ST. PETERSBURG INTERNATIONAL ECONOMIC FORUM

JUNE 16–18, 2011

TRAINING ENGINEERS: BUILDING ON FUNDAMENTALS OF RUSSIA'S ECONOMY

Building Russia's Creative Capital

JUNE 18, 2011 — 10:00–11:15, Pavilion 5, Conference Hall 5.1

St. Petersburg, Russia

2011

Since the inception of the ‘end of history’ school of thought, the supremacy of the post-industrial world over the industrial worlds seems no longer obvious. The economies that are recipients of high technologies are consistently experiencing higher growth than their developers. The fundamental requirement for this trend is the existence of a highly skilled workforce, especially qualified engineers, whose numbers have declined in Russia in the past decades.

Moderator:

Vladislav Inozemtsev, Director, Center for Post Industrial Society Research

Panelists:

Dr. Elhanan Abramov, Chief Executive Officer, Baran Engineering

Gu Binglin, President, Tsinghua University

Vitaly Klintsov, Director, McKinsey & Company Moscow Office

Edward Luttwak, Senior Research Associate, Center for Strategic and International Studies

Sergei Nedoroslev, Chairman of the Board of Directors, Kaskol

Alexander Nesis, President and Chief Executive Officer, ICT Group

V. Inozemtsev:

OK. Good morning ladies and gentlemen. We are ready to begin our session about the prospects of engineering education and the future of the Russian economy. I will just introduce myself. My name is Vladislav Inozemtsev. I am Chairman of the non-profit research organization called the Centre for Post-Industrial Studies. And I am chairing this session today.

I would like to begin with the problem of engineering education and the problem of the engineering renaissance. There is a big problem that is closely connected with the challenge of Russian industrialization, because as many of you know, industrial production in Russia fell much more than the GDP during the years of market reforms. And still, until now, it has not exceeded the amount of industrial production that was reached in the early 90s at the end of Soviet era.

What is happening here in Russia is a decrease in people's economic well-being, and a loss of disposable income, which comes not from increasing industrial production in China, in India, in East Asian countries and elsewhere. It comes mainly from under-investment, which was a serious problem in the 90s and which remains a problem now.

Russia invests in the industrial sector. It invests less than 20% of its GDP annually, when China for example invests a little bit more than 40%. The majority of newly industrialized countries invest around from 32% to 36%.

So, this is a big challenge for Russia. Except for several branches of industry, our industry in general is now in constant and prolonged decline, and during the 1990s it was clearly visible that the demand for engineers and the demand for highly skilled workers was declining greatly.

Today, the situation has reversed a bit. And here in St. Petersburg we want to discuss the possibility of reversing this situation to a much greater degree. We want to discuss the experience of engineering education here in Russia, and we

would like our partner countries in China, in Israel, and in the United States of America to propose some possible solutions for the deep crisis we now have in our engineering sphere.

I will stop here because I am not a profound specialist in this issue. I am just a political technologist and writer who covers industrial politics and industrial policy in Russia.

And I will give the floor to Mr. Edward Luttwak. Professor Luttwak is one of the best known American strategists, who has authored a couple of books on the industrialization of America, warning about the dangers and challenges of radical transformation to a service economy, to a financial services economy.

And I will ask him to share his views about the engineering profession today. How important should this profession be in a modern industrialized society? And what are the other dangers of industrialization? Mr. Luttwak, the floor is yours.

E. Luttwak:

Thank you. I am actually by origin a military strategist. The reason I was forced to look at this problem starting 20 years ago was because in American society, not only because of rational economic decision-making, but also because of a cultural attitude, there arose a kind of empty industrial culture. And this empty industrial culture resulted in a huge exaggeration of the possible role of what is called in English 'services'. Financial services, human services, you know, all kinds of services as they are called.

I started looking at the statistics and the first thing I saw immediately was that the actual wages for industrial workers doing apparently boring old industrial work at that time, 20 years ago was, let’s say, around USD 20 per hour minimum, from USD 20 to 40 an hour.

And in the service industry there were two or three people who became big millionaires in finance, but most service pay was very low. Why was it low? Any economist can tell you in two seconds that it was because actual productivity was very low.

But in the whole structure of American society, you have politicians who are lawyers. Then you have corporations, including industrial corporations, whose heads were lawyers, accountants, financial analysts. There was a complete lack of, let us call them industrial-minded people, running the companies.

This resulted not in rational business decisions, but in a kind of cultural of post-industrialization. Everybody talks about the post-industrial. Now, personal individual consequences were felt in the statistics of income and wage. Then you have municipal results, city results.

Today in Russia, I know that there are cities in Russia, small cities, medium cities, which are in horrible condition because of industrial decline. Well you are not alone in this.

There was the same problem in parts of the United States and most severely in parts of England. There are areas of Northern England that have become post-industrial deserts because the industry disappeared, and instead of having wonderful services you have actually welfare state parasitism, people not working at all.

