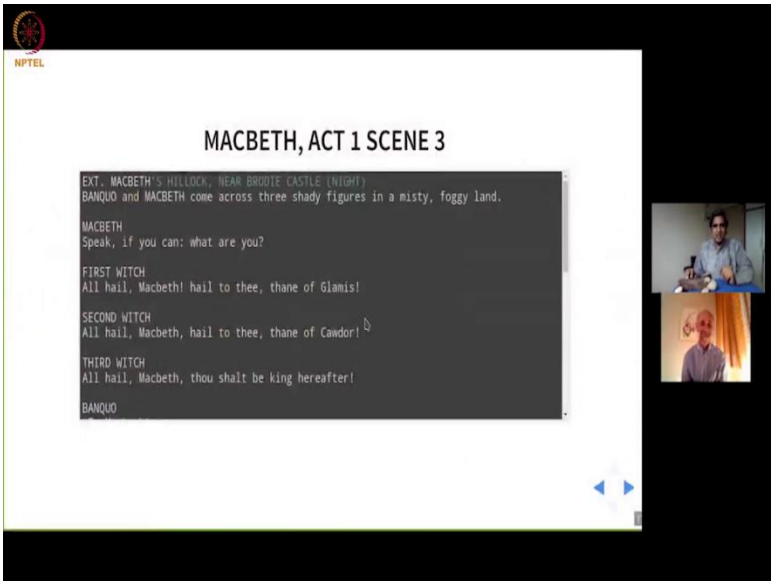

So, this particular scene is very interesting and I really like it, I will just read it out for you, this is a set of dialogues from there, in this scene what you saw were five characters on your left were Banquo and Macbeth, they come across three shady figures in a misty foggy land. Macbeth says, speak if you can, what are you? And the first witch, she is a witch says, all hail Macbeth, hail to thee, Thane of Glamis! The second witch says, all hail Macbeth, hail to thee, Thane of Cawdor! Third witch says, all hail Macbeth, thou shalt be king hereafter.

So, Banquo his friend and colleague to Macbeth says, good sir why do you start and seem to fear, things that do sound so fair. Banquo says to the witches, the name of truth are ye fantastical or that indeed which outwardly ye show? my noble partner you greet with present grace and great prediction of noble having and of royal hope, that he seems wrapped with all, to me you speak not, if you can look into the seeds of time and say which grain will grow and which will not. Speak then to me who neither beg nor fear your favors nor your hate. For this, first witch says, hail! second witch, says hail! and third witch says, hail!

I really like this particular dialogue, this is what caught my attention, if you can look into the seeds of time and say which grain will grow and which will not, so this is for me the essence of the course itself. Dmitry! can you hear me, hello!

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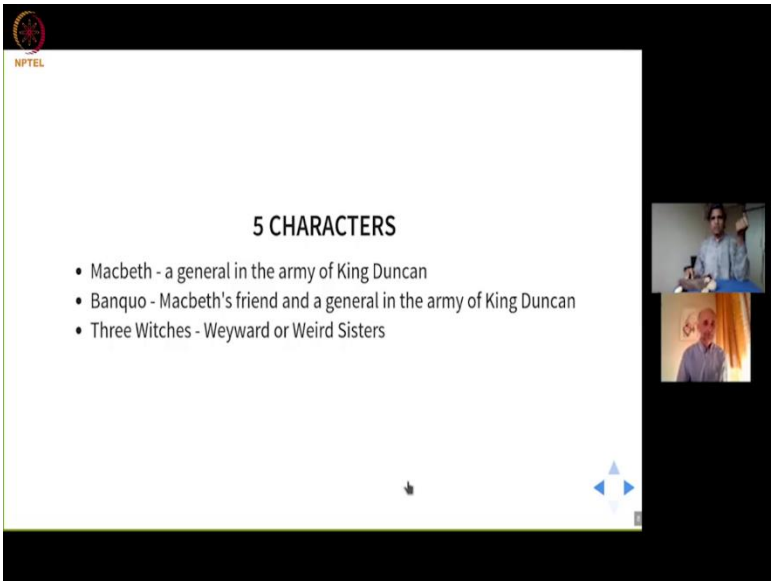

Professor Dmitry Kucharavy: Yeah, with difficulties, you appear and disappear.

