Technology Forecasting for Strategic Decision Making - An Introduction
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Alternatives to Forecasting in Scope of Technology Management

So, welcome back to our course Technology Forecasting for Strategic Decision Making. And now we are going to look together, why it is difficult to forecast and why usually, when we are forecasting, it is not easy to perform!

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For this, lets us see, let us use some slides, and lets us understand this question from a different point of view. The first part, I would like to discuss why it is difficult to forecasting from point of view of Planning and Decision Making.

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If you just look from the point of view of technology management, we need to provide understanding the value of technology in the company, but we have to do so in dynamics. It means the value of certain technology is changing within a time, it is not something constant. So, from technology management point of view, we have to understand how value is changing.

From another point of view, in order for decision for, for decision point of view, we have to be capable to make decision very precise decision when to invest in certain technology and when to withdraw. This is a real need from company operation within a time. The problem appear when companies with a short life cycle, they believe strongly that the value of the technology is not changing in them all the time.

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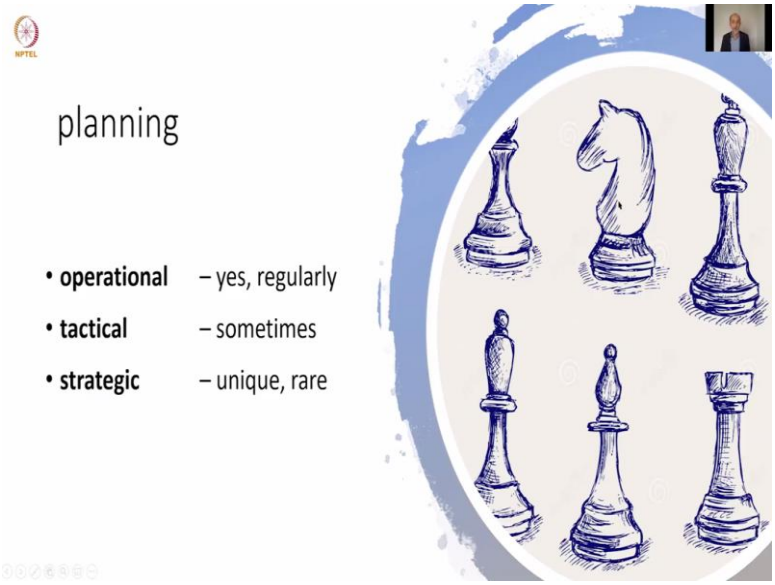

So, if you look from point of view of planning, from operational plan, operational planning is practiced regularly at the companies. Every day company, any company they have operational plan, what they are going to do today, what are they going to do tomorrow, how they are going to operate. So, operational planning usually performed and triggered. When tactical planning, tactical planning is performed not as regular as operational from time to time in different companies in different companies' different way.

Because most of the time, the companies when they operate properly, they do not need to change the tactic. They use the same suppliers. They do not change suppliers; they do not change their policies with their customers. And so that is why the tactical planning is not updated so often. When the strategic planning which is unique and really rare, you can recall our discussion about the differences between operational tactical and strategic planning.

Often, as soon as it is rare, it is just forgotten. It is just forgotten that we need from time to time we need to review our strategy, we need to check once again is it really strategy that is relevant for today's situation. If the value of technology within a time of operation of the company has been changed, or slightly modified, we need to align it always with a strategy. In practice, it happens that companies pay a lot of attention for operational planning and no attention at all for the strategic planning.

And we can see if you just recall the metaphor of chess game, we can see that within a chess game we have different figures and they are responsible for different things. Some of them are responsible for strategic, some of them they are responsible for the tactic, and some of them are responsible for the operation.

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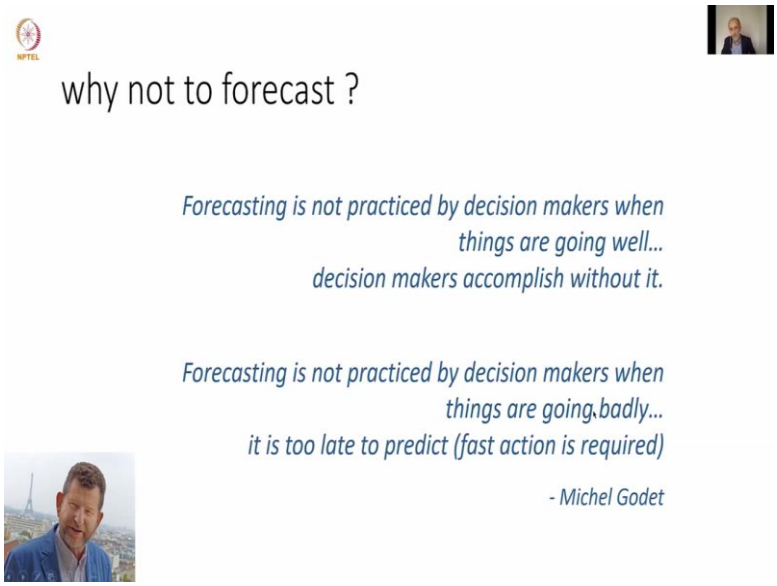

Why not to forecast? Why company often forget about aligning their strategy with their Forecasting. When we discussed with you about scope of forecast, we already discussed the forecast and planning, they are tightly connected, because when we make planning, we have to always to forecast what is going to do and align our planning with the forecasting, not only on the operational level on the operational level most of the company's performing that, but not on the strategic level.

And if we looked to the practice of people who spent a lot of years with a forecasting, and a lot of years with the consulting of the companies and policymakers in different institution, we can look through their experience that the forecasting is not practiced by decision makers, when things are going well. So, decision makers, they just do not care about forecasting. The decision makers accomplish without it. So, they, they do not need to change the strategy. So, they don't, they don't care about forecasting, unfortunately, they do not care about forecasting become a habit.