Now, while working on this, I am also a businessman. I am Chairman of an aviation leasing company. So every day I deal with Boeing, Airbus and such. And imagine my experience watching as Boeing developed their 787 aircraft, the 787 Dreamliner. What is Boeing today? Actually, it's the biggest American single industry company. Of course, General Electric is bigger, but they are in a hundred fields. Boeing is an aviation company, military and civilian.

What is the 787? It is the single biggest aviation programme in human history. So I am meeting these people and they are telling me, "Oh, we are so modern. We are not going to build this aircraft. We are not going to manufacture. No. We're going to conceptualize it. We are going to plan it. Then we will market it. But the actual production we're going to outsource. And it will be done by foreign partner companies".

Moreover, to reduce the expenditure on research and development – this is called risk sharing; the term is risk sharing, which means that now you do not just go to a foreign company and say, please make this wing for me, but you say, design this wing. You do the research and development.

So, the Boeing aircraft company, which occupies a monopoly position in a very important American industry, which is the source of a great deal of exports, they decide that they will outsource the entire production of the world's largest aviation programme in human history.

The second decision they made, a wonderful decision, is instead of using boring aluminium, they should use carbon fibre technology. So, lawyers and accountants decide that carbon fibre is better than aluminium. If they haven't talked to a carbon fibre person, then they say, look carbon fibre is wonderful, but it's not yet ready really for mass production. It is more for semi-artisanal production.

I know a lot about this because my son makes, produces, designs and sells musical instruments made of carbon fibre. So he is suffering every day from the thing.

So the first decision is, Boeing, the world's biggest aircraft manufacturer will not make the aircraft, but will outsource. Second, use a new technology chosen by non-technologists who make the decision because they told them that carbon fibre is lighter. That is true. It is true.

The third decision they made was that they would combine these two technologies with the outsourcing under a whole new management model.

And when you look at the management model, you realize that it consists of this, instead of stupid, boring engineers you have people who talk much better who are lawyers and financial analysts, they really run the company. The result is three years' delay, hundreds of problems, billions of dollars of penalties but, the Chairman of the company was not replaced.

If I make a mistake like this, my shareholders fire me the next day. He is still the same guy, still there. OK? The biggest industrial failure.

Now what is Boeing doing today? One, instead of outsourcing, they built two factories in the United States in addition to the old factories in Seattle, North Carolina and South Carolina. They are going back to production. They're going to make the damn aircraft themselves in their own factory.

The only part they leave to be produced abroad is the only part that had no problems, Japan, Mitsubishi. They had the wing, they do the wing. Fine, everything else did not work.

So they have gone right back and had to unlearn all the wonderful things. Now, when you look at this phenomenon, you are not dealing with actual rational business decision-making. You are dealing first with a set of cultural attitudes.

You have the same phenomenon in England.

In England, decision-making power in politics is in Oxford and London, and economy and finance is in the city of London. And they decided that England did not need all this boring, noisy, polluting industry in Northern England. And the result is that it has become a wasteland.

OK. Now the conclusion. The conclusion is that first of all, in the English language and in the Russian language, maybe we have to stop using the term 'engineer'. An engineer is somebody who operates an engine.

Actually, we have to educate an applied scientist. Applied scientists are people who take science and they make things with it like the Chinese term would be.
The second thing is to accept the fact that we have to find a way to make the cultural status of the entire enterprise much higher. This should have an effect within companies.
And thirdly, the American example once again is that Americans do everything right once they have made every possible mistake. And now General Electric, Boeing, everybody else, all they talk about is production, engineering and industry. Thank you.

V. Inozemtsev:

Thank you, Professor Luttwak. Then I will turn to Mr. Sergei Nedoroslev, who I believe will introduce his vision about the importance of engineering education in Russia and argue if it is possible to convert the high-quality of Russian engineering education into a competitive advantage for Russian industry and for the Russian economy?

S. Nedoroslev:

Hello. Thank you very much for this opportunity to speak before such an esteemed audience. I would like to talk about three things. One: what are the challenges for Russia regarding the education of engineers? Two: how important is the engineering element in industry, enterprise building and product development? Three: can we compete in this market? That is, can Russia compete? We do not have any slides today, but there are more pictures, so I can probably speak here in my own words: the main factors affecting engineering today – that is the fourth topic. Under globalization, advanced manufacturing technology is becoming ever more accessible. Professor Luttwak spoke very well

on this topic. Mitsubishi makes wings for Airbus planes in Japan. Many components are made in America; Europe has generally consolidated the production of the aeroplane, in which many European countries have come together. In fact, this is the Airbus. So, we need to recognize that technology is becoming global.