Professor Bala Ramadurai: Yes, my internet.

Professor Dmitry Kucharavy: You record it, record it on your side continue, but I the quality of connection is not so good.

Professor Bala Ramadurai: Yes, I hope the audio is also recorded here, okay! I will

Professor Dmitry Kucharavy: you continue your part.

Professor Bala Ramadurai: Okay.

Professor Dmitry Kucharavy: you can continue your part, and after that we can discuss

Professor Bala Ramadurai: Okay, sure thank you. So, there are five characters that you saw in this scene, Macbeth is a general in the army of King Duncan of Scotland. Banquo his friend and is a general in the army also. The three witches that you saw are Shakespeare refers to them as Weyward or Weird sisters, so these are the five characters.

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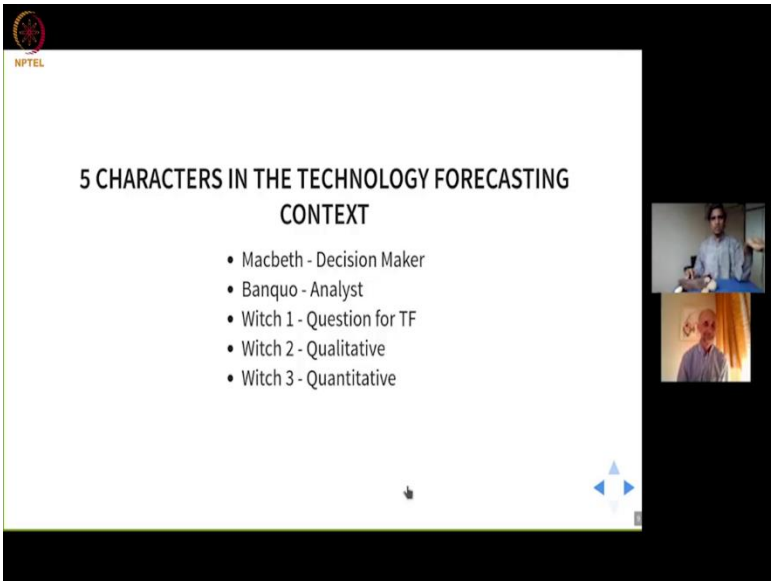

Now before you wonder what's this got to do with the technology forecasting, I will spell it out for you. In our context really the Macbeth is the decision maker, Banquo is the analyst, we were making a sort of parallel. The first witch is the question that we asked for technology forecasting that you saw me highlight a few minutes ago. Witch 2 could be a representative of the qualitative for methods that we use and witch 3 is the quantitative method that we use in the, in the course also.

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So, to keep it in your memory, in case you forget everything else, this picture if it remains in your memory saying I saw this and now I know this is related to technology forecasting remember that you are the analyst trying to help the decision maker, those are Macbeth and Banquo and the 3 witches form the question, quantitative methods and the qualitative methods. So, this will serve as a hook for yourself to keep in your head, what are the steps or we have covered in our course. So, that is why we covered this.

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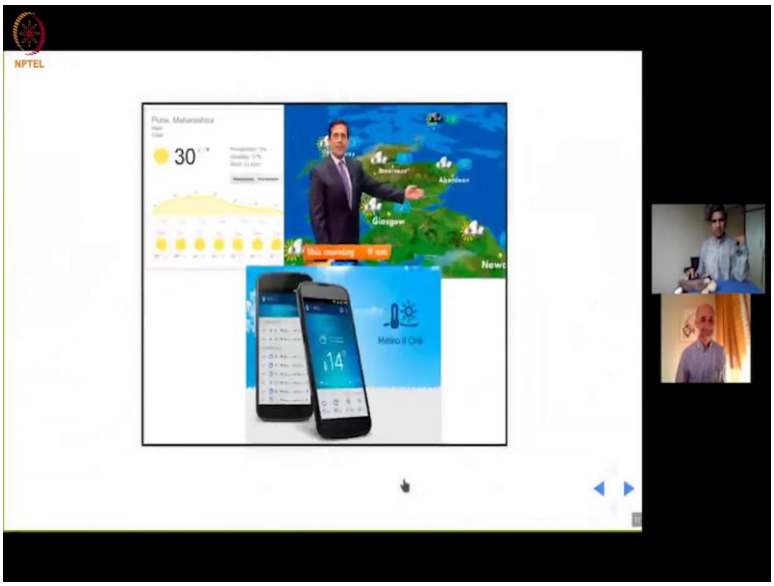