From another point of view, forecasting is not practiced by decision makers, when things are going badly, when company in a crisis, it is too late to predict, fast action is required. These days, we are all experiencing some senator crisis with a caveat, which lead to economic crisis worldwide. And this is exactly, exactly the situation after the first wave a lot of people, a lot of countries were so relaxed that today when the second wave appear, we once again in the situation that we need to act very quickly.

I took these quotes from one of the famous French person Michel Godet who made a lot of contribution in a foresight practice. And he, he is a consultant for policymakers and for big companies, about their strategic planning and about the strategic decision. This is something that happen regularly in a practice, the forecasting not practiced when everything is going well. And forecasting not practiced when it is too late for the customer. So, that is why if you looked at the alternatives to forecast, what happens really?

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We can see that companies very often, they just simply do not care about long term changes, they try to be as efficient as possible. Today, they take care about increasing efficiency of the company, when they do not care about the goal in the future to reach when we when we discussed already about effectiveness. What are the alternatives to forecasting that we can observe in real life?

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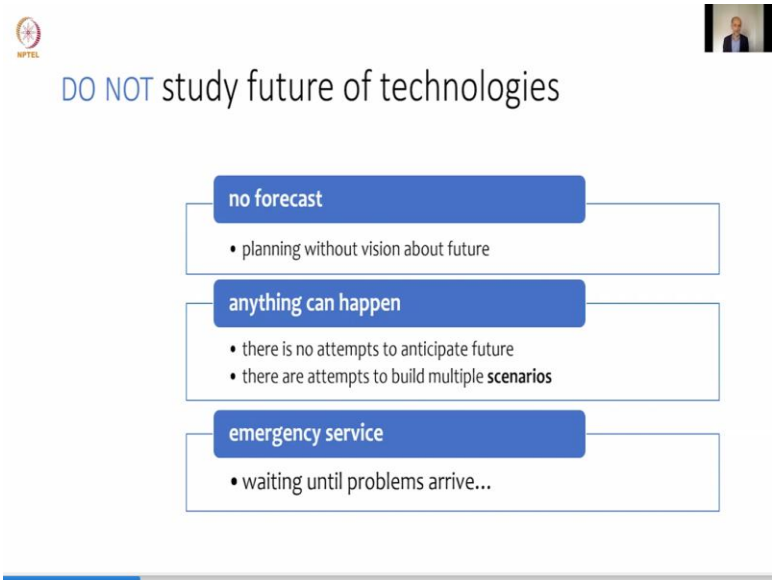

When company do not study future of technologies, they do not study future of changes. First, alternative no forecast at all, the company is just made planning without any kind of vision about future. So, but the planning without vision about future does not work well in a time of changes. It works pretty well in a time when everything is evolving without changes, but we will learn within this course Logistic S-curve and we will learn that whatever we are talking about everything is changing within a time and we arrive to the point of pivotal changes.

Planning without vision about future has very limited application. So, that is why if planning performed like that companies and organizations arrive regularly to the what they name crisis, the crisis it is just time of changes. Another way to deal with future that decision makers are company they say, but anything can happen. Why do we need to forecast so this way they do not spend time they do not spend resources, they do not even make attempt to anticipate future! Because there is a strong belief that it is not possible at all.

Or another attempt is to secure future to manage risk, to medicate risk, the attempt to build multiple scenarios. The most positive and the most negative scenarios and after that the company, they try to be prepared for both. And this is not forecasting. Also, this is also very expensive for the companies from point of view, it is like do not care about weather forecast, and bring everyday with your umbrella, and in the same time, the sunglasses.

Another way to deal with the changes, without forecasting, this is an emergency service. And this is a real strategy that we can observe also, from practice, the company is just waiting until problem arrive. And when problems arise, they try to secure it as fast as possible. So, that is why there are a lot of companies that are looking for the skills of people in inventive problem solving, in creativity, because they need creative people. Why?

Because to manage merchants, to manage emergency situation, when everything starts to go not as it was before we, we asked for creative people, instead of predicting changes, and well prepare with these creative people, the future changes. Waiting, waiting until problem arrive does not work always, unfortunately, because when we have really dramatic changes, we in most of the cases, we are just not in a power to manage them.

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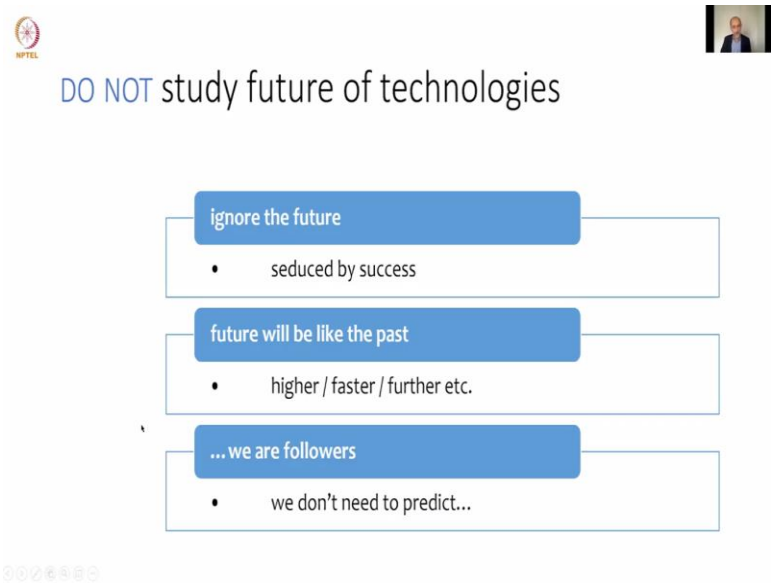

Another alternative to forecasting, when the companies do not study future of technologies, they just ignore the future. We can observe that a lot of companies who became great early leaders of the market, they often just ignore the future, they are just playing the game, which is named seduced by success. They said, ok! the future depends on up why we need to forecast it, it is we who are going to define the future.

