Technology forecasting for strategic decision making - An Introduction
Professor Bala Ramadurai
Indian Institute of Technology, Madras
Professor Dmitry Kucharavy
EM Strasbourg Business School
Technology Lifecycle - Seasons, Clockspeed – Part 5

Professor Dmitry Kucharavy: Now, we are interested to discuss about scope of technology forecasting. What do we include into technological forecasting and what we do not include in technological forecasting! And for this purpose, I would like to share the screen and let us discuss about scope of technological forecasting.

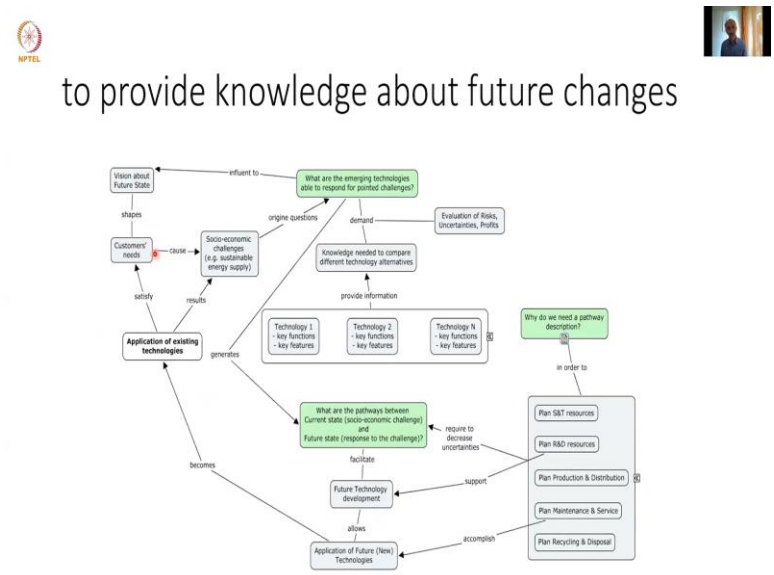
(Refer Slide Time: 00:40)

scope of technological forecast

In fact, if I just look to the dictionary and just recall, we already gave our definition of technological forecast when explicit answer for the question - what, when and where one technology will evolve and be substituted by another one. But if you look at the dictionary, the technological forecasting can be translated as a process of predicting the direction and scope of future technological advances, okay.

Then whatever technological forecast we are talking about, we need to be capable to answer for explicitly for all questions of decision makers. And it depends, as we already discussed about product lifecycle, it depends on the knowledge lifecycle, it depends on the lifecycle of regulations all together because for us, technology, this is a synergy of this three one.

(Refer Slide Time: 01:55)



But let us see a bit more in detail, how we can provide knowledge about future changes and why we need to provide knowledge. And why, technically, one technology is replaced by another one. If we start with a question of application of existing technology, whatever technology we use, for instance, now we are using smart phones, it will lead us to new customer needs. First, to satisfaction to the customer needs, for communication, to have access to internet, to have access to data, to entertainment.

But it also results the new challenges like energy consumption, like material to produce and continue to run this technology, new knowledge and new regulations also. And those socio-technological challenge will produce also the question - what are the emerging technology able to respond for those challenges? What are the next technology which will respond for the question about limitation of energy use, how make it that our smart phone will be always charged, for instance?

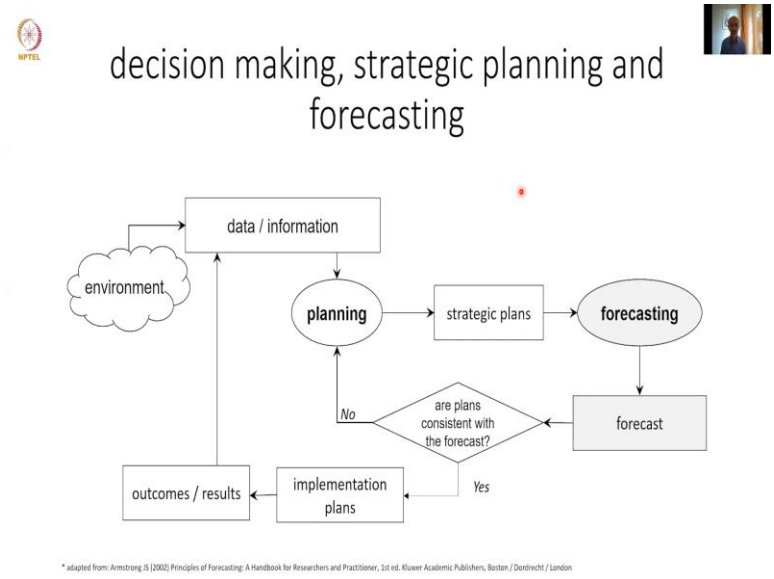
In fact, we always have several technologies to choose among, okay, some substitution. We can, for instance, for our smart phone we can use harvesting of energy, we can use additional batteries, we can use reduction of energy consumption. But we need to provide information in order to answer for this question - what other emerging technologies will be candidate for the current future to replace existing one, existing technology that we use today?