And, one practical example I would like to give, if you have weather like what we have today, morning it is raining, now it is a bit bright outside maybe it gets sunny a bit, so my basic problem is I have to venture out tomorrow. So, I have to venture out in in a weather like this I do not know for sure, so that to me is the business context in which I operate.

So, now the context is clear, now my decision that I have to take is whether should I carry the umbrella or not, so that for me is the step zero, where we have set the context and I have asked the question, should I carry the umbrella or not form step 1. Step 2 is qualitative - around this time of the year in my place, I know that it rains unannounced, have the probability of getting rain is definitely very high I know this from experience, I have lived in this city for about six years now, I know that in the time that we are in right now it definitely rains. So that is my instinct, intuition whatever you want to call it my experience, I have used it now.

And the third part of it is quantitative, I check whether people have crunched numbers to tell me that, wow! there is a 70 percent chance that it is going to rain and guess what! I am going to take the umbrella, for when I am venturing out tomorrow.

So, that is my practical example that one can relate to covering the steps. So, Dmitry, so this was a very frivolous sort of light example, now to up the seriousness a bit I have one question for you and you have worked in this context a lot and you have gained a lot of experiences. It would be

great if you can hear it from you, the types of strategic decision making, what is a strategic decision? What are the types of these contexts that we talk about? So that will be great to hear from you Dmitry.

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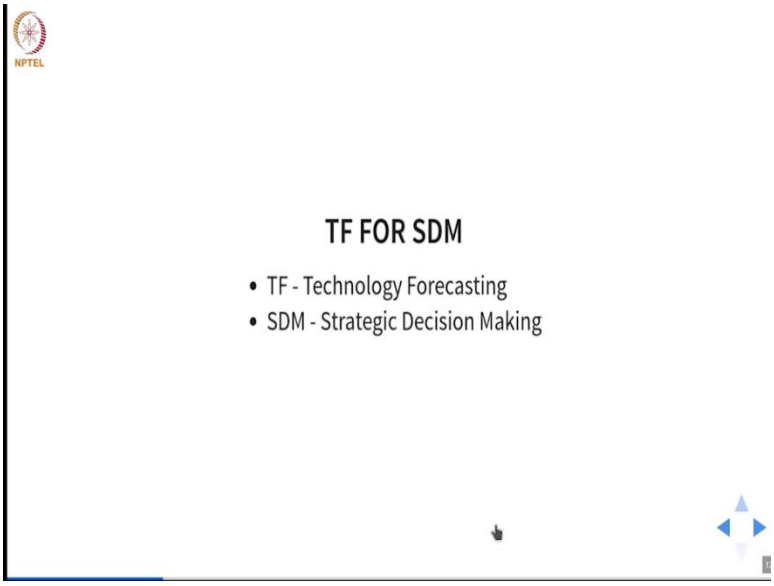

Professor Dmitry Kucharavy: Thank you, thank you Bala for giving me stage and I would like to try to sum up out of these stories and cover this introduction, some kind of useful rules that we are going to use in our course. First of all, when we are talking about strategic decision making and strategic forecasting, we have to make clear, what is a strategy? and if you look to the strategy through the dictionary, we can find something like that - Strategy is the general plan or self-plan intended to achieve something especially in a period.

But in our course based on our experience we are going to suggest you a more specific definition, and please refer to this definition in all our next exercises. We will define a strategy as a management plan for strengthening the performance and competitive advantages in context of technological forecasting for strategic decision making, we are interested to reinforce our plans such a way that when we will perform what was planned, you will be beneficial for companies, you will increase competitive advantages of technology.