In addition, evidence of the turnover in technology is not only in the aviation industry, but in all areas of human life. Take a look at your mobile phone. Probably 50% of you have an iPhone, the rest have smartphones and almost nobody has a small, simple Nokia. Phones are being replaced ever faster. We await the release of new products every six months. Design and construction software programs are developing fast, an area where, in fact, over the last—I would say—10-15 years, a revolution has taken place, unnoticed by anyone outside the field. This has enabled such an increase in engineering labour efficiency that it is discernible in every single product. Any product: a razor to shave with, the bridge that you can see, are products of those same software products that are changing very fast, and becoming an effective development tool for the creation of both products and industrial enterprises.

Since globalization is an unavoidable process, and since we are always talking about it as a positive, we should understand that in a global economy there is increased competition. In India, China, Russia, Brazil, America and France, people are already competing in a kind of virtual environment. The physical place where they are sitting is becoming less important, because they are competing in a global market. That very Airbus that we referred to is a company that is very tough with its tenders and commodity prices. When participating in their tenders, a company never offers advantages just because there is a cheaper labour force somewhere, or some other conditions, but only offers a price for the whole engineering package. So there is almost no competition within regions, and

competition has taken on a global nature. The further development of industry has led to the emergence of a trend: an increase in the demand for qualified engineers. If we compare the building of a bridge some 50–100 years ago, a fairly basic knowledge was adequate, whereas today it is almost an art. Basic engineering work means less and less; a library of programs, standard solutions and a powerful set of tools allow not only an engineer, but also, say, an artist to use standard solutions. It follows that we have less and less of a need for standard engineers with standard qualifications. Yet overall, the demand for engineers, in terms of numbers, is growing, and it is already inevitable that there will be a shortage of qualified engineers in the future. In Russia we are watching this very carefully.

Russia is competitive in comparison with developed countries. We are in the top-five developed countries in terms of population with both higher and intermediate level of technical training, and we have built the basis for this over many years. Nonetheless, there is a huge shortage of engineers in industrial enterprises today. In construction in particular, there is a great shortage of engineers that can build industrial corporations, and not just develop products. Due to the increase in the complexity of these products, narrower, deeper specialization will be needed in all fields in future. Even in today's world of narrow specialization, ever greater significance is attached to certain fields.

I think that the status of engineers in society will probably rise in the future, as will the level of pay for their work. Perhaps in Russia, engineers will achieve the status they had 100 or 70 years ago, or in fact, I would say, still had 30 years ago. Engineers have always been highly valued in Russia. I had prepared a picture that clearly showed the different contributions to creating a product, but unfortunately I cannot show it. The contribution of an engineer to creating a product is, today, between five and seven per cent, which is not much, so

materials, labour costs, overheads and other expenses amount to 95%. Yet, today the products of engineering, and their competitiveness depend roughly 70% or, perhaps more (these figures, as you know, can never be absolutely accurate) on engineering solutions. Once again, let us turn to those products that we have in our pockets – iPhones and other engineering solutions. It is their designs that you bought them for, not for the number of megahertz; that is secondary. So, a maximum impact engineering solution can be demonstrated in high-tech products, showing why engineer training is so important. In Russia, we are currently experiencing the following two difficulties when training engineers: firstly, Russian education is quite traditional, which may be to its advantage. For many years it was good, thorough and conservative. Yet in a changing world with changing needs it cannot change quickly, due to its conservative and classical nature. We do not have lots of smaller, state-funded schools, like in France or Switzerland. We do not have the numerous private technical schools that they have in America. We currently have inadequate feedback from large companies on the training of qualified engineers at special institutes, despite an improving trend. As a result, we are training lots of narrow specialists that are not needed. They are then retrained within the companies, so they are doing double the work. Such poor feedback does not enable us to take quick decisions on changes to courses and study programmes.

Now for the second question: can Russia be competitive? It can! Russia is already competitive. This is confirmed by a range of changes both in the industry and in training engineers. For example, we built a competitive engineering centre in Moscow, together with Airbus, where the very latest products are developed. Airbus, Motorola and other companies have large bases here, which give young people an incentive to go and study, and get a grasp of engineering art. So, why is there still a big problem? We have, no doubt, talked a lot at this Forum about

the fact that, unfortunately, the structure of the Russian economy is, to a large extent, still resource-oriented today. This means that non-engineering industries that manufacture products with low added value have, today, a greater significance for the economy, and so the level of pay there is very high. I do not want to say that the position on the global markets is the same, but to draw a comparison with engineering resources. However we might condemn it, today, the salaries that pull away talented people preparing to enter engineering departments are dropping significantly, and these people go off in different directions. The same applies to the financial centres and financial engineering, and I would like to note that today, financial engineering and work at investment banks, and in many other places, brings in ten times more money than real engineering. In my opinion, the global economic crisis has shown that this is not the correct evaluation of the work of financial engineers and of technical engineers. I believe—and the previous speaker said a lot about this—that in the future this bias will be redressed, and that we will view Russia's position optimistically.