Why do we need so? Because we need to have a pathway from present state to the next state, why, because we need to plan the resources, we need to plan resources for research, scientific and technological resources, we need to plan resources for research and development, industrial resources. We need to plan production and distribution resources; we need to plan maintenance and service.

Also, which kind of services we will need, what kind of specialists we will need, what kind of education program we will need, professional education and high education program we will need, in order to support this new solution in the current future. And we need also to plan recycle and disposal in order to not appear in the situation that we appear in many technologies which were produced in 20th century today.

So, assume that we plan all this and we accomplish with application of new technology, we will arrive to the point from which we start. We apply the technology in order to satisfy our needs. But our needs also will shape our vision about what we will need in the future. The technology forecast provides us a knowledge about future, but this knowledge are enough in order to plan and in order to describe the pathway between current state and future state. And if I would like to keep our definition of this code as simple as possible.

(Refer Slide Time: 06:11)



In fact, our technology forecast main application is planning. We take data and information from existing environment, we make our strategic planning and we make our forecasting and after

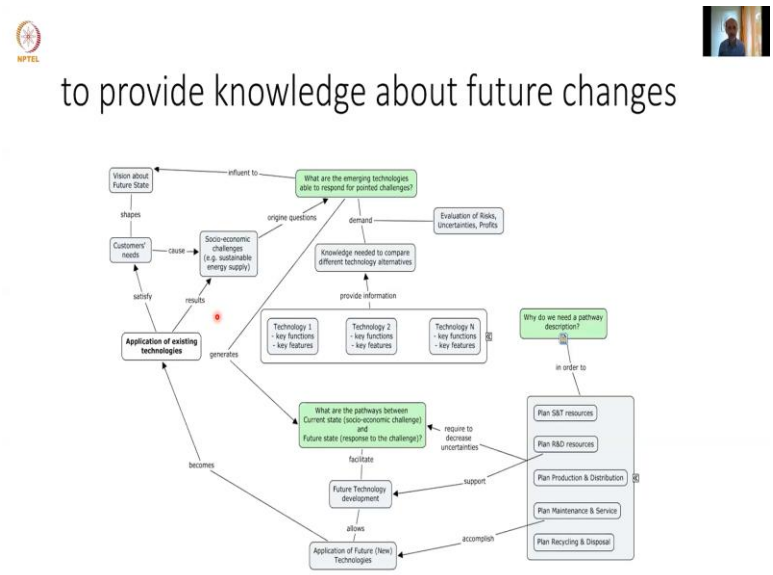
that, we compare how our forecast, how our plans are consistent with the forecast and if they are not consistent, we change the planning in order to keep it consistent because if the future changes are not consistent, (sorry), if our planning are not consistent with the future changes, they will not be successful, whatever action is based on our planning.

When they are consistent, we implement our plans into the reality and we have a positive outcomes and positive results. If they are not consistent, the result of our action, result of our implementation will be always the losses and negative. Of course, our outcomes and results will produce some data and information that we will use for the future planning and we will use for the future forecasting.

So, our technology forecast scope is to provide knowledge which are useful for decision making and in vote of our course, we are trying to learn the methods for particularly for strategic planning. We are making forecasting which are provide knowledge for strategic planning. Next, what I would like to share about scope of our forecast in order of our course, how do we define technological forecasting in order of our course? Do we have any?