So, this is about strategy, an example about the weather forecast, in fact you choose which strategy you are going to apply, to take umbrella or not to take umbrella, was example about may be do square the question also in order to make the choice. So, the second definition that we need to

make here, this is a definition of what is decision, because we are talking about strategic decisions and once again if you look at the dictionary the decision - It is situation when you make a choice what should be done or which is the best of whether it is a possible action or what should not be done.

The same way I might suggest your attention the working definition that we are going to use in our course and it is bit shorter and simpler, for our decision this is a choice, this is a choice between two or more options and when we forecast, we need to make clear those options, we need to reduce uncertainties and to transform uncertainties to the risk, the definition of uncertainties increased we will discuss later on. But for now, it is clear it is interesting to sum up that for us decision this is a choice between two or more options. In order to make this choice, we have to forecast.

But what is the difference between a strategic and other kind of decision? In order to understand this difference, let us just see three different decisions that we usually take which is based on taxonomy presented in academic papers. We can distinguish strategic, tactical and operational levels of decision. What are the different areas of this issue? When we are talking about operational decision the area, this is how to use resources in production process for instance, to take umbrella or not to take umbrella this is operational decision, when you look to the weather part.

When tactical decision, the area of decision, this is a more management of resources, how we are going to arrange resources, what are the functional specifications and what kind of automation we are going to use in this process or another process? How we are going to arrange human resources? How we are going to organize process? And the different kind of regulations all of them those are the areas of tactical decisions. What is the area of strategic decision?

The strategic decision usually, this is the area when we plan for the changes and when we plan for the reason, when we define the objectives of design or when we define the objective of the process. When we try to justify economically our decision, those are the strategic area. If you just compare the different effect or impact of decision in fact everything is starting from strategic decision because a tactical decision which are stored in the short term in scope of decided strategy they depend on their strategic decision, when operational decision can be considered independently but of course they depend on the taking strategic and tactical decisions.

The level of decision maker who are doing those decisions, for instance if you are talking about operational decision, normally this is a head of service rational method. The functional direction and middle management usually responsible for the tactical decision and the strategic decisions usually are done by top management and senior management which are responsible for competitiveness of all companies of long, long-range changes.

If we take one more parameter to compare these three different decisions, usually the frequency of operational decision they are frequent compared to, we know for instance that we need to check weather forecast in order to take decision about to take umbrella or not to take an umbrella, we know what kind of situation we will face in the coming future.

Technical decisions they are less frequent than operational one and they are less predictable because we need to provide resources management, we need to provide human resource decision, where the strategic decision usually they are unique, means we do not take strategic decisions every month or every six months, strategic decision they are taking for certain period because the big changes they need certain time to be accomplished.

Let me give you some examples in order to finish this distinction and in order to understand more what is the difference of strategic receiving from others. For instance, if you need to decide how to restock inventory or how to determine special offer usually your decision is based on your choice is based on the demand forecast on the operational point.

When you design a marketing plan or when you develop a department departure, this is a tactical decision how you are going to allocate available resources and this is a tactical level in which place you need to put more and in which place you need less, usually they are based on the forecast and which can be classified as a tactical forecast like a signal change in supply chain, if at all you got supply chain.

This is a tactical decision on how to prepare for a certain situation like changes of the market or changes of the external situation. When we decide to entry or not to entry to the market or when we decide to exit from certain markets and new business for instance a company who produced the cars, they decided to start produce heavy trucks or the company who created heavy trucks decided to start producing of another kind of equipment which has nothing but heavy trucks. This is strategic introduction of new manufacturing process, for instance we produced our products

raised in the steel as a material and we decided to introduce new manufacturing process and completely replace the steel as a basic material by certain plastic materials.

Those are examples of strategies, but to support of those strategic decisions those strategic choice, which have very high impact or competitiveness of the company and on the competitiveness of what they recover for investors, we need to be capable to forecast the future changes because if our decision will be in accordance with future changes, we think if our decisions will be not in accordance with what is going to happen, usually we can find ourselves in very difficult situations and secondary sources, lot of resources in order to prepare and we are not in a lot of changes so we lose our competitiveness and we can lose our market and energy.