But if you look to the history of even very big companies in the past, we can see that even the companies with worldwide market share more than more than 50 percent, they collapsed. And they collapsed just due to this seduced by success. Because whatever is growing at a certain time,

is going to change the speed of growth. And later on, is starting to decline. So, that is why the strategies seduced by success is not something that in the long term can give you the right strategy.

Another strategy, when people say why do we need to forecast we, we are going to, to do the same like we did in the past, because the future will be like the past just bigger and faster, or faster further. This also does not work in the long term. Because if you look for from this perspective, that imagine somebody is working in a computer industry in, in the end of 90s. So, let us make our computers just faster, faster and faster.

But in fact, today, what we what we can have in our hand, and probably you use this device to access to this course, you do not use computer anymore, you use a Smartphone, which is not something that was in the past. This is a new quality. So, that is why this strategy that the future will be like the past does not work. Well, in the long term. It works pretty nice in the short term for operational decision sometimes it works for tactical decision. But for this strategic decision, it cannot be applied just due to the fact that the technologies are going to change all the time. And they are they are changing all the time. The question is, do we see these changes or not?

Another strategy that companies say, ok! we are not interested about forecast, just because we are followers, we are going to do what others do, we do not need to predict, we will just copy and we will make it cheaper, probably we will improve the quality, we will see, but we will make it cheaper. We are just followers, why do we need to forecast?

And this strategy does not work also, and the company who are following these, those strategies, they collapse, and it was very, very well introduced in the famous book ‘Red and Blue Ocean’, how company interact on the market. Because if you look from the point of view of system dynamic, whatever company is competing just by prices, this is a direct way to collapse the company. Competing just by the prices, just by doing what others do already. This is a very short-term reason; this is a very short-term strategy for running the company.

We need to be capable to see the future changes and to adapt to these future changes through regular innovation, through regular changes, adapting of our technologies, transforming our technologies for those future changes. Otherwise, our company will be short leaving, and why a lot of companies even they are short leaving, they are so popular. Just because the human

memory, we, we do not we do not remember the companies from the past who existed long term. And they even defined some direction of technological evolution. And those time, we do not remember them. Who remember today? The company like Dec, which produced mini computers, and was one of the worldwide leaders.

Today some somebody can remember AT&T, and but it is still this company and the or some companies already collapse their business, they paid a lot and they restart the business and they try to restart the growing process in different domain like company Nokia who failed completely with their business of Smartphone just by 6 years by success. So, this is a one part of alternative from point of view of predicting technology.

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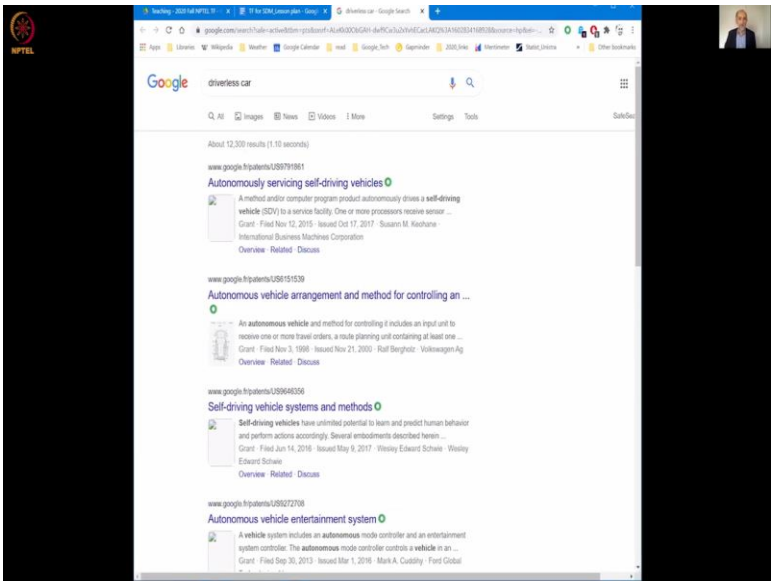

There are other alternatives which are complimentary study of future it means the companies, they a study of future but not only with the help of forecasting, what companies or organizations or institutions are practicing. The very popular today, especially in an era of internet, this is a technology monitoring, like analyzing relevant information in data using Patent Analysis. The Patent Analysis today you can feed the data from, for instance, Google patent or other open, open sources, open databases about patents. And you can monitor or monitor this. I would like just to show you the screen how it looks like if you look to the to the screen of the browser About driverless cars. For instance, if we Google patent, I am asking about driverless cars, I will receive 12,300 results.

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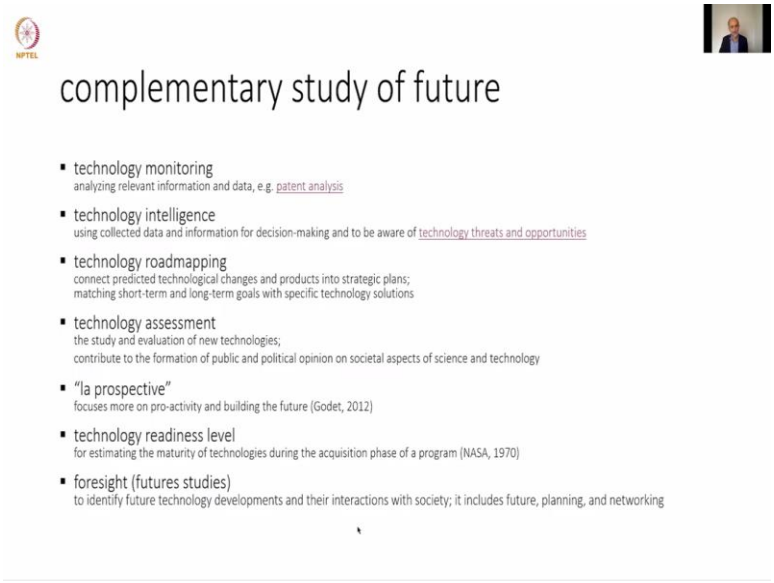