V. Inozemtsev:

Thank you. So, I want to go further, and since the two previous speakers stressed the issue of competition and competitiveness, and also the problem of education, I would like to go further and give the floor to Mr. Klintsov, Vitaly Klintsov, who wanted to speak predominantly about the problem of Russian education and what can be done in this particular sphere, in comparison with engineering education in other parts of the world. So, Mr. Klintsov?

V. Klintsov:

Thank you very much, Mr. Vladimir Inozemtsev. I would like to thank you for the invitation to speak before so many experts; it is an honour. I would like to begin by setting out my objectives. I believe that Russia should build the best engineering education system in the world. This is a very ambitious goal, but it is an essential one that must become a strategic imperative for Russia, because if we do not meet this challenge, we will not be able to meet the many other challenges that we face today: modernizing the economy, economic growth, improving living standards and resolving a great number of others. Therefore, creating a forward-looking system for engineer and technical training is the most important goal.

This is a challenge that, from a management point of view, is also one of the most difficult, because despite the fact that we are starting from a reasonably good level, the trend in recent years is far from ideal, and building a system of engineer training requires considerable effort, a large budget and a lengthy time frame. Nonetheless, it is crucial that we achieve this, and I would like to highlight a number of priorities in order to do so. The first priority is the quality of education. We must not compromise on the quality of education. At present, the quality of engineer training in Russia varies – there is a very broad spectrum. We have a number of universities whose graduates are not only falling short of the needs of industry, but that generally fall short of the quality that we expect of engineer training. One of the problems here—and it is not very nice to talk about, but I must say it—is corruption in the education system. Of course, corruption exists in many countries, but corruption in the education system—a relatively rare phenomenon involving buying diplomas and grades from engineering and medical institutes—is something we invented. I am ashamed, as a Russian, to say this, but it is our biggest challenge. We must resolve this problem and we must fully root out corruption.

The second challenge that we are talking about is the quality of degrees, the transparency of degree quality. Any graduate engineer that has been awarded a degree must, in 100% of cases, be highly skilled. We must not allow someone to obtain a degree, go out into the job market and then... The quality of a degree and the quality of education define career opportunities all over the world. Can you hire him? Is he needed in a given area? Maybe he will arrive and develop something in aircraft construction or the petrochemical industry, or maybe he will not be able to do so, because he does not know the basics. The quality of degrees is varies considerably today, and often a degree is not a guarantee to a company that they are getting the specialist that they need. So companies approach them saying, ok, fine, a degree. I will not go into more detail or focus on how to achieve this result and how to approach the requirements. I have my own methods for this, but we could have state accreditation, there are a whole range of good tests that can verify qualifications, knowledge of physics, technology and so on.

Transparency is also very important in the education system. How do we know which universities are good, which are ok and which are very good? Not overall, in general, but in each subject area? As soon as that information becomes available, each university, and the entire education system, will have a serious incentive to improve the quality of tuition. If we can measure quality, then we can say: there, that is the best institute. If you want to become a chemical engineer, you need to go here, it is the best. If you want to become a research physicist, then you need to go there. Then you will know that theoretical physics is taught better here than there, and that will be a big step forward.

What would I say was the most important factor in education? It is in fact the quality of the teachers. Why was Soviet technical education so good, and how did it allow the Soviet Union to take such 'leaps forward' in so many

technological industries? Yes, it was because of teaching, and teaching at higher education institutes was incredibly prestigious, it provided good social security and we had a good social standing as teachers at higher-education institutes. Today, this work is not as attractive, and, if you have the opportunity to do so, you may go into financial engineering or even just engineering. And here we will have to spend resources.

Now, finally, the last thing that I would like to mention: we cannot fully hand this task over to the universities, we need to view university as a link in the value chain from school and into industry, the academies and beyond. I will begin with school. It is a matter of fact that many students need to work in order to study. If you study some kind of soft science then that is possible, but if you study physics or technology it should not be allowed. You cannot seriously study engineering at a globally competitive level and also work somewhere! It is not possible! This is why the state, industry and business must all resolve this problem together. How was it previously? I really liked the way the Moscow Institute of Physics and Technology used to work. It was like a physics and technology 'funnel', which brought gifted students from across the country, through specialized physics and mathematics schools, televised competitions and school olympiads. You understand, of course, that not every student can go and become a good engineer, you need a gifted student. If you were not taught mathematics in secondary school, the university will not be able to do anything, it is already too late. Some people cannot, conceptually, master mathematics. There is nothing terrible in this: some people can, some people cannot. So it is very important to find gifted young people at the early stages, get them involved in the education system and then support them. I would say that if you have a talented, gifted individual who is not in Moscow, but far away, and is not well-off, you should create the right conditions for him, so that he can become a good

engineer. And here the state must play a major role, as, of course, must business.

