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ИСЧЕЗНОВЕНИЮ СРЕДНЕГО КЛАССА?**

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Модератор:

Саймон Никсон, Главный обозреватель по Европе, The Wall Street Journal

Выступающие:

Александр Галицкий, Основатель и управляющий партнер, Almaz Capital Partners

Д-р Фань Ган, Директор, National Economic Research Institute (NERI); председатель, China Reform Foundation

Хубертус фон Грюнберг, Председатель совета директоров, ABB

Симона Маринеску, Директор, Международный центр по содействию развития частного сектора, ПРООН (IICPSD)

Владимир Мау, Ректор, Российская академия народного хозяйства и государственной службы при Президенте Российской Федерации

Оздчан Саритас, Ведущий научный сотрудник, Национальный исследовательский университет «Высшая школа экономики»; Главный редактор журнала Foresight: The journal of future studies, strategic thinking and policy

Пол Эрик Шотиль, Управляющий партнер по региону EEMA, McKinsey

S. Nixon:

Good afternoon, everybody. Welcome to this afternoon's session: Will Technology Hollow Out The Middle Class? I am Simon Nixon; I am Chief European Commentator at *The Wall Street Journal*. We have a couple of members on the panel who are going to be arriving late, as you can see, but I will introduce the panel as we go along. To get our discussion going, I am going to turn first to Simona Marinescu, who is the Director of the UNDP International Centre for Private Sector Development in Istanbul. Over to you.

S. Marinescu:

Thank you very much, Mr. Nixon, and I would like to mention from the very beginning that this is the only panel that is joined by an international development organization, and we are very grateful for the opportunity.

Coming to the topic itself, I should, from the very beginning, mention that technology has helped the international development world to lift millions of people out of poverty. We speak today about 50% fewer extremely poor individuals around the world, so in 14 years, we have halved extreme poverty, and one of the ways in which that has been possible is with the use of advanced technology. I will just mention very briefly that introducing the better-than-cash initiative and helping poor people to become bankable using mobile banking, reducing the mortality of children using technology and early monitoring and warning systems, being able to promote distance education using technology – these are all important gains that technology has made possible, leading to where we stand today.

But just because we are joined by a series of economies here, I also want to mention that the growing inequality that we experience today is not only a given by the expansion of technology-based growth. In fact, for the last four decades there has been a massive change in the distribution of incomes globally and that was driven by a series of factors. First of all, globalization itself has increased competition in the marketplace, technological advancement has made capitals more expensive, and at the same time we

see a decline in power of unions to defend workers' rights and their financial rights.

That has led to a massive decline of the labour share globally and to an increase of the capital share. This is the first layer of inequality, let us say, between capital owners and labour suppliers. From the 70–30 ratio that we have all learned in school – those were the labour share versus capital shares – we are today at something like 50-50 in some nations, and even lower shares than that in other countries. We argue that this has been behind the crisis. Also, what has happened is that the decline in demand that labour suppliers were able to express has been addressed by central banks, making money cheaper and transferring consumption from pockets onto borrowing. This is still there.

Restoring growth right now needs to look into the redistribution of incomes with other ways of making it possible. We speak obviously about policies, about fiscal policies. We also speak about the important role that the private sector should play. Technology itself has created inequality between skilled labour and not so skilled labour, and I think that is an area in which we all need to look at with maximum attention and consideration. The skills gap is the main problem of the global economy today, or one of the most important problems, and as technology advances, and we all hope that will be the future, we see an important role for the private sector, for technology producers, to play in skills development. There should be a change in the governance of the education system, primarily vocational education as well as technical education in general, to give an institutional role to the private sector – to give the younger generation relevant skills.

That is something that the centre itself does, and I am honoured to say that most of the CEOs present here are from companies that are members of the UN Global Compact, which is a platform of the United Nations that works with businesses towards addressing development challenges.