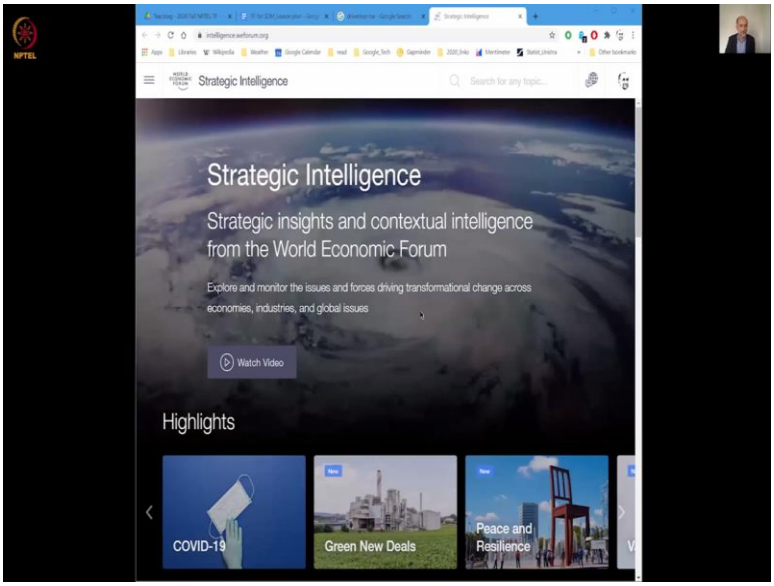

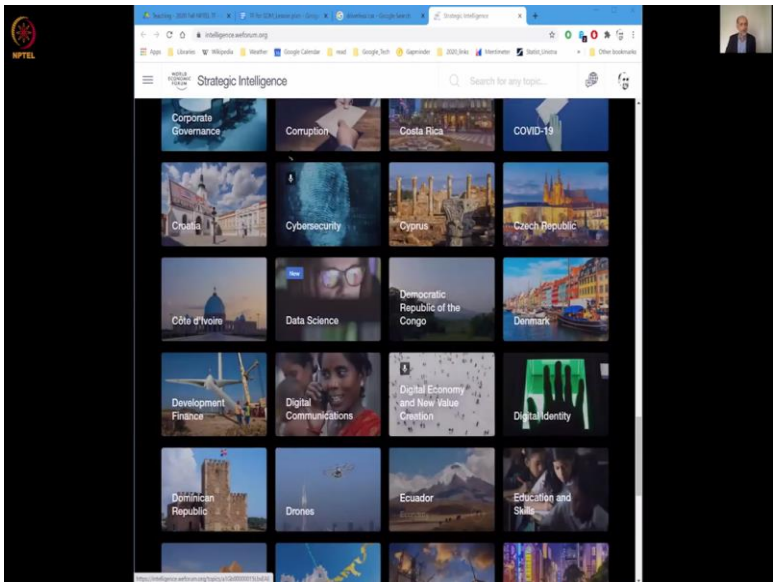

We can also see how those results changed within a time and other things. But the question is, when we make this monitoring, we are not forecasting really, we just try to get information what is going now. Another way of study about future is named Technology Intelligence. When we use collected data, not only about patents, different kinds of data, we use collected data and information for decision making and to be aware of technology threats, and opportunities.

If I just give you some examples about this let me share another screen. I would like just to provide you the example of the website where you can find information about Strategic Intelligence. For instance, the World Economic Forum provide on their website, the strategic intelligence articles about different subjects, not only about continents, but about different kinds of activities like Education, about Climate change and other things. And Drones, different technologies.

But when we run the strategic intelligence, once again, it is not technology forecasting, technology intelligence, we collect data, and we try to apply them for decision making. Because we believe that what we had in the past will continue, we just try to understand what is going now better and faster. Another activity, about starting of future this is a technology Roadmapping, the technology Roadmapping this is a very interesting activity, when we try to connect predicted technological changes, and what we are going to introduce into our product. And we try to shape it as a strategic plan.

In other words, we try to match short term and long-term goals with a specific technology solution, known technology solution. The technology road-mapping can be successfully applied and we have some good records from the past for the strategic planning and strategic decision. In fact, the technology roadmap provides us really kind of vision about our strategies within a time. But unfortunately, the technology road-mapping without reliable technology forecasting cannot be fitted by proper data and proper connection. When we try to connect, we need to connect also with the changes that has to be predicted.

Another activity, the so-called technology assessment, which is very popular on the level of policymakers. When we study and make evaluation of new technologies, known technologies, but from point of view, how it will have impact to the public and political opinion changes on certain level. But this is just part of the story. This is a look to the technology from another side without trying to connect the technological part with social changes, just to observe what are known technologies will make impact to the social aspect and scientific testing. Well, this is very popular, and there is a certain time it feels very well strategic decision making.

Another approach, which was suggested by Michelle Godet and his school and even in French, even in English literature, they keep the original “la prospective”. This approach focus more on pro-activity and building the future. So, this approach, try to use the idea about future in order to make decision for today such a way that this vision about future will be supported by today's decision. Well, there are advantages and disadvantages of this approach. But what I would like just to underline on this part of our discussion that it is not forecast in the meaning like we are discussing within our course, because for other forecasts this is a clear answer for the question, what will happen, when and where.

When la prospective they use partially, this vision in order to build their plan of activities. In fact, the main idea is la prospective to change from the reactive mode of acting to the proactive right instead of asking the production of you test for COVID for instance, when the cases are growing, then proactive, we asked, we start the production several months before the pandemic is growing.

Another methodology, this is a methodology technology readiness level, which was developed somehow in 70s by NASA for estimating the maturity of technologies during the acquisition

phase of a program, but in fact today, in order to predict in order to take strategic decision, we look to the emerging technology from point of view of their maturity and we make can make kind of quantitative assessment, how the emerging technology are mature, to be applied and on the basis of that we can change our strategies at the company level.

And today very popular approach which try to envelope every scene including forecasting is it is so called foresight or future studies. And the main idea of foresight is to identify future technology developments and their interaction with society. In fact, this approach include at least 3 axes, the axis of future, what will happen in the future, the axis of planning and the networking, it means, how they are interconnected and how to communicate those changes.

