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Realizing Russia's Potential

THE R&D STRATEGY OF THE SKOLKOVO INSTITUTE OF SCIENCE AND TECHNOLOGY

Presentation

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Panelist:

Mats Nordlund, Vice-President for Research, Skolkovo Institute of Science and Technology

E. Crawley:

Welcome to this session on the research strategy of the Skolkovo Institute of Science and Technology. I am Ed Crawley. I am President of the new institute, Skolkovo Tech. We have now been operating for about seven months.

As you probably know, Skolkovo Tech is an important part of the Skolkovo ecosystem of innovation, which will include those things that the Skolkovo Foundation has direct responsibility for. The university is actually an independent, autonomous body. There are other key partners, multinational corporations, venture investors, and investment firms that are all part of the Skolkovo Institute.

Today we are going to be talking about our research strategy, and I would like to introduce our Vice-President of Research Mats Nordlund, who will present the outline of our research strategy. We will hopefully do this in about 15 minutes, leaving time for questions and answers after the presentation.

M. Nordlund:

Thank you, President Crawley. I will move straight into the presentation, and will keep up a fairly quick pace to give you an overview and to allow for questions at the end.

To point out our position in the Skolkovo ecosystem, it primarily comprises three different parts. There is the large Skolkovo Foundation, which I am sure you are familiar with – you can visit their stand right next to us here – which has the clusters, the key partners, and the Technopark.

We are a separate, independent university operating in very close connection with the Foundation, and with the investors and venture capitalists that are also in the Skolkovo area, and we are becoming a key partner of the Foundation.

The university we are building is a graduate university, which means that we have no undergraduate students. It is only going to be Masters students and PhD students. We will teach in English. The university will be focused on science, engineering, and technology, and will be addressing problems and issues in the

same areas that have been outlined by the Russian Federation, which are IT, energy, biomedicine, space, and nuclear.

At the university we also have a strong innovation programme, and in 2020 we aim to have 200 faculty members, about 300 post-doctoral researchers, and 1,200 graduate students, growing that number to 300 faculty members at steady state. We are building the university on a new campus – we do not have any buildings today. We plan to open the first buildings in 2014.

Of course there are a number of challenges when starting up a new university. I look at them myself as a chicken-or-egg problem. How do you get attention when you are not known? How do you attract junior faculty when you do not have any senior faculty to mentor them? How do you attract them when there are no facilities and no students? How can you build laboratories without input from faculty? How can you attract faculty when there are no laboratories to go and work in?

On the research side, how do we make long-term research investments without knowing what our future is?

There are a lot of parallels here with starting up a company. It is all about speed and quality, and our entire research strategy, and strategy to establish the university, is built around speed and quality.

I will go through each of these steps in more detail shortly but, as you can see, we are operating on a spiral development cycle, which means that we are taking many steps in rapid sequence rather than trying to do one thing at a time and then moving onto the next. On the quality and excellence side, I will go through a lot of these in detail. I would like to draw your attention to the last two: transparent and open processes and international competition, which also leads into the last step, which is about partnerships.

We are selecting partnerships with Russian and foreign universities to help us through a very transparent process in international cooperation.

Looking at the spiral development, these are the five key things that we are working on in parallel as we take small steps quickly. We are looking at facilities, we are outlining the university’s structure, and we are determining which main laboratories

we are going to have, whether or not we are going to have a clean room, whether or not we are going to have animal facilities, and so forth. That influences the faculty and what kind of faculty we can attract based on what facilities we have. At the same time, we also need to talk to the faculty and identify a couple of key faculty members who can give us advice on what facilities we need.

That leads into the research establishment. How do we establish our research programmes? Doing that will drive some of the curriculum. Once we have researchers in place, they will help us develop the curriculum and that combination of research and curriculum can then lead into innovation. We can already look at some of the innovative programmes that could emerge from our research programmes, and that again can feed back into facilities in such a way that we can step around this cycle very quickly and develop our university in the five areas that we are looking at.

We are also saying that in the five areas we have – biomedicine, energy, IT, nuclear and space – we cannot cover everything. We need to identify what we call concentrated excellence, in other words, what part of biomedicine is it critical for us to go into? What part of energy? That is so that we do not try to spread ourselves too thin.

I will also talk about how we actually get into this concentrated excellence strategy.

The first thing to point out is that, since we are engaged in innovation, our research is going to be research with consideration of use. We apply this framework here to illustrate what we mean. This is called Pasteur's quadrant. It was developed in the 1990s to discuss different types of research.

The Skolkovo Tech research will be primarily located in the upper right corner, and if you look at the vertical axis, you can see the quest for fundamental understanding, so the further up this axis you go, the more research is concentrating on fundamental understanding. On the horizontal axis you have consideration of use, so the further to the right you are, the more there is consideration of use.