Again we speak about the skills club. We also speak, unfortunately, about financing tools to promote further development and to address inequality, but I

guess that is something that other speakers will also mention. Technology will accelerate this space. What we need to make sure is that global systems are more inclusive of people. We have a global economy that is not as inclusive of people as we thought it was, and that is an area in which businesses should focus and business models should be changed to offer more opportunities to individuals. And when I say opportunities I am primarily talking about skills.

S. Nixon:

Thank you very much, Ms. Marinescu, for getting us off to a provocative start. Can I now bring in Dr. Fan Gang, who is Director of the National Economic Research Institute in Beijing, to give us a perspective from developing markets? Thank you.

F. Gang:

Thank you very much. It is a very challenging topic. If we have new technology which replaces or substitutes labour, I think the group that suffers most is not the middle class, but rather the lower class. China still has 70% of its labour force that is low educated and engaged in labour intensive industries. If those labour intensive industries convert to automation, that would lead to serious social and political consequences.

However, I think that technology is not something either low or high. I think there is a large spectrum in between. Think about other industries, including the low valued-added labour intensive industries. They can still be upgraded by new technology but use a lot of labour. And skills, of course, are important with this upgrading.

Here we are talking about the middle class. In China we talk about the middle income trap. For me, the middle income trap is this inequality problem. However, if we pay attention to middle technology, we should also pay attention to the high technology. We ought to apply and try to utilize high-tech in old industries to try to catch them up, but this is not possible for a developing country, which has just come out of the so-called 'low income

group', to have the capacity of high-tech innovation etcetera, so we have to go through this very large spectrum and the long process of so-called 'middle technology'. In terms of economics, if you earn a middle income by middle technology and middle productivity, it should not be a problem because you are still in the equilibrium and you can continue to move on.

I think quite often in developing countries people make the mistake of thinking we have got to have high-tech, high-tech, high-tech, but they do not have the capacity. They do not have the capability to have this high-tech and they give up all these so-called low-tech or middle-tech industries, without focussing very much on the gradual, or step-by-step, development of technology. You go through this middle-tech process and try to jump to the high-tech, and then you are not able to do so, so a lot of resources are wasted and a lot of jobs are lost.

That is why, I think, particularly in a developing country like China, we have a large population with 70% of the labour force being low-educated. We have to pay more attention to labour intensive and so-called low-tech and middle-tech. We need to catch up with the high-tech, but still pay more attention to this. That will be an issue for jobs, and that will be an issue of income distribution equality.

S. Nixon:

Thank you very much, Dr. Gang. Now I turn to Hubertus von Grunberg, who is the Chairman of ABB. Maybe you can tell us whether you are in the business of hollowing out the middle class, or whether you are going to provide middle-tech jobs for workers for the future. Thank you. Over to you.

H. von Grunberg:

Thank you. It would be bad if we were bad to mankind. We need the middle class because also they buy our product, and national prosperity is the foundation of our survival, so you have to act consciously if you have an explosive new product at hand.

It is interesting, referring to you directly, Dr. Fan, there is no doubt that China has the most populous, the largest workforce in the world. Astoundingly, with all the simple thinking, which I find positive, that you are not entirely and only market controlled, that you have some central philosophy in your nation, which often works to your advantage.

With all this, your country is at the same time, this year and also next year, the largest robotics market in the world, so China with their need to protect their workforce are accelerating robotics more than anybody else. That is an interesting fact to observe. Would I say you are wrong, and your central planners and your government are doing the wrong thing? I honestly think you are right. I would refer to practical examples to indicate that automation in an economy and its rate of employment are not automatically correlated in a negative fashion. A schoolchild would conclude, a pupil would conclude, that where automation is highest, it is most likely that there is the highest displacement of manual work and thereby a pressure on unemployment becoming high. The facts reveal the opposite.

So the mechanics of an economy work differently from intuition. In South Korea, there are a very high number of robots per 10,000 inhabitants, namely 350 per 10,000, and unemployment is 3.7. Even in Germany in old Europe, not a new dynamic place and not an easy place to keep high employment, we have a high rate of robots at work of over 260 per 10,000 inhabitants, and we have, in the European context, a remarkably low unemployment rate.