So, from point of view, from point of view of difficulties of forecasting, we can say that those complimentary study make some difficulties because we need to decide what to use and what not to use for our strategic decision making. But, the companies even they do not forecast they can use another way, another way of starting on future for management, technology management and their strategic decision.

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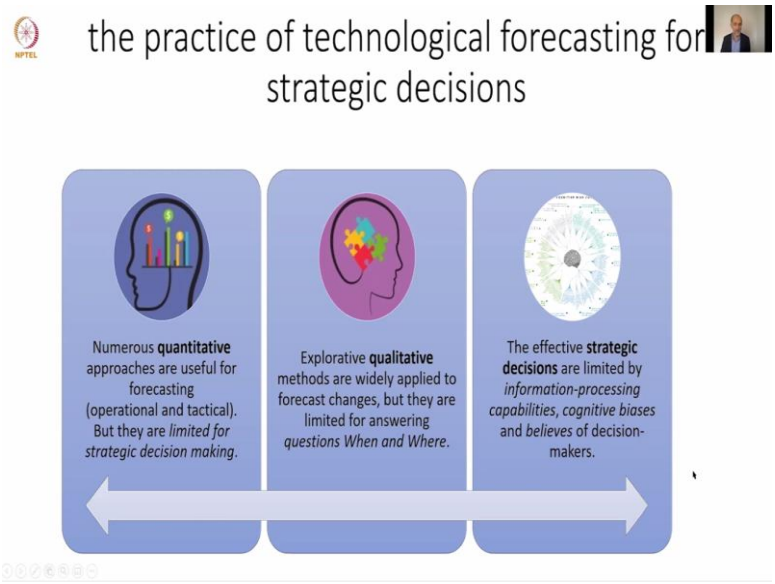
difficulties to forecasting

Part II: methodological and cognitive



Now, we almost completed our overview about difficulties from point of view of decision and planning. And if we discuss the difficulties to forecasting from methodological and cognitive point of view, we can say that the practice of technological forecasting for strategic decision phase with several difficulties and if you looked at the methodological level, we have a lot of different quantitative approaches. And there are very good textbooks about there are very good courses about quantitative approaches using time series using different kinds of functions fitting regression analysis, which are really very useful for operational and tactical level.

But when we start to apply them for strategic decision making, for long term changes, this becomes more limited. From another point of view, we also have explorative qualitative methods and they are also applied for, forecast changes, but those qualitative methods like Delf, Delphi study and other judgment methods, they are limited for answering clearly when and where those changes appear. And the third point that we have to take into account when we are discussing the practice of technological forecasting, this is a limited capacity of information processing and cognitive biases of people who perform analysis and they beliefs, the beliefs of decision makers what is going to happen.

These 3 component we can say they produce to us, they produce to us what we what we named the difficulties of the practice on the methodological level and interaction between them, which kind of approach we are going to go qualitative or quantitative, how we are going to manage biases how we are going to manage our limited information processing capabilities, how we are

going to manage our beliefs, all of them, they have to be answered in order of the method that we are using for technology forecasting.

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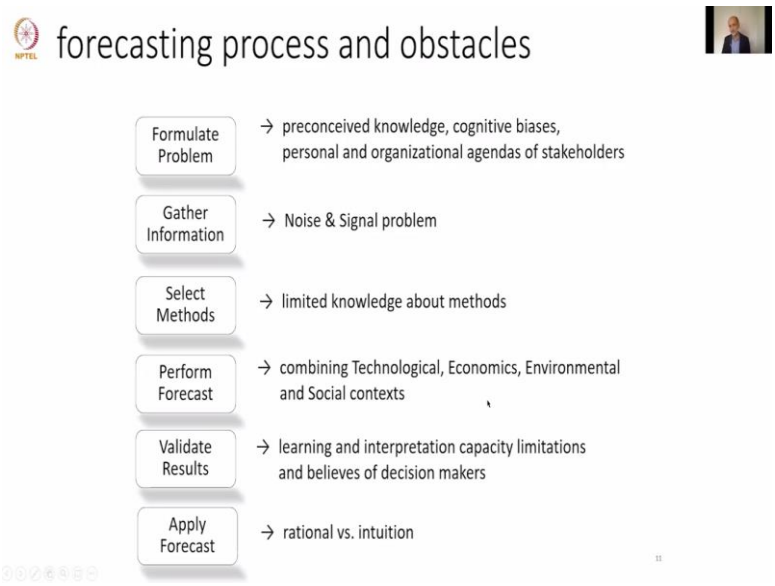

What are the obstacles if you look from point of view of process, if you look to the process, process of forecasting start usually from formulating the problem, but the main obstacle on this stage, this is preconceived knowledge, the cognitive biases of participants of study personal organizational agenda of stakeholders, what do they want? Not always the same? What is correct from point of view, what is going to happen?

When we start to gather information we face really with a problem, what is the noise and what is a signal for our situation? How to select information and data? If for instance, we, we try to predict the future of market of Smartphone and how we are going to collect what kind of information is suitable? Is it price of our Smartphone? Is it number of our Smartphone? Is it revenue of our Smartphone, what will be the noise and what will be the signal data and information from point of view of our problem to answer?

When we select the method to forecast, are we going to select quantity, quality, combination of them, we always faced with a situation where when we have a limited knowledge about methods, there are hundreds of methods, which want to select how to combine them, in order to be efficient and effective for answering our forecasting problem. When we perform forecast, when we already select the method, and we performed the study, we faced with a situation that we

need to combine several contexts – technological, economics, environmental, and social, but the data and models from those contexts they are hardly compatible.

So, in order to combine those contexts, we will need a model which will be applicable for different contexts. But what when we look to the reality to the practice, the engineers are thinking not the same way like policymakers and they are not thinking the same way like people who are concerned about environmental changes and make monitoring of changes in the environment and of course in social context.