This was my trial you know, it means you have the difference, we our course mostly focused on how to support strategic business. There are plenty of different methods and techniques to support tactical and operational levels which are really powerful efficient and effective, this is not a subject of our course. Our course mostly about this level of decision. Bala.

Professor Bala Ramadurai: Yes, thank you so much Dmitry that was enlightening for me and I knew a few bits of this from our discussion, but very nice, thank you so much.

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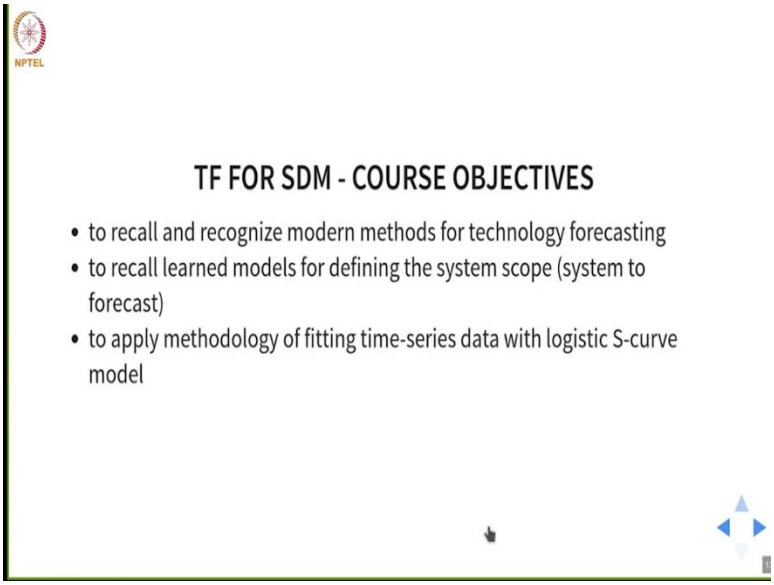

So, I think some it is time to give us give our learners a glimpse of what the, what the course will look like, in terms of the objectives that we have set out to attain in this particular course, this is a

very unique course in one sense that we have taken the technology and we are trying to forecast it but also within the business context itself.

So, for that we need to, the course objective that we have set for learners is they should be able to recall and recognize the modern methods that are required for technology forecasting. So, it could be many methods that we described during this course they are able to recognize or even recall a few that they could use and can tell that from that, during the course they experience the course, that is one of the objectives that we want to achieve.

Then if they are able to recall the same models that they have learned on in particularly defining the system scope that is another objective attained as well in this. So, in this there are terms like system to be forecast because we are focusing on a particular technology, we call it a system to be forecast, so we take that and see what is happening with this, we want to examine that and see how it all works and how do you project it forward. So that is the system to be forecast and we need to know the scope in which it is there. This is not the system; this is the system.

So, that is kind of a thing that we would do it and lastly, I think for me personally this is a very exciting methodology is to fit time series data with the logistic S-curve model, why is it exciting for me because this is reflects nature in several ways this model is and with our long discussions and from the past I know how useful it is to for looking at systems like this in a time series given a time series data, how can I look at it. So, to me this is the most exciting part. We will cover many examples and cases as to illustrate all these to make sure that these objectives are met during the course itself.

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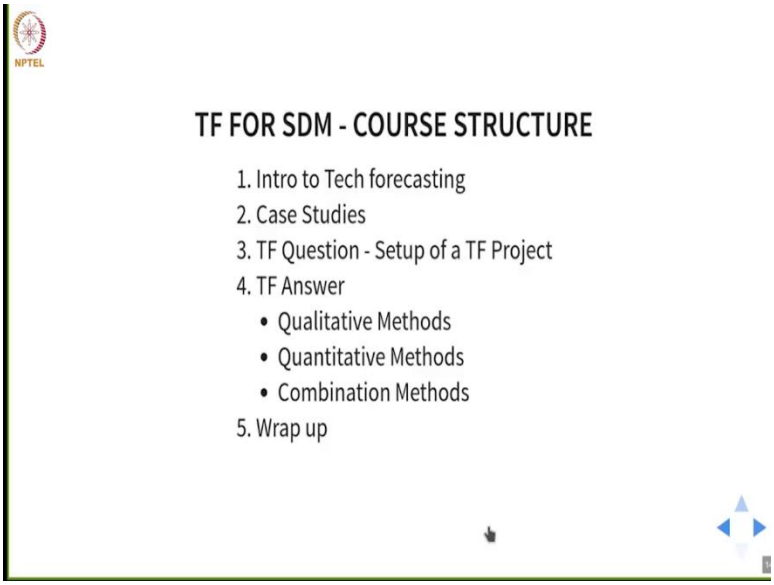