So I would say it is both true of the same phenomenon where dynamics are biggest for technological advances, there also may be and should be an explanation for the biggest dynamics for creativity, for new product development, and for developing new chances. Let us have this as a target. Take the dull, dirty, and dangerous out and away from humans, because they deserve better, but at the same time make sure that new jobs are being created, and here I come back to your remark about education, about getting people skilled.

Automation has a tendency of bringing up the average income of a population by bringing up efficiency. By having machines do what humans would otherwise do, you contribute to public wealth. You bring the standard of living up. It happens to be a sour fact, a bad fact of life, that an increase in the standard of living is not easily accomplished without higher qualification at the same time. For the model to be stable, to shift primitive work to machines and the population thereby to become richer, more affluent, more successful with a higher standard of their living, it is a corollary, a necessity that with the automation, the average education and skill level of the population grows. And we cannot say the government alone must do that; we all have to make our contribution.

Now, one last remark, if I may. One size does not fit all. I do not think there is common knowledge around the globe and a common philosophy to be applied to each and every nation. I would argue that a different principle, a different recipe be handed over to each and every nation, in this regard. For instance, in Russia, automation can do what? It can help overcome the vast distances in the country, because with digitization and automation we can make onsite what we need onsite instead of hauling it over the country. The tendency of making in local demand centres instead of hauling it over thousands and thousands of kilometres from one place to another. We need small centres of production and automation allows for that. It is good for the nation.

In Russia, we can have the 'onshoring', the hauling back of business that has been relocated for labour cost arbitration to low cost places. With automation, we become aggressive enough, competitive enough, to manufacture again in-country what had to be produced in different countries in the past without automation and solely manual labour. But then those other countries would lose the jobs if Russia brings them back in, and we have to look at recipes for those countries where the offshoring, where the low cost sourcing, has happened before. But for the national economy of this country, it is legitimate to say that we need to bring our labour back, our work back, because with automation we can afford to.

Then you need the highest qualifications in engineering and science. Russia fortunately has this enormous availability of top scientists and engineers. For me, Russia is an ideal place that could win from this overall global tendency, whereas some other countries might come out differently.

I shall stop here. I would just say that it is not one size fits all – it is different from country to country. Thank you for your patience.

S. Nixon:

Thank you very much indeed. Mr. Galitsky, technology is not hollowing out the middle classes; it is going to be the salvation of the middle classes. As a venture capitalist, as an investor in private equity high-tech startups in Russia and America, you are doing God's work, right?

A. Galitsky:

Some of it, but I will say I agree with the previous speakers on some points and disagree on others. The point is that in the model which we have seen develop over the ages in countries, each wave of the industrial revolution, it is clear the computer revolution is changing the world greatest. That is my first point. Even speaking about China, the biggest manufacturer of all Apple computers, and I mean Apple iPads and everything, will put RUB 1 billion in the next few years and they have 900,000 people working for these plants. They will be replaced by these robots. So what will they do?

Today, taking the statistic that only 10% of surgeons can use the Da Vinci machine. This means the Da Vinci machine, which allows surgery to be done remotely, and this 10% of surgeons can provide and replace other surgeons. So what will these surgeons do? If you are speaking about technology that is coming in, I found some numbers. Some high skilled workers that we name today, like telemarketers, like accountants, will be gone. The probability is that it will be 0.99% for telemarketers, and accountants and auditors have a probability of 0.96%, which is pretty high. Tech writers: 0.89, that they will be

replaced by a machine. Economists: 0.43. Of course editors for magazines: just 0.06, so you guys are lucky. And dentists are better than ever; it is 0.04.

What is it bringing us? It is bringing us some kind of understanding. Ten years ago nobody believed that a car would be driven automatically. In ten years, it is the expectation that a Google-driven car will become a regular thing, so many drivers will lose their jobs.

What I would like to say is that this industrial computerization will change our world for ever and for the future, when you use a geographical model. Since in the US manufacturing workers decreased from 30–40% in the 1950s and 1960s to 10% right now, as all labour has moved to China. But China is growing, so where will the labour move?