When we validate the results, when forecast is performed, what we face as a difficulty, this is a learning and interpretation capacity limitation, which comes from our decision makers who are going to use the forecast because the decision makers they have different experience, they look to the same diagram, they look to the same result, but they make different interpretation of them. And this is this can cause a problem.

When, for instance, we arrived with the forecast that this certain technology, technology A has to be which is going to be replaced by technology B in coming 5 years, different decision makers, they say, well, they say it is good news, we are going to catch more market share, because we are going to enter the market faster than our competitors. But from another decision maker point of view, it is bad news, he said, because we need to reorganize everything. This is kind of very simplified example of different kinds of interpretation.

But we have an interpretation capacity limitation and very difficult to deal with this. Those are the beliefs of people that are driving their decision. And when we upload the forecast, we have a very issue that rational versus intuition. And when we apply the forecast for the planning, what really happen regularly what can be observed that even to the forecast was supplied even later on we can see that forecast was correct. The decision which was made out of this forecast was not aligned with what was forecasted. Because it was done more intuitively.

And how to manage this rational versus intuition and this is, this is an open question also, because this is the one of the obstacles to implement, forecast and in practice, those are not exhaustive list, those are just a list of major obstacles according to our experience major obstacles when we perform the forecast. But whatever method we use, we always start with formulating problem, we have always got this on data and information, we always make decision

about what kind of method we are going to apply. We perform this study, and we need to validate, validate, and apply results.

So, whatever you are going to do in the future as a forecast, take care about those obstacles and make clear how you are going to bypass this limitation how you are going to bypass this obstacle obstacles, if your beliefs that you had the beginning of forecasting has not been changed, and at the end of the forecasting, it is another good sign because usually the forecasting study, this is a study inform you.

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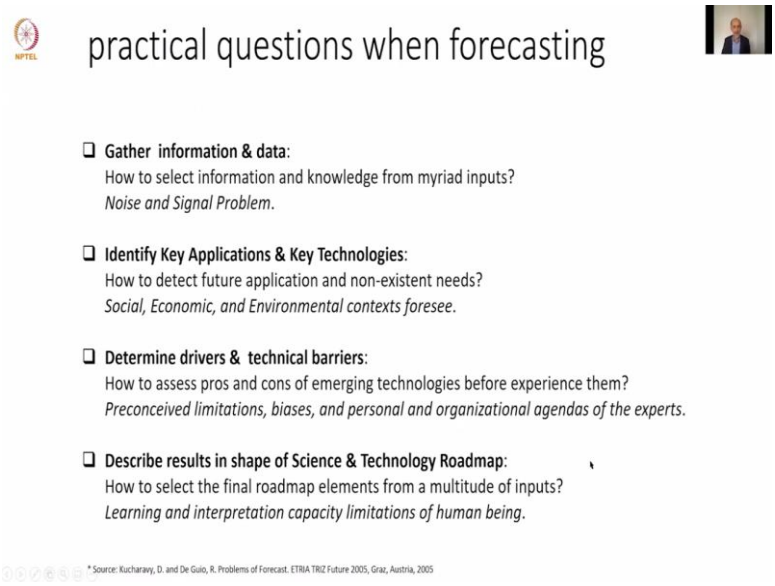

Well, if I just try to be more detail about few of these obstacles, we need to answer the following questions when forecasting when gathering information and data, we need to make clear how to select information and knowledge from materials inputs. We have to have a bold idea, we have to have a method and we have to have a procedure robust, reliable procedure in order to manage the issue of Noise and Signal Problem.

What is the Noise and what is the Signal? Because if we will have a lot of information, it does not mean that we will have what we what is really useful for the forecast a lot of data and a lot of information usually need us to more complicated picture and to less clear for the constant we need to answer the question, how to detect future application and nonexistent needs. It means we need to at the stage of identifying key application and key technologies, we need to find what

will be the needs from social point of view and from the government point of view before answering the question how it will be performed technologically.

Unfortunately, in the real case, we often start from another side, we say, we have a great technology, why not apply? And after that, we realized that this technology is not mature enough, it produced a lot of waste, it is not efficient enough and it has a very high environmental impact. So, the question how to detect future application and do not exist in needs has to be clearly answered, but it is always limited by our beliefs, we have to have a methodology we have to have a bold ideas process which will help us to see things as they are not as we are.

So, we also need to answer the question how to assess advantages and disadvantages of emerging technologies before experiencing them. And this is very important part before experiencing them because when we have experienced there is no doubt, we have a certain experience we can say, these are those are the advantages of those are disadvantages, but how to take emergent technology which just appear and be aware about the pros and cons in advance, because our preconceived limitation our biases and personal and organizational agenda usually drive us in one direction.

If you if you for instance we are discussing about electric cars, and if I just straight the question, is it clean car or not? Most of the people answer yes, it is clean technology, they do not produce any pollution. But if you look just in the nearest super system, how do we produce electricity that we use in order to recharge these cars, we are added to come to conclusion that they are not so clean. It is not the main advantage of those technologies.

And if you look to the end of lifecycle of those cars, how we are going to recycle very poisoning electric batteries. And this is this is exactly the meaning of this question how can we assess the advantages and disadvantages of something which emerge before experiencing them and how to manage our biases and our beliefs? And the fourth question that I suggest for your attention, it is not exhaustive leads, it is not complete list of questions, it is just example of difficulties, one of the major difficulties that we are facing with when we are forecasting.

When we perform the forecast, usually we have a lot of data and a lot of information which was traded, we have a lot of ideas. And we faced with a situation how to select the final presentation, the final roadmap if you presented as a roadmap or final roadmap elements from multiple

multitudes of inputs, it means, how to deliver to decision makers, what they really need to take decision not what was developed, but what will be useful for them. How to deliver the outputs such a way that learning and interpretation capacities will be bypassed. Let me give you an example. From personal mobility, for instance example, the people who are using the new solution.