A couple of examples: firstly, Thomas Edison, who was working on the light bulb and who was very much concerned with how to use it rather than understanding

exactly how the filaments work and why they would burn out. He went through a lot of experiments to determine the best solution: that was very clearly focused on consideration of use.

Another example is Niels Bohr, who was developing the atom model. He was not particularly interested in how it was to be used, rather in a fundamental understanding of how an atom works was his quest.

Louis Pasteur is held out as an example of a person who did both: fundamental understanding as well as consideration of use. We are looking to locate our research in the upper right quadrant here, with some elements, of course, going into the more pure fundamental research.

When we talk about concentrated excellence, we need to be able, in one way or another, to create a vision of the future. In order to do that, we are getting help from the outside. We are looking at three main areas. One is the push of science and technology, or what is coming out of the universities. Here we are talking to and getting input from the Russian scientific community as well as from MIT thought leaders and faculty. MIT is one of our key partners in starting up the university.

On the other hand, we are looking at the industrial side. What is the market pull for science and technology? Again, we are getting a lot of help from Russian industry and the Skolkovo clusters. We are also turning to multinational industry here, and we are getting help with what they see coming in different parts of the world.

All that feeds into the SkTech vision, but that is not it alone. We are also looking at societal and legislative megatrends. What are governments looking at? What kind of legislation is coming out that is going to drive the development of science and technology? Also, what is happening in the population? Do we see any major population shifts in terms of demographics, aging populations, emerging countries, and so forth, which would drive investments from the government side into different areas of technology and science?

We are combining all that into a vision that we call Skolkovo Tech 2030, and that helps to guide our research investment decisions. We have had our first iteration of that. We now have a draft version of our vision for each area, so we have visions for

energy, nuclear, biomedicine, space, and IT. We are going to have a workshop in Skolkovo on July 9 and 10, in which you are invited to participate if you have the opportunity. We are going to sit down and go through these with the participants in the workshop, and refine it to a level where we can release the first version on the web for further feedback as we go forward.

I would like to illustrate the partnership that I mentioned, which is a very important component of our research strategy, with this figure. When we identify a research area that we want to address, which is shown by this larger box here, we seek to find an international university partner and a Russian university partner that can get together in what we call a research centre.

A research centre proposes research to address this area, and it identifies a white space where Skolkovo Tech can build our capability. Partners are expected to cover parts of the area. They are also expected to identify how they are going to help us build capacity.

There are many different ways this can be done, but a key part is to create a fully operational SkTech part of the research centre, and that includes helping to recruit faculty and to define facilities and the research programme. Here you can see the mechanism that we are using to get through this rapid iteration: the spiral development that I described at the beginning.

It is also intended to connect the Russian university to the international community, and to generate synergies directly between the Russian university and the international university.

There is a double benefit in doing this: both building us up as well as strengthening the two partners. Once we are in place with our facilities, our laboratories, and our faculty that have been created by this research centre, we go into a more regular operation, where we continue to build new science, technology, spin-out innovation, entrepreneurship, patent licensing, and so forth.

The research centre, if you look into the details of it, has depth, breadth, and scope, which means that we can have several different thrusts in one centre. It does not just focus on one thing. In one general area, IT for example, it could be big data, it

could be intelligent control systems, it could be something else. There can be several thrusts that are pursued, and each thrust can have several projects.

Some of these projects will start up, some of them may fail because of technology risks, and others might start up a bit into the programme. The projects can be located at a single university or can integrate participants from several different universities. We expect each programme to have both faculty students and post-doctoral researchers in the actual projects.

I have spoken about how we create excellence and quality in what we do. An important aspect is to have transparent processes, clearly established selection criteria, and competition. This is the process we have used to achieve our first three research centres, which we are going to establish here within the next few months. We are going to repeat this process with very small modifications for the next call and for the third call.

The way it works is that we send out a call for proposals. We invite universities to come in with a white paper – a shorter description of what they would like to do. They go out for remote review, we get feedback on the remote reviews and do some scoring. Then, we select the top scorers, with some consideration of the investment directions that they are going in, and we invite a number of universities to submit full proposals.

In the first round, 130 white papers were submitted. We selected 13 and invited them to submit full proposals. Full proposals are much more complete, about 20 pages long, and they go out for another remote review. Then the proposers are invited, and this happened this week. On Monday and Tuesday we had a panel review where the proposers came in and presented, for each centre, what they are trying to do, how they are going to do it, and what the impact will be for us, addressing all the important criteria as well as taking questions from the international peer review panel.

They are scored again, and the final review, with the scoring, is submitted to our board. The Skolkovo Tech board makes the final decision as to who they want us to go and negotiate with. The board meeting for the first call for proposals is going to

be held on July 9, and after that we will go out and start negotiating in the order of priority that has been set by our board.