If it will move to automation, to robots, it will not move to other more emerging countries; it will stay in China. So Chinese people need to find something to do that is new.

On this, of course, we know that we do not use our time effectively, since we are speaking about the fact that we have only 12,000-15,000 working days in our life, not too much. And we are spending only a few hours efficiently, even in this conference. This means that automation will bring us more productivity, but how we use this time we still do not know. We do not know what abilities it will bring us. As a society, as countries, we will need to keep people happy. We will have many people who will just watch screens and do very little.

As a technologist and as a venture capitalist in investment technology, I would like to say that in the next ten years we will have many, many changes. What needs to be done is education, since education needs to react very intensively to what is going on. Education needs to react not just from graduation, but from primary school. Kids need to be oriented to problem solving, since it will be a lot of fragmented stuff done by computers, but you are right, something needs to be done by brains intuitively. So many professionals will need to be more human related, since people will need to have more psychological help. So a lot of education needs to go in this direction. So I will say that in the future, we will have a very interesting and a very difficult time.

S. Nixon:

Since we are talking about the future I think it would be a good idea to move to Ozcan Saritas, who is a Leading Research Fellow at the National Research University Higher School of Economics, but more importantly is the Editor-in-Chief of *Foresight: The journal of future studies*. Perhaps you could try and paint a picture of this future for us.

O. Saritas:

I will try, yes. I will do my best. Actually, so far around the table, we have heard some positive and negative impressions about technological developments and advancements. I will try to bring a bit of a futuristic perspective into this discussion. But actually, before doing that, it is always useful to look back a little bit to see what has happened in the history of humanity.

Probably we are not the first human beings, first of all, discussing this kind of topic here. I think this sort of discussion, may be not in such a venue with such technology, actually happened when humans moved from being hunters and gatherers to a more agricultural society. The play was different, so different skills were needed, and the same discussions were probably held when we became industrialized, when the industrial revolution came into place. We started building some huge cities. New jobs emerged. There were new cities, and we created the big problems: the traffic problem in cities for example, pollution, and very bad and dirty living conditions.

All of these actually brought some challenges and opportunities at the same time, and as humanity, we have survived all of these very strong transformations in history. Now we are actually at a similar kind of situation with the introduction of new technologies which give us a lot of challenges and a lot of opportunities at the same time. We have all these computers and all this information technology, which are replacing humans in some jobs,

especially in jobs which are greatly routine. We have tried to do the same thing along the manufacturing line or in the assembly unit.

Basically, the biggest opportunity here is that we have a possibility in front of us to behave like humans, because we lost all those middle level jobs or we are about to lose them, because actually it is not very humanistic to build the same thing on the manufacturing line all day. We are more social creatures. We have a great ability to create, to interact with other people, to solve problems, and to deal with some unexpected situations at unexpected times, and we are more adapted to that than the machines. Basically, I think it is probably not a bad idea to leave a job to the machines and then to start being human, to try to do our jobs in a more humanistic ways by adding creativity and new perspectives and then to start making them different with some more interaction.

Thinking from the futures perspective, I would say that we can talk about some positive and negative features based on these assumptions. What we can say is that, yes, this is not the first time we are facing this challenge and hopefully we will survive. I trust humanity will do it well, but we need to be careful, of course, and we need to introduce some new aspects into our jobs. We need to learn how to use our brains in those cases. Sometimes it is very difficult to be creative, to introduce some new ideas and come up with innovations. Innovation is one of the biggest buzzwords. We think that it is so difficult that only a few can do it, but actually all of us have some kind of an innovative capacity and capability, we just need to externalize it. If we leave some of the things to machines, then we will have a greater opportunity to start being innovative and to explore this aspect of ourselves that is hidden somewhere in our brains, in our minds, in our hearts. So we need to actually bring this out again.