So, as I hinted in the in the start of this introduction and we will further elaborate this, this particular session and this module will cover, what is introduction itself to the technology forecasting methodology, what does it look like. So, this is sort of overview of all the terms that are involved in case you have never heard of this, you should not get scared of this, so we are we are introducing it to you to the basics of technology forecasting, the different terms involved, what do they mean? How do you define them? All this sort of takes place in this particular module.

The second part of this case study is Dmitry and I both of us believe that experiential learning is the best way to learn is one of the best ways to learn any new methodology that you can lay your hands on, and so the second-best way is to look at what other people have done in companies in various other contexts, so we will be presenting some of this which you can relate to.

So, case studies is what you will see as the second part and of course I talked about the question that has to be raised the technology forecasting question, what is the correct way to set up this project? How do you frame the questions? How do we go forward with this? How do you even define the system itself? Like I talked about the system to be forecast what is the boundary in which the system resides, how do you define it? All that goes into this particular question, what all formulates a good question to be framed? How do we frame it? Why now with what are the components that have to be there in to form a question?

And of course, once you frame the question you need the answer, how do we get the answer is to these three methods which are qualitative methods, quantitative methods and a combinatorial combination method as well. So, in short this is all we put together and then finally it should be applied back into a decision we sort of will wrap it up with how do we put all of this together.

So, this forms the basic parts of the course itself it follows the exact method, the steps of the methodology like a process itself we wanted the course structure also to reflect the methodology structure, so that we go through it in a logical manner. So, that is our reasoning rationale behind this design of the course itself.

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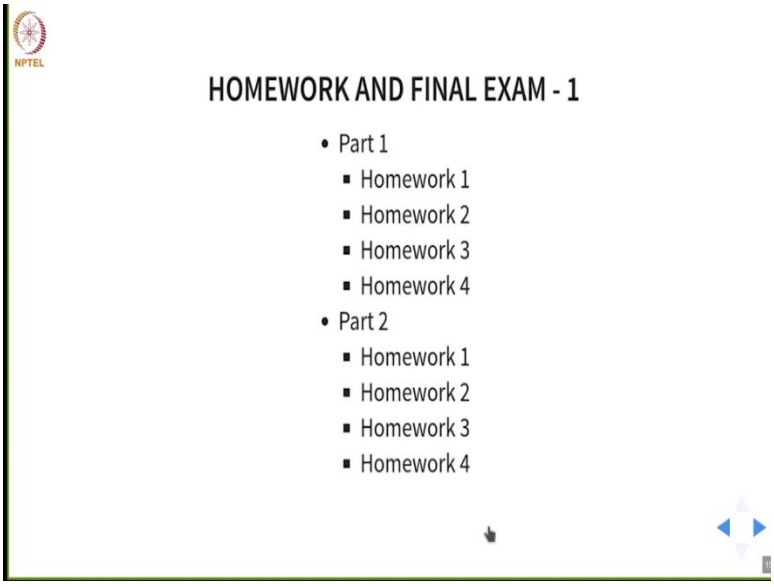

In this particular course, I think the slight distinction or departure from the other NPTEL courses and we have framed it such a way that the retention addressing our course objectives is maximum and it, like I said this has to be very experiential, ideally, we would like you to actually apply this on a technology forecasting project and take your learning from there on a real project to take your learning from their work in a team.

This is how Dmitry has been conducting his classes, I love such a method also I have been conducting my classes also in such a way. So, but this is a massive open online course, so the next best thing is to make sure that the retention is high, so this is the, you know its going to be home works and a final exam.