For instance, let us continue with example for electric cars, the people who are driving electric cars, they do not need to know how it was designed, how it was manufactured and what is inside. They just need to know how to drive it. The same we have a situation with the decision makers. The decision makers, they would like to take technology forecast and we use it and what are we going to put into the front? And what are we going to put in initiative summary of our forecast? This is not always easy to answer question just because the people who participated the development for a constant and the people who use those, those are not the same people with the same experience and with the same needs.

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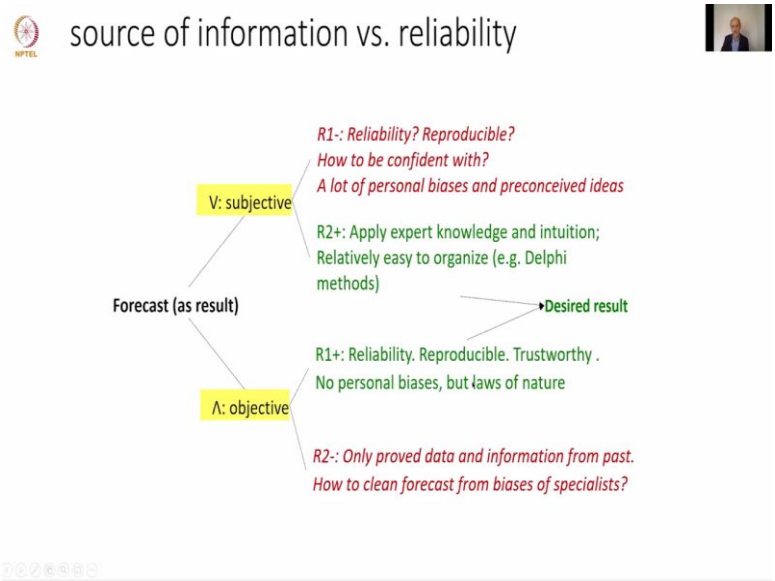

Well, in border of research and future technology-methodology and in border of approach that we are going we are teaching you we are already teaching you. We are using a model of contradiction. So, that is why I would like just to introduce some of the difficulties using this model of contradiction. For instance, when we say about Noise and Signal problem, when we say

about information and reliability of data that we use, we are often faced with the situation that the knowledge and data they usually come from the experts.

And when we apply expert knowledge and intuition, it is relatively easy to organize for instance, we can take existing method, judgment method like Delphi method with different modification and we can apply but what we will have in this situation the forecast as result will be more subjective because it is based on the knowledge just from experts. But how about reliability? How about reproducibility? How to be confident with this kind of forecast which is based on just subjective level of subjective knowledge of people even very, a very knowledgeable people?

But even knowledgeable people, they have their personal biases and the preconceived ideas, which are not always well aligned, what will happen in the future. I do not want to use here a lot of forecasts from past which show us how were knowledgeable were respectful people. They made wrong forecast about what will happen in their domain in the future but you can find a lot of them in different publications about forecast. But when we would like to have a forecast result objective in order to have good reliability, reproducibility, it means different teams they perform the same output, trustworthy forecast without clean of personal biases, based on the laws of nature.

In this case, we can use only proof data and information from the past, in this case, we cannot use the knowledge of experts and people who are really the front end of development like scientists, like inventors and innovators. And the open question is how to clean forecast from biases of specialists. In order to get just objective information, without any subject subjective ideas. The desired result from methodological point of view, we would like to have we would like to use the expert knowledge intuition, because the most valuable source of knowledge and information.

But we would like to have reliable reproducible and taskforce forecast without personal biases, which correspond to the law of nature. This is a this is a problem to manage whichever method we use, whichever method we use, we need to manage this problem.

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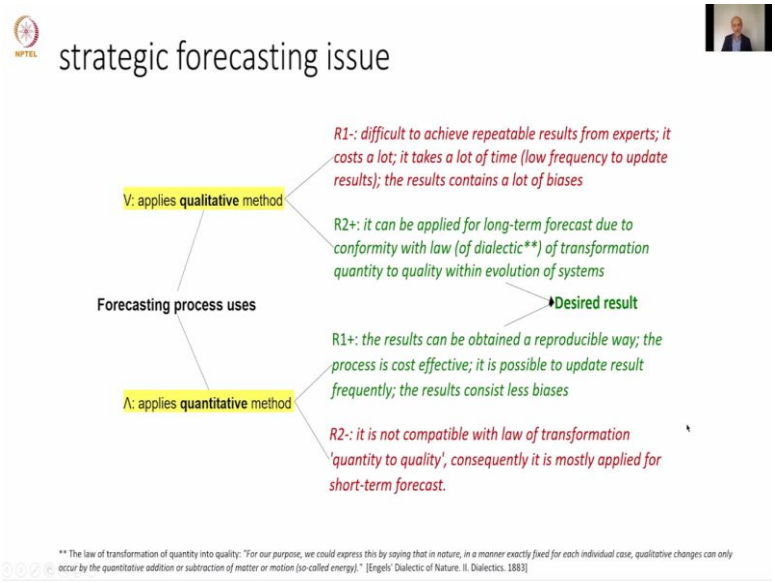

Another problem for strategic forecasting issue, stay on the tradeoff between qualitative and quantitative forecast, because if we run forecast for the long term, we need to be in accordance with the law of transformation quantity to quality within the evolution of the system, this law was proven on different levels different times and even formulated in border of law of dialectic in philosophy level. Because whatever system evolved, they evolve always the same way, we have reached a certain stage of evolution, we have a transformation of quality into a quantity into new quality.

For instance, a growing number of personal computers allow us to have internet as a network and Internet this is an absolutely new quality, which cannot be explained by property. This is a phenomenon of emergency, if you already watched the video that we suggested for your attention about system one of the key features of the system this is emergency how to respect this emergency phenomena.

In this case, when we apply qualitative method for forecasting process, we can respect it, but it is difficult to achieve repeatable results from experts and it costs a lot when we run qualitative method, the judgemental method they usually run not so frequently because as soon as it will have high, high level expertise, which costs always. So, we have a lot of expenses, it takes a lot of time, it means we cannot run it regularly and results can contain a lot of biases.