Basically, if the machines come in, then this means we will not need to do repetitive and boring things, and this will give us some opportunities to clear our minds of tasks that are actually very routine and very boring, like how to go to work and what to buy from the shop and things like that. These are

covering most of our time and our brain capacity: what to wear, what to eat, what to do, other than our jobs, and then we have very limited time for creative and productive thinking. I see it is as a big opportunity for a more advanced and wealthy society, in that sense, in my positive scenario. So this could be a new renaissance for humanity.

In addition to that, I think there are great opportunities to improve human skills and human capacity. There are a lot of people, as we speak, working on technologies like synthetic biology, genetic modification technologies, cognitive sciences and things like this, so if the machines are becoming smarter, then humans are becoming smarter also. So this is not a battle we have lost or we will lose. We will just give some of those repetitive tasks to machines and then we will have some clearer minds and more space, actually, in our brains, which is good.

On the negative side, if we look at it from the negative perspective – so the first one was the blue sky scenario and now I will give you a dark cloud scenario – we may lose the race against the machine. So that might be one of the consequences of this process which I do not think will occur, but it may be possible. There will be fewer opportunities for people, and some people could even feel alienated from society because they will be doing very highly qualified jobs which require a lot of education and skills, and they will be very advanced. They will be involved in these kinds of jobs because these jobs require some creativity, like design, engineering, science, and those kinds of jobs. They will require a lot of training, experience, and knowledge, so part of society will go into that extreme, and the other part of society will go into simpler service jobs. For example, it is so complicated for a robot at the moment to clean your room, because there are a lot of things that you need to deal with. A robot would need millions of sensors, probably, to clean your room, to go around your sofa or to clean around the wardrobe, to take your clothes, wash them and bring them back, so we will need these kinds of jobs also at the same time. But they are at the lower end, lower wage jobs. This is where the middle class starts suffering in the negative scenario.

If I bring a wild card into this trend, we may see some kind of anti-technology movements emerge, where people who strongly oppose technological developments start attacking machines, and machine breakers emerge. Things like that may occur in the not-too-distant future, in the next maybe 20 or 30 years.

There is another one, which I will cut very short. This is a technology-free scenario. There are some communities in the world who organize their lives by following the philosophy of back to basics. This changed the rules of the game a little bit, because all the technology and manufacturing sectors are driven by some wild capitalist ideas. So if we can put aside all this crazy consumption concept, be humans and then measure our success and prosperity in a different way, instead of measuring our wages and purchasing power, we can actually measure it by how naturally we are living, how naturally we consume, and how naturally we produce at the same time.

This might actually change the rules of the game and may calm the waters down. We may actually have some more liveable environments with less demand for consumption and competition. This would be a good moment for humanity to sit and think. They will probably say that we have done everything wrong for the past one hundred years, because there have been so many mistakes and we have not learnt from these mistakes, from the experience. It could do a lot. I think humanity in general needs a moment of just becoming calm and thinking where we are going in that sense.

Technology would not dominate life in that sense, and it would have some enabler roles, but at the same time it would help us be like humans as part of nature. I will stop there for the time being. I hope it was helpful.

S. Nixon:

Thank you very much. So technology will make us more human, free us up to be more creative and use our brains more. Pal Erik Sjatil, you are the Managing Director of McKinsey, which has been in the brainwork business for a long time and I know McKinsey has done quite a lot of work on technology

and the potentially disruptive effect of different technologies. Perhaps you could talk to us a bit about what societies can do to try and mitigate some of the disruptive effects and maximize the benefits of technology.

P. Sjatil:

We are, of course, very worried that the knowledge workers will be automated, so I hope you will not do that.

S. Nixon:

There will always be room for more managing consultants.

P. Sjatil:

If that happened very few partners at McKinsey would earn a lot. Actually I think in this debate there is one thing we all agree on, so I will just share two facts from a big piece of research we did, and that is around education and skills. I think we might disagree on what would be the consequences of technology, but I think on this other point we agree. We actually did research in Europe on something we call education to employment, looking at how efficient our education system is to drive employment. Even investing in Europe, where we have significant unemployment numbers, in particular, we see that only 40% of employers say that they actually find enough skilled labour. So 60% of the employers, even though we have all of this unemployment, are looking for skilled labour and cannot find it.