Once we have the agreements signed, we will announce who has received which centre. The second call for proposals is opening up now, which means that during the autumn we are going to ask people to submit white papers again. As I indicated, we have the workshop on July 9 and 10, where we are going to make it possible for industry to meet university representatives from inside and outside Russia to discuss and explore opportunities. Then, during the autumn, up until November 30, white papers and ideas will be developed and submitted and the process will be repeated, again selecting some of the best proposals that we would like to invite back for full proposals. Then, we will go forward to review again.

At the end of this build-up phase, we envisage at least 15 research centres, each of them comprising components from SkTech and other Russian and international universities. More partners could partner up as sub-contractors or as sub-partners with a Russian or an international university. These partners can also be in industry.

Each centre can be funded by us, as we have the funding, up to USD 12 million per year divided between the partners. Each partner can receive USD 4 million for a five-year period. You can see here that we envisage centres in all areas. Some of them can cover several areas. You can have a combination of biomedicine and IT, or energy and IT, for example, to address problems that are more cross-functional.

You can also see that we are expecting the research centres not only to do research but to contribute to developing the curriculum just like I described in the spiral at the beginning. How do you go from developing a research centre to a curriculum? It is also a matter of interfacing with the Centre for Entrepreneurship and Innovation, both in terms of subjects and in terms of spin-out initiatives.

Here are a couple of examples from the first call. We had 130 papers and they were primarily submitted by research universities in the United States, the European Union, Israel, and Australia. We had six former Nobel Prize winners participating. From these 130 we got the 13, and they represented nine non-Russian universities. There were some universities who had several proposals in the winning group.

It was the same on the Russian side. We had universities as well as institutes from the Russian Academy of Sciences and the Russian Academy of Medical Sciences.

Two of the Nobel laureates did not make it, so we do have very high levels of quality, and it was a very good competition among the proposers. These are just some slides from the reviews we had on Monday and Tuesday, so you can see we had proposals in all areas, including space and energy. We had several in biomedicine. That was the best represented area, both in the 130 papers, and in the final selection. We have nuclear, and a combination of space and biology as well as some in IT, so there is a total of 13. This does not show all 13. These are just some examples of the slides that were shown earlier this week.

Negotiations are to start in July after the board decisions and announcements, once we have signed agreements.

With that I would like to conclude my overview of what we are doing. I would like to welcome you all to come and help us at Skolkovo Tech. There are many opportunities for academia to get involved, especially around our research centres, and getting involved in the research centres gives you access to world-class research collaboration and good funding sources. It helps us to form our research strategies, to find facilities, and with students and faculty opportunities, so that we can recruit and give you and your faculty some opportunities, as well as developing educational programmes that of course can be applied on both sides.

If you are coming from industry there are also several opportunities: getting involved in the research centres with one of the university partners, either outside Russia or inside, and also getting involved in our industry groups, who are helping us to define our 2030 vision and the key investment areas that we should go for.

Another important part of that is to express the type of education you are looking for in industry: what kind of programmes should we develop that would be useful for students, so that when they leave us they take that knowledge with them? There may also be an opportunity for some of your industry colleagues to come into the university and participate in our courses.

All this will be presented in much more detail at the proposers' conference that will be held in Skolkovo, in Moscow Region, on July 9 and 10. If you go on our website you can see the call and the invitation for this workshop. If you have any specific questions, we have a special email for those coming from industry, industry@skolkovotech. If you would like to contact me directly, feel free to email me as well.

With that, I would like to conclude and invite President Crawley up on stage, and we will be happy to take and discuss any questions you might have for the next 10 minutes, which is what we have on the schedule.

E. Crawley:

Just to plant a question, I want to point out that when Mats referred to Russian universities, in fact the call for proposals is open to Russian universities and research institutes. As you mentioned, there are in fact some teams from various research institutes of the Russian Academy of Sciences and the Russian Academy of Medical Sciences, so it is not only universities that can propose from the Russian Federation side.

From the audience:

I have a question about students and researchers. How are you going to attract the best post-doctoral researchers or whoever so as to get the best university? Without people, you cannot build it.

E. Crawley:

This is the spiral model. We want to attract the best students, the best post-doctoral researchers and the best faculty members, and we have various mechanisms to do this. Imagine that in a few months we announce one of these research centres that has world-leading researchers from Europe and the Russian Federation. That would instantly allow us to attract faculty in that area – professors in that area – who would have the opportunity from the first day to work with world-leading researchers, and

to build up not only the student body but the facilities as well. We are going to build 200,000 square metres of new university space in Skolkovo and fill it with brand new research facilities. I think the opportunity to come immediately and work with leading scholars to recruit students from the Russian Federation and abroad, and to help define the research facilities will be very attractive features to scholars around the world.