The last thing that I would like to mention is the collaboration between business, companies, industry, academies and the state. This is a very important alliance. Why? Because we are seeing a trend all around the world of industry and companies being involved in education. Because it is the only way in which they can obtain highly-qualified graduates. If we talk about research activities, which are, of course, strongly linked to education, manufacturing and engineering, here is very big topic concerning joint laboratories and processes. That is the nature of this process. It is a separate challenge in itself, and today many countries around the world have accumulated great experience that can be learnt from and applied in Russia. Thank you.

V. Inozemtsev:

Thank you so much. And now I would like to turn to our guest from China, Mr. Gu Binglin, because everybody knows that the Chinese economy has done very, very well in recent years and that China has already become the manufacturing stronghold of the world.

Now, the Chinese leadership and the Chinese government is resolving a new issue, or the next issue, I should say, to convert China from an industrial powerhouse to a place that is the home of most innovative technologies in the world, and how they will succeed really, I think, depends on the future of the global economy. So Mr. Gu Binglin, the floor is yours.

G. Binglin:

Thank you. Ladies and gentlemen, good morning. It is my great honour to be here in St. Petersburg at the International Economic Forum. I will share with you some of our viewpoints about engineer training.

Since time is rather limited, I will focus on engineering education in China. As the second largest economy in the world, China is now generally recognized as a large manufacturing country. Forty per cent of total GDP comes from the production industry.

It is expected that China's industrialization period will continue to the middle of this century. So, it is not difficult to imagine how important engineers and engineering education are for the development of China.

Today in China, about 90% of universities have engineering disciplines. Roughly one-third of the total undergraduates and graduates in university are in engineering programmes. There are about 3.7 million undergraduates and 470,000 post-graduate students studying engineering at Chinese universities. The scale of China's engineering education has become the largest in the world. It is now the biggest challenge for China to improve the quality of their engineering education.

What is the meaning of quality? In the world, there are generally two engineering education systems: the European model and the American model, roughly speaking.

The formula is for training students in the practical ability for production and problem-solving, and then later towards the students' overall quality and innovative ability. China's higher education in engineering started in the 19th century, when the American system was adopted. But after 1949, China learned from the former Soviet Union and copied its engineering education system. Universities in China were training practical engineers as their major responsibility.

The training programmes became more similar to the European model. After the opening and reform of China in the late 1970s, the rapid development in China required engineers in higher positions to have both good overall quality and a strong practical ability.

So, how to help engineering students to acquire both comprehensive quality and practical ability has now become the critical issue for China's engineering education. As a matter of fact, China's universities are taking various strategic measures to tackle this challenge.

These measures can be summarized with three capital Is. They are: Interdisciplinary, Integration, and Innovation.

'Interdisciplinary' means to provide future engineers with a broader knowledge base, enabling them to tackle increasingly complicated engineering problems while considering the importance of broadening the engineering discipline. For example, we expand the thermal engineering discipline to areas of energy and environmental studies as well.

We promote interdisciplinary interactions among engineering, life science management, economics, and so on. Besides this, courses in humanity, sciences and the arts are introduced into engineering programmes to strengthen their all-around quality.

By 'Integration', we mean the integration of resources from university and enterprises, both at home and abroad. To develop stronger practical abilities and the global vision of our students, various measures have been taken. For example, universities have established joint research institutes with international companies in building strategic cooperative relations with national key industries such as power, railway, and aerospace. Universities also run programmes for a Master's degree of engineering for industries and set up practice work in enterprises.

As for international resources, China's universities have established many international joint top-notch universities around the world. Some major international foreign seminars on engineering training have been held in China for years.

Innovation means to emphasize training of the student's innovative awareness and concepts in sustainable development. We believe that future engineers should not only be rigorous executors, but more importantly constructors with innovative capabilities, and considerate of the concept of the harmonious development between nature and the whole. Only in this way can they adapt to and play a leading role in the constant innovation in procedures of science and technology and development.

Just a year ago, in June 2010, the Chinese government launched an education and training programme for excellent engineers. It stated that the programme aims to meet the needs of industry, the world, and the future development. Since then, Tsinghua Chinese University has been developed to be the first group of universities to participate in the programme by means of deepening cooperation with industry, promoting international cooperation, and fostering innovation ability.

Reform in the engineering education system was launched so as to ensure that a larger amount of qualified engineers can be trained who can meet the demands of industrial development in China and help the country to change from being a large manufacturing country to an innovative country.

This is just a brief introduction to engineering education in China. We are really looking forward to establishing a close relationship with Russian universities and industry in this area. We do hope with our joint efforts that we will be training more excellent engineers for the advancement of science and technology. Thank you very much.

V. Inozemtsev:

Thank you, Professor Gu. This time, I would like to turn to a practicing leader and chairman of an engineering company, Dr. Elhanan Abramov, from Israel, to address the issue of the challenges and problems that engineering companies are facing in different parts of the world, parts of Israel and Europe and the United States and Russia. So Mr. Abramov, please share your experience with us.