If you then poll the students, which we also did, only half of the students find post-secondary education at all useful. So there is this whole gap in education, which we believe, at least, is a very significant part of it, and if we were to agree on one thing around this table, I think addressing the education to employment issue would be important to which perspective you take on technology.

If we then talk about whether technology will hollow out the middle class – I am an engineer, I am not an economist, so I am a big fan of technology. It is

hard for me not to say that actually, in the longer term, I do believe there are these technology improvements. As we are positive also on how we as human beings are able to embrace and adjust. I do think this most likely is positive. We currently have 2.2 billion people in the middle class, at least that is how we define it. This is a family with more than USD 13,000 in income per year. I think already a significant part of this middle class was created by technology, and I think as you mentioned, the revolution in agriculture, the revolution in manufacturing, it triggered exactly the same discussions as we are now having. I would be surprised if we were not able to continue to innovate and actually alter this technology, then we would be able to create not only new jobs to take to the lower and middle classes, I think also it is quite important that we are bringing the lower end of the middle class to middle or higher end of the middle class, because that is also a huge number of people.

I think the only other thing I would say is that we should not underestimate what some of the technology also brings to end users. If you think about the car, I would say it was the same price twenty years ago as it is today, and now it is a very different product thanks again to technology. How we define the services and the products that you can afford as the middle class has also changed significantly. I think by and large, we are slightly a bit more on the positive when it comes to this discussion about what the longer effects of technology are.

Then, of course, short-term, as we have also seen in the past when we had the industrial revolution, the agricultural revolution, you will always have difficult transitions, and I believe here the government and the state play an extremely important role. I think the government and the state will have to embrace this and encourage the restructuring of economies, really work hard on education to make sure we avoid this employment trap which we now see in Western Europe. And again, I think, as we have seen in the past, the nations that do this well will most likely be the countries also that will sort of be the winners, adjusting and leveraging this technology. Then there will also be those who maybe struggle to restructure, which is, if you ask me, a little bit of

what we are now seeing in parts of Western Europe, where I think the economy is overly inflexible right now.

S. Nixon:

Ms. Marinescu, would you like to come back on that?

S. Marinescu:

Yes. Thank you very much. I was just thinking that I would agree that eventually the system should adjust. The problem is how fast the adjustment takes place and what is the cost in between. We speak today about four billion people making around 20% of the global income. That is what we call the base of the pyramid. Individuals who will not be able to take the full benefit of the technology you are creating, individuals who may not be able to adjust that quickly to the basics to go back to.

One question for the technology producers and for the distinguished participants in this discussion is: how can technology actually reach these people? In the work we are doing in the UNDP, and in the Istanbul International Center for Private Sector in Development in particular, we are looking very carefully into the so-called reverse innovations: solutions that are technology viable that are more affordable to people who are at the base of the pyramid. I will just give a few examples and, if possible, if acceptable, I will mention also the companies that have promoted them.

With General Electric, for example, a series of very cheap convenient medical equipment, medical devices, have been created to reach out to communities in India to provide healthcare services that are affordable. Some of the food producers and beverage producers work on solutions for entrepreneurship that are extremely complex from a technological point of view but still very affordable. We are speaking about solar power and entrepreneurship, to help people in poor communities to make an income, so that while adjusting they will still be able to survive. We are speaking, again, about a significant number of people who are not able to make a living that is decent, and chances for

them to move up are not very high, so the dynamic that we know of people moving in a lifetime from very poor status to mid-income or above mid-income is not as high as it used to be.

I totally agree that the education system is faced with a massive challenge right now. It is a huge investment in education that is going on right now and leads to almost nothing, to aspirations that are failing people. With youth outside employment, youth by age is the most productive group when it comes to technology and to advanced technology, and still they are jobless at a very high rate. Again I am coming to the point that the system is not as inclusive as it should be.