Professor Bala Ramadurai: Dmitry, thank you for that. One quick question I have is, can you please give us an example for this? Let us say, I just top of my head I am thinking, I want to organize a conference, say, something not at all, anything to do with technology. But is there something that we can do in this flowchart? I found it very interesting and intriguing. So, can you explain that example please?

(Refer Slide Time: 08:45)



Professor Dmitry Kucharavy: Okay, let us take an example of our mobility, mobility technology. Today, assume that we are living in the cities and not only in the cities, we all always have a need to move to travel from point A to point B. And today, we are using different technology for that. We are using bicycles, we are using motorbikes, we are using cars. This is our available technologies. But whatever technology we use, we use the hardware, as we already discussed, we use knowledge and we use some regulation.

But on the level of the hardware, if we continue to scale the system that we use, we arrive to the limited resources like air pollution, or like available materials to produce hardware. On the level of knowledge, when the density of transportation flows increases, we arrive to the problem that we have not enough skills and the number of accidents starts to increase. And this is what we name 'socio-economical challenges'.

And on the level of the regulations, we arrive also to some problems, for instance, in a situation of pandemic, we arrive at, we have to transport or we have to travel but we have to travel not in contact with other people, okay. Those are the different limitations that will arrive. And we aggregate all this kind of limitations what we name 'socio-economical challenges'.

When the customer needs is always the same; to travel from point A to point B, and the customer needs is always changing also, because if he has today, I spent 20 minutes or 30 minutes to travel from my home to my office, tomorrow I would like to spend less; 15 minutes and more

comfortable. So, this is why, in a time of running of this technology, we are looking what are the new solution which will help me to gain time, which will have less limitation and which will satisfy all the regulations which arrive from the environment.

So, we say, okay, how about different kind of transportation, different kind of mobilities that we can use? For instance, if today I am using bicycle to travel, how about electric bicycle? Will it be the option for me in the future and what will be the past from using today's bicycle to electric bicycle? We need it in order to plan our research and development, to be capable to produce electric bicycle for affordable price.

Also, maintenance and service, because maintenance and service of electric bicycles and normal bicycles is not the same. The same like electric cars and internal combustion cars. This is absolutely different kind of services. And of course, we need to plan the recycling and disposal because, for internal combustion engine, recycling and disposal, this is a one thing but when we need to recycle and dispose the batteries, this is another form.

So, so this why when we predict, when we predict we have to have enough information to see what will be the speed of these changes and what are, will be the real technology which will substitute one another? Will it be electric bicycle or will it be just walking a distance from the office? So, the technology forecast has to cover all these questions.

But we always start from existing technology, we try to understand the evolution of customer needs and we try to measure out socio-economic challenges. Socio-economic challenges on the level of limited resources. And we try to depict the changes on the level of our evolution, evolution of our system all together using logistic s-curve which include behind of logistic s-curve there are always limitation, that is why the exponential growth is limited, is cupped and we inevitably will arrive to the platform. Is it okay with this example or we need one more example?

Professor Bala Ramadurai: No, this is more than enough, what I was looking for. In fact, it is comprehensive. One related question I have is, and again this comes from our conversations from the past, is Laws, particular you brought the topic of recycling and disposal, these Laws, particularly in developing nations like India, change on a far more quicker cycles and have to be included in the planning itself.

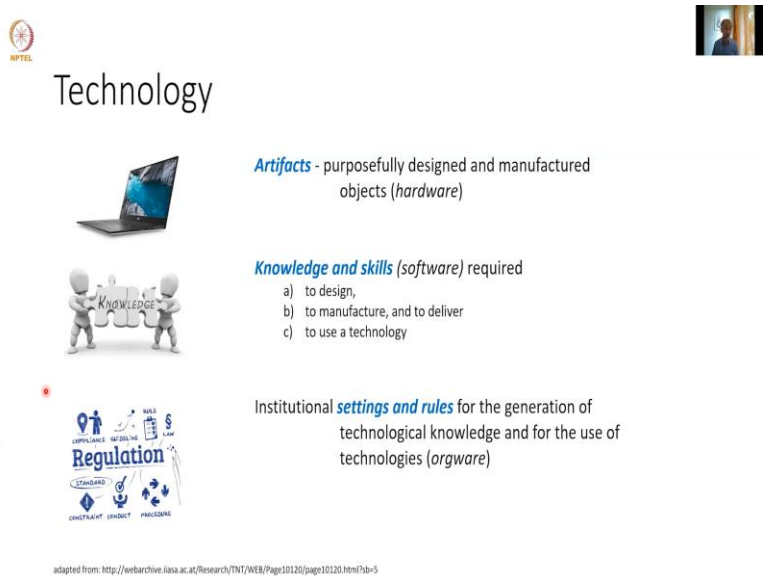
So, how do we take that into account when we are looking at technologies of the future? So, when I want to look at alternatives, I also want to consider this but how do I include that in the big model that you showed?