When they come to work at Skolkovo Tech, the young faculty members that we recruit, who will be, roughly, not yet in their mid-30s, when faculty are considered mature, will go and spend one year at another university – primarily MIT, but there will be other options – being mentored and working with a senior professor there. Skolkovo will pay for the research budget of our faculty member and the mentor, the senior professor there.

This combination of things creates a lot of incentives for faculty members to come and work with us.

M. Nordlund:

You can see on this slide here that a lot of the proposals that we received for the first call for proposals, the blue arrows, include proposals from the universities to actually host faculty that would be specifically recruited for this research centre.

They would help us recruit as well as host, and then help us define the new facilities at that point. Once we have the university in place, they can move into Skolkovo and be effective right away. They know their partners, they know their colleagues internationally, and they have a laboratory in place that they can define themselves.

From the audience:

Thank you for your presentation. Could you talk a little bit about the reaction you are getting from industry, and what they see as some of the barriers or problems from engaging with you quickly, particularly in the biomedicine area?

E. Crawley:

Skolkovo is being designed in a triple-helix model, which means that fundamental to our strategy and implementation is an emphasis on education, and on research, and on innovation. You could say that Skolkovo is open to business, meaning that we want business to engage with us. Particularly being set in the context of the Skolkovo community, where there are multinational research and development laboratories and the start-up small and medium enterprises, there will be a great deal of engagement.

So, what is the response? The response is very positive, because we are working very hard to engage industry. There is no shortage of opinion in industry on what universities should be doing. I believe there is a shortage of people in universities who are listening, and we are working very hard to listen. We are now designing our education, for example our Masters programme, and the first step in designing a Master's programme was to conduct a stakeholder interview process with international and Russian industry, and have them define for us what the attributes Skolkovo Tech graduates should be, so that we can design to that model.

Yesterday evening, we had a meeting of the Industrial Advisory Board of the Skolkovo Foundation, and we had a very positive response to this. We are very sincere. We are creating six or seven industry advisory groups – panels made up of international and Russian industry – to advise us on a sector basis about both research programmes and educational programmes.

We are really seriously engaging industry: existing industry and, as the start-ups next door grow, those programmes as well.

M. Nordlund:

I can add some more specifics. I have been in industry myself for the last 15 years running a large US corporation's research centres in Europe. I have just joined academia again: I was in academia before that, and I have come back to academia. I am at least half an industry guy.

Two of the concerns that have been specifically directed to me have been around ethics, i.e. corruption issues, and. around IP patenting and how that is going to work. We have a good answer to both of them.

We are implementing a very strong ethics programme. We are essentially duplicating what we have at MIT, so that is one of the things we are putting in place. When it comes to IP policy, we are more or less duplicating the MIT IP policy, with some modifications to allow for Russian Federation legislation in that area.

Any company that feels comfortable cooperating with a large American or European university would recognize themselves in our area. Coming from the industry side myself, I know that predictability and stability around these policies are important. We are basing our policies on well-tested policies from other universities, that we are not just inventing something ourselves that we will have to debug over the next year, but starting again using the partnership model, starting with what we consider to be the best policies in the world in these areas and modifying them so that they come within the Russian legislative framework. The feedback I get from that is very positive.

E. Crawley:

With regard to IP, which is an important issue to industries working with universities, we are pushing the IP policies of Skolkovo Tech down with the money to the Russian participants, which is to say that the universities or research institutes will own the IP that is associated with the funding that we provide, which gives much more clarity than is often the case in Russian experience.

Let me just say a few words about some of the other activities of Skolkovo Tech. We are already working very hard at attracting students because, as you point out, students and professors are the real core of a university.

We have admitted our first group of 21 students, who will start their academic programme this August by going to MIT for a workshop in innovation. They will be joined by other students from MIT and around the world. Those students will then go off to MIT, to Imperial College London, to ETH Zurich, and to the Hong Kong

University of Science and Technology, where they will spend an academic year learning about both their field, either information technology or energy, and innovation and entrepreneurship. They will return in the summer of 2013 to Skolkovo, and will help us design the education programme.

This is using voice-of-the-customer techniques to engage students and help them to understand how to engage with us and design the education programme. We have recruited our first group of faculty members – the first virtual faculty: 11 scholars from around the world who are helping us design our policies, review the incoming students, and to interview faculty.

We have created an innovation support programme for universities and institutions around the Russian Federation to accelerate their transition of new technology to new products and services.

There is a very wide front of activity going on at Skolkovo Tech. We are trying to achieve a very high clock speed in this cyclic process of designing the university. We invite you all to participate and to learn more by going to our website. In particular, let me remind you one more time that on July 9 and 10 at the business school in Skolkovo, we are running the research proposers' workshop, to which you are invited. You can register online, and you can learn much more about Skolkovo's research programmes and meet other people who are potential collaborators in those programmes.

Thank you for your attention.