E. Abramov:

Thank you. First, I would like to thank the organizers of this Forum and especially the organizers of this panel, for their initiative and for the honour to be here and to speak with you about this very important issue.

I am not going to talk about the Baran Group and what we are doing; this alone would take a few hours. But since I am going to base my comments on the comparison of what we are doing in Russia relative to other places in the world, I am going to give you a few facts.

First, we work all over the world, in about 12 countries, as local companies and in some cases as offices. We serve as a one-stop shop for the global supply of engineering technology and construction solutions.

We execute projects from basic ideas to completion, mainly aspects of engineering, procurement, construction management, and project management. In some cases, we serve full turnkey project delivery. Working for over 30 years, we have completed more than 1,000 projects with 250 customers.

But more important for me is to talk about our experience in Russia. We have been active in Russia since 2002, nine years ago. We operate as a local company. We have a company here based in St. Petersburg. It is based on our

international know-how and experience and procedures that we have brought with us while working here.

We execute mega-projects with a great emphasis on implementation of foreign technologies, using both know-how from other countries and local capabilities here. Most of the projects that we undertake are very complex, needing the use of foreign engineering companies, technology providers, and equipment supplies from all over the world.

We have Israeli engineering teams that sit in Israel and do some of the work, and we have local design and construction firms, of course. And all this has to be managed, and this is very relevant to what I am going to talk about here.

One of the most prestigious complex modern projects that we are doing is in Tikhvin, not very far from here. It involves a lot of modern technology, a lot of modern suppliers from all over the world, and it is almost in the completion stage.

What we have learned from our work in Russia, and you have been hearing a lot about some of this during the last few days in this Forum, first of all, we see this as a very hot and promising market for industry.

We have on one side, a state policy for import reduction, meaning more production here in Russia, a lot of investment for modernization of existing industries, and as you have heard in the last two days, a lot of progress on moving from raw materials to end product, which needs more industry and more industrial capabilities.

Most of the projects can be characterized as having a very significant input of foreign technologies and know-how on one hand, and on the other hand, you cannot do it without local capabilities. You need to understand local standards. You need to understand local regulations and how to work here. So these two, in some aspect, seem to represent a conflict, but for us, it is an opportunity.

And we think that it all comes down to engineering management. For these kinds of projects that have a lot of different suppliers and a lot of different designers from many different parts of the world, the key issue is how you manage the engineering teams, how you manage the integration, and this was also mentioned by my Chinese colleague. Integration is very important.

A broad basis of engineering knowledge is very important. You cannot be very specific in your knowledge. You must understand more than a few parts of engineering. And this is what we have found out.

There are many good things that you can find here. People here mentioned a strong background in engineering, but I am not here to talk about the good things. I am here to talk about the problems. By the way, without problems, we will be out of business. So this is what we do. And I have divided the problems and the gaps that we see into two different categories.

On the one hand, these are the basic gaps in what is needed for the designers and for the quality managers and about the systems. We see a lack of multidisciplinary design capabilities. There are very good design institutes for very specific areas, but they are not very good at integrating them.

We see a lack of overall quality management of designs and not enough systems and tools to make these kinds of designs. Just to give you an example, in Israel, we run big projects for the refinery industry and we have on our desktop designs made in Italy, in France, in the US, and in Israel, all on the same system, and we could not find these in many design institutes here in Russia.

The other level that we see that is more challenging and more difficult to achieve is high-level engineering, meaning integration of coordination between many different design teams, many different suppliers of know-how and technology suppliers, and system engineering.

Actually, if I look at what we are doing here with these mega-projects, they are not projects. They are programmes. Each one of them contains actually few projects but with one target, and we need to integrate all of them.

The keywords in the world today is the holistic approach to project management, system management, programme management, and we are very strong in this and would like to offer these as solutions.

Before we talk a little bit about what we offer as a solution, let me spend two minutes to explain that, for us, this is not a new problem.

As many of you know, during the early 1990s, a lot of engineers from what were Soviet Union countries arrived to Israel. The Baran Group identified the potential in this population, and we established a programme together with the government of Israel to train these engineers and to upscale them to, first of all, western standards, and then all these things that I was talking about, interdisciplinary design, coordination, project management, quality management.

So we did this less than 20 years ago. It was a very successful programme. It has enabled the more than 1,000 engineers that we educated to get very good jobs and high-quality jobs in engineering teams. Two hundred of them are still working with Baran. One more slide.

First of all, as has been mentioned before by a few of the other speakers, we need the involvement of the government, the private sector, mainly industry, and academia. Without these three, it cannot work.

The main idea is that the engineering companies do not have any machines, any IP, our intellectual property is our people. So the idea is to improve the human capital and the idea is to conduct training that will do all of these: staff project management, software and tools.

We do not want it to be just theoretical studies. We want to base this education on practical experience on case studies, on successful stories, stories of failure, in order to reach the goal.
And the goal is for 21st century engineering in Russia to lead to a significant impact on the business for the company and for the performance of the company. Thank you very much. Spasibo.