Professor Dmitry Kucharavy: You are talking about regulation, you are talking about regulation, okay.

Professor Bala Ramadurai: Yes, regulations.

Professor Dmitry Kucharavy: Let us look to this slide once again in order to better understand the meaning of the technology.

(Refer Slide Time: 15:08)



Let us see the definition of the technology. In fact, the regulation, this is inevitable part of any kind of technology. Without regulation, technology does not work. If you would like to introduce new kind of, new technology for mobility, without regulation it does not work. I would like just to give you example about new autonomous vehicles.

New autonomous vehicles, they are available on the level of hardware for decades. More than 10 years, we have a safe automative vehicles which circulate on the road, not in regular basis but as a test prototype in Europe and United State. Why do we still not have them on the street? Because the regulations of countries are still not clear. And just another, to give you example,

very simple question. If any accident happens with this autonomous car, who is responsible for it?

And this, until this question is answered, the autonomous cars cannot appear on the street. Even the rate of accident for those cars dramatically lower than accident rate for cars which are driven by human being and that is very true because if you just look how do we recognize the badges and signals on the road, the human being usually recognition rate about 73-75% when recognition rate of artificial intelligence more than 93-97%.

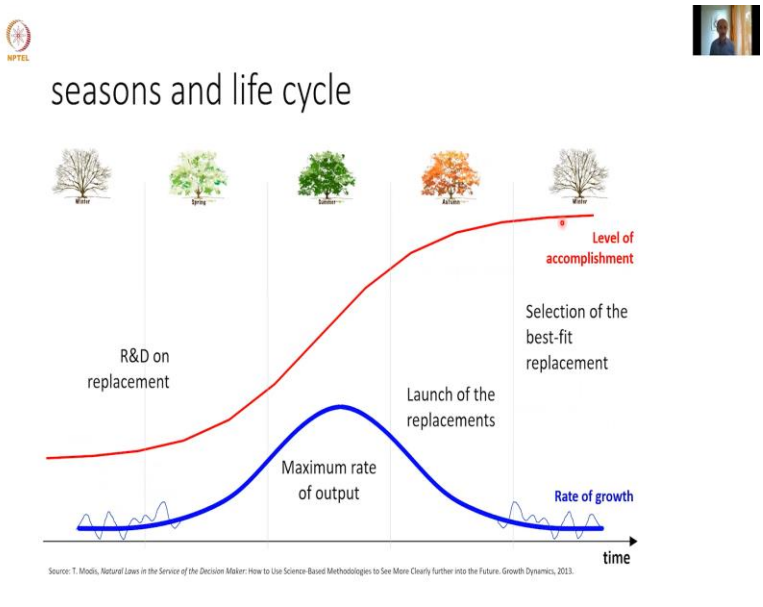
So, those systems are much safer, but assume that we have no answer on the level of regulation, those hardware cannot, even we have a knowledge and we have a hardware how to use these autonomous cars, they cannot appear in our real life, it cannot appear as a technology that we can use on the daily basis. Is it, is it example which is clear enough or you, your question was a bit different?