So, that is going to be the broad two structures, so in part 1, which is the first part that you saw in the introduction and the case studies you will have at the end of every session we will give you a homework. We hope that you will be able to answer each of these and help you retain some of the, some of those stuff that you have learned in the course, and then this is really beneficial in that. So, you will have four of these for every part that we cover.

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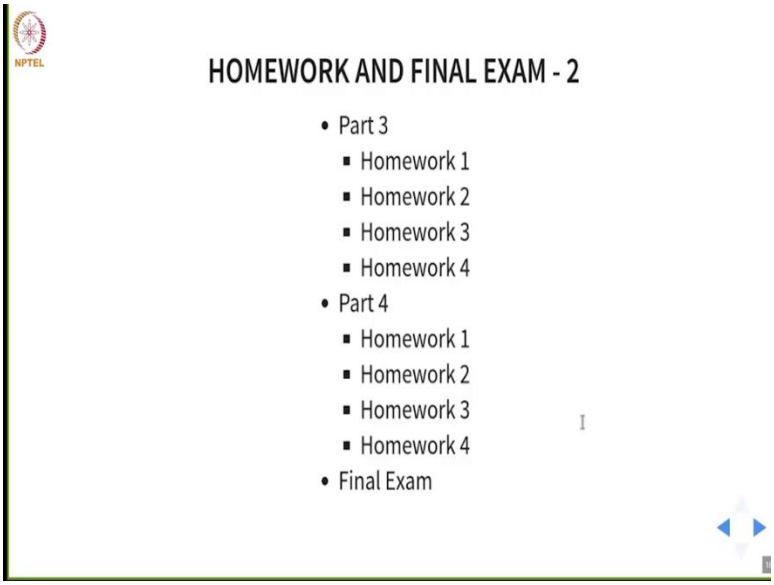

And then part 3 and part 4, so if the structure repeats and of course the final exam which is going to be, so what in other NPTEL courses would be assignments is now split into four homework and all of that put together is the assignment for you and of course the final exam is not going to be very different from the other NPTEL classes, if you have taken other NPTEL courses that is, you will have a final exam. Now the big question Dmitry is what about the finals, so is it how are we planning to have that in part of this course, Dmitry?

Professor Dmitry Kucharavy: You are talking about the final exam?

Professor Bala Ramadurai: Yes, final exam this is something that the learners are really looking forward to how is it going to, what all is it going to comprise up and how it is?

Professor Dmitry Kucharavy: the final exam through the specificity of organizing this course we are going to organize the defining exam based on the post content. In fact, you will be asked for

questions and considerations which you need to recognize how they can be answered with the content of the course.

Professor Bala Ramadurai: Okay

Professor Dmitry Kucharavy: In order to pass the final exam, you need to just regularly perform your homework, if you perform them regularly, I do not see any difficulties to pass the final for you because it will be mostly based on what you are going to see, what are you going to participate and what you are going to learn during those four parts.

Professor Bala Ramadurai: Fair enough, and we will have a proctored exam as I understand like with the other courses the 75 percent of it will be a classroom based proctored exam, the assignments of course the home works will of course be online, will be multiple choice questions. Dmitry we are thinking of also giving them some kind of application-oriented questions as well, so that they can apply what they have learned is am I, is my understanding correct?

Professor Dmitry Kucharavy: yeah, yeah, if you see examples of forecasting using this method which will be suggested by us or it will be given reported, how potential student can perform with what they can learn from the course and we are going to share these experiences.

Professor Bala Ramadurai: Excellent. I am so excited to be part of this course, hopefully learners will, our learners in this course and make maximum use of it, will actually take up a problem and apply it anything that something is not clear in this course we will be more than happy to answer them in the discussion forums, where we well be looking at and looking forward to your questions your observations you want to go and apply and need some help with that we can definitely help you with all that in the discussion forums itself.

So, Dmitry and I will look at it and will respond to it, will definitely make sure of that. So, I am so happy to co-teach this course with you Dmitry and hopefully it will be useful to be learners as well

Professor Dmitry Kucharavy: Yeah thank you very much, thank you Bala for this opportunity and thank you NPTEL for organizing the course and let us do well.

Professor Bala Ramadurai: See you in the next module then. Thank you, see you, bye!