V. Inozemtsev:
OK. Thank you, Mr. Abramov. So we now have between 15 and 20 minutes left for the discussion, so I would like to give the floor for short remarks to two of our participants who have already expressed their interest in speaking.
The first will be Nikolai Dobrinov. Do you have a microphone?

N. Dobrinov:
Thank you, Mr. Inozemtsev. I would like to bring a little spice to today's discussions, because it seems to me that the speakers are very politely talking around the problem that has developed in current engineer training for Russian industry. In addition, we must remember that, whatever we might have wanted, Russia's future is to be a fast developing industrial country, with the emphasis on industrial. In our experience, that is the experience of a company that has previously and is currently implementing a number of industrial projects in Russia, I can say that the engineer shortage in Russia is close to being a disaster.
If we are talking about industry and engineers that actively use working equipment, the situation is more or less OK. But, if we are talking about the people that should be building new enterprises, people that are qualified and capable of doing that professionally, they simply do not exist. In addition, the

current system of technical training does not, at heart, train such specialists. There is not one Russian higher education institute that trains such specialists. Accordingly, when we talk about reforming technical training in Russia—and it goes without saying that it is a complex and difficult tasks that should involve everyone, particularly the engineer training sectors, we should remember that many technical institutes need to create the departments that would train engineering specialists from scratch.

And the situation is more than a bit messy: state reforms of education are a long-term task, although, if we are optimistic, they can be carried out within five years. If we are pessimistic, they might be dragged out for a long time. The economy, on the other hand, cannot wait. This is why I would like to bring attention to the previous speaker, who described a situation that is a little bit like ours, where former Soviet engineers ended up in the western labour market and had to, in fact, retrain. We were shown, for example, that by using similar experience, it could be possible to attempt to resolve the shortage of suitable specialists today in just a few years. How could this be done? It could be done through some kind of training institute of our own. I do not want to say that it should be a kind of advanced training course. Who would be the students of such an institute? Firstly, of course, existing managers and technical leaders in today's industrial enterprises who can still learn something, and who simply need to study the basics of what we call contemporary engineering, at least so that they can be professional clients to those western engineering companies that are prepared to come to our country. Secondly, future managers of Russian engineering companies, because relying on the help of western engineering companies alone is, at the very least, naive. There is one more category of students for this training institute, a more serious one in our opinion: current graduates of technical institutes. These graduates, having perhaps worked for a

year, or two, or three in industry, will have understood the need to undertake further training thanks to their work. And, of course, copying the study programmes that exist already, excuse me, on the other side of the border. A fairly streamlined system for training such specialists has emerged throughout the world, and I have no scruples about saying that if we even just copy what exists around the world, if we take on that best practice, this would allow us to solve the problem.

We are directly involved in the implementation of industrial projects, and we therefore have realized that, without waiting to see whether we will have a partner, or whether no one will participate in the implementation of these programmes, we, by our own efforts, our own funds, and with the participation of western technical institutes and the participation of western engineering companies, are attempting to create that school of engineering. I hope that we will succeed.

V. Inozemtsev:

Thank you, Mr. Dobrinov. The second person who expressed interest in speaking on our panel today is Mikhail Rogachev, who is unique in that he is working and acting both on the side of private business and the side of the government, the state agency responsible for innovation. So, Mr. Rogachev, please.

M. Rogachev:

Firstly, thank you for the invitation to this session, although, judging by the numbers in the room, I am not sure that it has attracted as much interest as other topics. I would like to return to the programme that we had here: the industrial 'leap forward' made by China and Brazil, and their influence on long-

term trends. I would like to note that our Chinese colleague said that this is a long-term trend, and that we must compete with them.

Moving on: ways to attract foreign technology. We are compelled to compete, because at present we have overlooked what we call the technology package, which we are already having to buy from foreign companies. Incidentally, we do not have the experience that would allow us to introduce that into our businesses and systems. At the same time, I would like to focus on the fact that the experience of various countries—Israel, China and of course America—allows us to hope that we can nonetheless solve this problem if the industry leaders that need to be involved can apply it. For example, at present the ICT Group has set a challenge, and they will need it, they must somehow meet that challenge. If industry leaders were to set this task, then it would be resolved.

When I worked in commodity companies, my colleagues and I decided to solve our problems by, if you will excuse the expression, stupidly copying western experience and creating replicas of western engineer training programmes for our engineering companies. It does not take very long, you simply need to create precise assignments, and in the meantime I could hope that the problem or engineering personnel could, from my point of view, be solved. In this case we were led by American experience. I have often heard complaints from American universities about the terrible, simply dreadful, quality of American school education that means students cannot gain entry to higher education institutes. There, on the contrary, they love Chinese students that get into American universities. Nonetheless, they have created a system that enables them to form fully capable engineers from not very gifted material, and I cannot agree with Vitaly Klintsov here. The Moscow Institute of Physics and Technology and all the other so-called 'funnels' are good for training unique specialists, whereas engineering, especially under current conditions, must become not a

unique, but a standard profession. Ten years ago a system programmer was also considered a unique specialist and was well paid. However, the industry has now developed methods to quickly and successfully train such specialists.