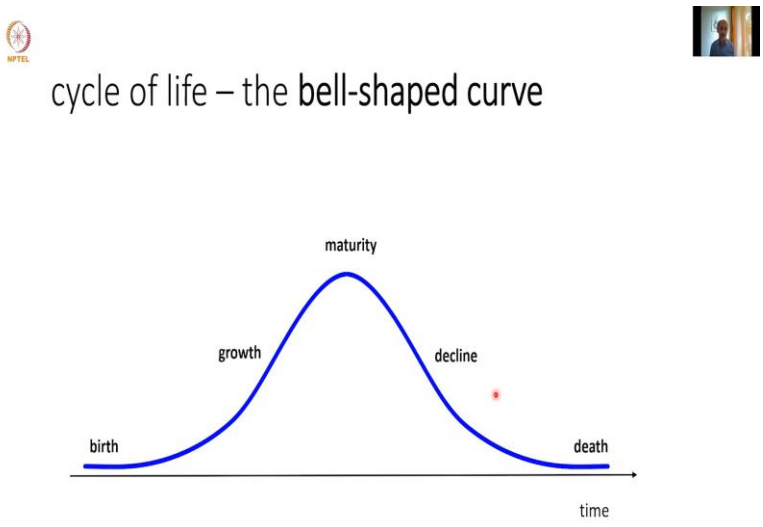
Professor Bala Ramadurai: That is one part of it, I think. I think what I was looking for is the change in regulations also. Particularly these pollution laws, disposal, they seem to be changing and getting stricter by and tighter as we speak. I mean, every year there is a new regulation itself. So, how do we include that in the forecasting? You know, the map itself, that we were looking at, the big one that you showed us?

Professor Dmitry Kucharavy: Yes, the regulation about pollution, this is, this can be considered from point of view of competition for the resources between technical system hardware and human being. I fact, when we use the logistic s-curve, we are talking about always limiting resources. And the new regulations about pollution, for instance, this is their way to protect human being health from the competitor.

This is a means to solve the problem that the technical system like the internal combustion engine or existing technology to produce heat, they take resources out of human being which are essential resources for surviving. And this is from point of view of competition that is pretty clear situation. And whatever technical system we take, why technical system will arrive to the plateau, we already discussed about the lifecycle.

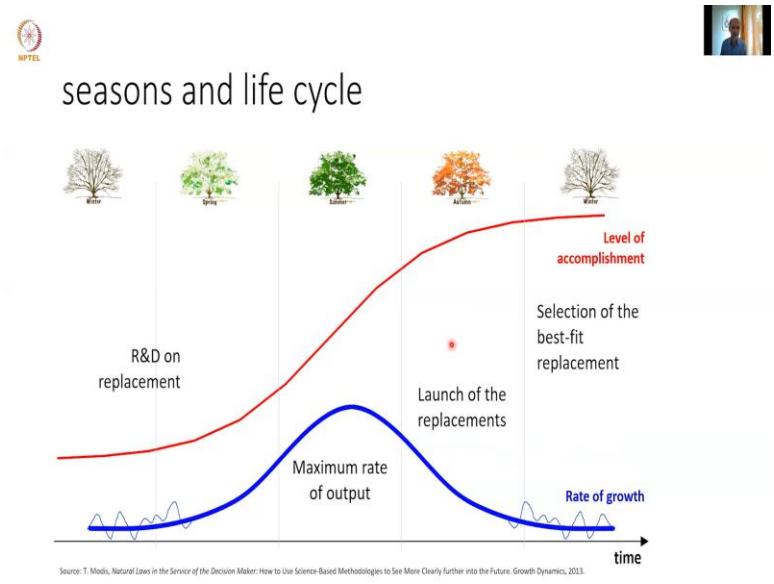
(Refer Slide Time: 19:26)





Why technical system always arrive to the plateau of level of accomplishment and why technical systems will always arrive to the face of decline and death, because the available resources, the available resources are limited.

(Refer Slide Time: 19:47)



So, that is why today, we, not only in India, we have the same situation in Paris, for instance, vehicles with diesel engine, heavy tracks, they are not allowed to enter into the city. And when we have not enough range and wind, for instance, sometimes cars are not allowed to circulate in Paris after 6 pm.

That is because there is not enough space; there is not enough fresh air for people who are living there. From point of view of competition, we are going to discuss how we can compute it, because the main idea, it has to be computable. Is it okay for your question?

Professor Bala Ramadurai: Yes, perfect. Thank you so much. That helped me a lot. Thank you so much for that.

Professor Dmitry Kucharavy: Yes, thank you for your questions.