But when forecast use the quantitative method is measurable based on the calculation computation, the result can be obtained a reproducible way, we will practice with logistic curve. So, you will see independently it is me or you who are running this model we will arrive to the reproducible results, but the quantitative method, they are not compatible with law of transportation-transformation quantity to quality.

You cannot predict with a growing number of personal computers, the internet will appear which will take a lot of functionality of personal computer as a system today, we can store the system the data in the cloud today we can perform very demanding calculation using distributed, distributed network of computers. So, a quantitative method mostly applied for short term forecast.

So, this is this contradiction also help us to understand why the strong belief of many practitioners than the methods which are efficient and reliable for the short and middle term forecast is the reliable for long term forecasts. Because they try to apply the quantitative method, which are pretty good, reliable, because the short term for the long term, but in the long-term forecast, we always have this transformation of many interacting systems, they continue to evolve as a combination of those systems.

Today, we can see the same situation not only with information technology, we can see the situation in the food supply, we can see the situation in a transportation, in mobility system technologies also. Just in order to complete this list of difficulties, one more difficulty that we still did not discuss about that I would like to share with you this is complexity.

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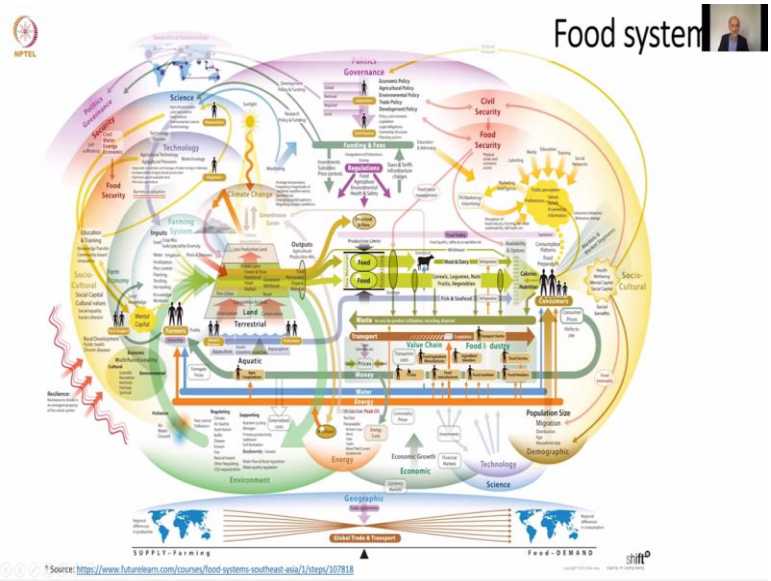

If you just look to the food system, if you look how it is interconnected, we can see that there are a lot of connection not only evolved, consumers, and producers, but between many participants and stakeholders who take part in this process. And those links and those participants, if you are running forecast, we have to be able to predict the changes within the time on the level of not only participants but also the level of connection between them.

Simply saying, we have to predict the connection between supply and demand and how technologies are going to change in order to satisfy this demand by changing supply. And when we look at this is this is a food, this is a food system as an example, which include a lot of technologies a lot of solution, when we just look at this system.

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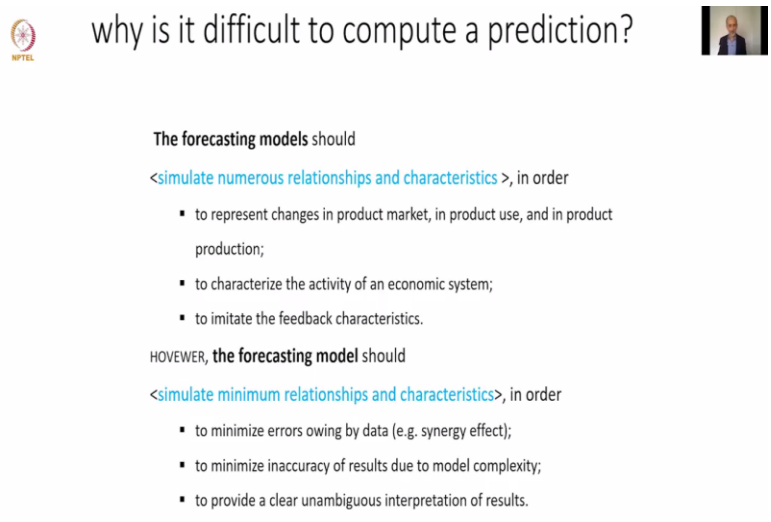

We can say that, in fact, our forecasting model should simulate numerous relationship and characteristic in order to represent changes in product market in product use and product production, to characterize the activities of the economic system, and to imitate the feedback characteristics, but our forecasting model should simulate minimum relationship and characteristics in order to reduce errors or even by data, because we have a lot of data a lot of interconnection. So, we have a synergy, synergy effect.

Which will increase the error in order to minimize inaccuracy of results due to the model complexity because keeping model by itself is very complex. We know that very complex model they do not produce a result, accurate enough for practice and to provide a clear and ambiguous interpretation of results. Because at the very end, whichever forecast we have, we have to be capable to apply it for the decision making.

If all forecast is very interesting, very representative, even reliable, but is not applicable for the decision making. This forecast is not correct, it is a failure if we cannot apply it. So, we have to use a minimal relationship and characteristic in order to keep it thinkable, because do remember we have a limited cognitive capacity of our decision makers, who are the real end customers of our forecast.

So, just to sum up, in fact, we discussed the difficulties to forecast from at least 2 levels, for 3 levels, let us say from one level, this was a level of decision-making planning. This is a system

we should include our forecasters upon. After that we discuss our forecast from system level. What is forecasting facing with as a system which provide us support for strategic decision making and we try to understand and discuss the difficulties of forecasting from a subsystem level, subsystem level. This is a part of the process and requirements to the model of forecast. Thank you for your attention.