In conclusion, I would like to say that the state—and I currently represent a state company—was concerned by the lack of trained engineers, but that the principal problem is not, in fact, the shortage of professors and teachers. Today's engineer must have work experience, he must have experience of manufacturing and must be able to turn a screw himself, he must, as in the past, be at work and try something out. Unfortunately, the Soviet Union's work placement system has been practically destroyed, while the new companies that are now entering the market are reluctant to let unfamiliar students into their facilities. For their students there are such programmes. This is why the national research universities programme was created (27 programmes are already running). The task of the programme is to find the path, methods and solutions for training qualified engineers. St. Petersburg State Mining University is one good example. It has, at least, resolved the issue of salaries for the professors and teachers that train engineers. The salary is in the region of RUB 150,000, which gives real hope of returning some status to the profession. Nonetheless, I would like to note that the task has been set, and that at this Economic Forum has even been given its own session. I hope that it is quite interesting and that it brings hope that the state and companies will find a common denominator and move in this direction.

For my part, I fully support the ICT Group's initiative to create a school, and our fund will offer financing. We have already considered the possibilities of complementary programmes, but here, I believe that we need to bring in higher numbers and more of those people that are truly interested, like Mr. Nedoroslev

and his group, because the problem is not just for us to solve, but for the entire country. Thank you.

V. Inozemtsev:

Thank you, Mr. Rogachev. I will give Mr. Shmatov, the Rector of European Technical Institute here in Moscow, an opportunity to speak for a short time.

M. Shmatov:

Thank you very much, Mr. Inozemtsev. A little bit, one minute. Thank you very much for giving me the opportunity to speak. The European Technical Institute has long been involved in personnel development in the Russian language, and in general we work in raising the competitiveness of Russian engineering and technical personnel. We also work with a round table of industrialists.

I very much enjoyed Mr. Klintsov's contribution, which described what to do. I would like us all to understand how to do it. The issue of copying engineer training must not, in any circumstance, be linked to competitiveness. This is something we must understand. Copying is hardly competitive. You could say that we can pick and choose the best. Regarding the way to solve problems in business, Mr. Abramov had a table for this. Business cannot resolve the problem of retraining specialists without state involvement and without the involvement of higher education institutes. There is currently a terrible problem with our higher education institutes. What are we doing for many European companies? We take students and fill them with systems thinking, business processes, management and language, which is what Russian engineers do not know. So that must be what business needs. If it was business facing this problem, then there would be a lot more people here.

We spoke at the Industrialist's round table with Mr. Chubais and eventually a question was raised about what we need to do, not only in raising the level of

training in business, but tackling the existing education system, the higher education system, because we still have it, although it is falling apart, and it is that competitive advantage which in the future could be Russia's key brand. We have always had good training for technical and engineering specialists. And here I have one small remark: think about who will be training these specialists in 5–10 years? We have thought about this, because we know that many people are taken in the West. Lots of people who leave for the West gain business knowledge there for companies that are leaving for Russia, while we need teachers here. I suppose to begin with it will be foreign teachers, but we need engineers here. So this is a very important question – the teaching staff at engineering and technical institutes. This problem must be resolved. We need to create a working group together with Mr. Katyrin from the Russian Chamber of Commerce and Industry and with Mr. Shokhin, and of course Mr. Fursenko, to consider this issue. Only a combined working group of this sort can solve these problems. Thank you.

V. Inozemtsev:

Thank you very much. I must finish here, because our time is up. To conclude I would just like to speak to Professor Luttwak, who spoke at the beginning about the need to rethink terminology and understanding, in particular the understanding of the word 'engineer', since the understanding of the word is linked to the English word 'engine'. At the same time we are narrowing the meaning of the word and downplaying the role of the profession and its people. I think that it is worth debating this, possibly outside the limits of this section, since the word 'engineer' came to European languages from the Latin word 'ingenio', and from the French word for 'a person who thinks up, invents and develops new solutions'. So this name comes from the mind, the intellect and

talent. In this case, in my opinion, it is very important to return that sense to the engineering profession and the engineer's calling, so that engineer training is linked in people's minds with talent, with intelligence, with innovation and creative thinking. Then, here, and in other countries that are going down the industrial path, the path of innovation, everything will be successful and it will all work out well.

Thank you very much to all those in this room today, thank you for your interest in this section. I am sure that the ICT Group's initiatives will be successful, and that their new project to develop engineering education in Russia will also be successful, because not believing in their success would mean not believing in the future of our country. Thank you again.