The first question is whether reverse innovations and reverse technology is something that technology producers are looking into: making technology more convenient and helping people make an income and then move up the ladder. Another question that I have is that we have seen amazing progress in telecoms. I saw a recent report showing that in Africa in 12 years we moved from some 10–12 million mobile phones per year to 700 million mobile phones per year, and with the mobile phone comes greater access to information and more opportunities for an income.

Why can we not make similar progress when it comes to energy? We are still struggling to create alternative energy that is efficient, that is convenient, that is feasible. We are far behind, so despite efforts, most of the mid-income countries and high-income countries are still relying on fossil fuel technology. There are certain areas in which technology can and should do more. So that is a second question.

And one point that I am willing to make is that obviously machines are replacing some of the labour suppliers. Is the business model and employment model not changing towards offering more opportunities for sourcing entrepreneurship? I mean not hiring people, but sourcing entrepreneurship? We can see that, for instance, some of the large ICT businesses are sourcing innovation through entrepreneurship and not necessarily hiring these people, as that might be, cost-wise, unsustainable in

the long run. But entrepreneurship is what can actually reduce the negative impact of the labour-saving technology on incomes and on living standards. Entrepreneurship is what we should look into, and schools are not generating enough entrepreneurial skills. I also believe that if we speak about adjusting the education system, indeed our children need to have access to more digital literacy, to more financial literacy, to more entrepreneurship along with the classical disciplines that children and students have access to in school. Those skills are important.

Moving back to reverse innovations, more technology in sectors that are critical to better living standards – labour markets are very rigid, and since we started with your comments on Europe and with so much knowledge on Europe, I think Europe has been significantly affected by the change in the distribution of incomes. Europe is the region that will have a decline in the middle class by 2030. Europe has countries that have had a much slower improvement in the human development index over the last ten years than the rest of the world. We define human development by income, life expectancy and education, life expectancy being one of the growing, let us say, the improving indicators, and this is owed to technology. Income is not growing, and education has big problems. The labour market of Europe needs to change. Europe has created a social model that is very rigid. There is an unemployment trap. There are the barriers against youth integration in the market, so the social model needs to consider more flexible labour markets, more entrepreneurship, to actually translate the progress in technology to better lives. Thank you.

S. Nixon:

Thank you, Ms. Marinescu. I would like to turn that one back to the two representatives of industry and finance on the panel, and there are some challenges there. So firstly, Mr. von Grunberg, would you like to respond?

H. von Grunberg:

I will try. First of all, reserve integration, what is industry doing to help the case? Everybody has to make a contribution. This is from an ethical point of view and to take care of humanity, but it is also a business case. For instance, let me give you a practical example. In a world of vast penetration of robotics, and therefore a large amount of manual labour being displaced by robotic activity, you need surface personnel because I think it may not be cost effective to repair robots by robots. The assembly of a mobile phone or of a car is repetitive and high frequency and the robot pays. The repair is sporadic, is occasional and not programmed. Nobody programmes for his mistakes if he is a sound business person. They happen inadvertently and unexpectedly, and you will not automate what is not expected and what is only occasionally happening. There, the human comes in. Now you might ask how this helps the lowest end that you have replaced with the robot? I guess our business and our more important humanitarian duty will be to get artificial intelligence, intelligent support of manual work, still being manual work, to a level that a formal assembly operator gets to the point of repairing robots. That is an example of the robot maker thinking about what to do with those that he has put out of a job.

In this context, Ms. Marinescu, a thought strikes my mind. You speak about entrepreneurship so importantly. We heard from the Club of Rome decades ago that by now, if we had only believed them, we would all be out of natural resources, we would all be flat-footed, we would not have this and that, we would not have any rare materials, we would be out of oil entirely, and we would be out of gas. Entrepreneurial creativity is stemming the tide; it is offsetting it. If mankind can overcome, against the predictions of the Club of Rome, shortage of materials, then it has that much more incentive to overcome the abundance of superfluous labour. The human creativity which can overcome those problems is there. As much as we have overcome material shortages, we can overcome the negative impact of labour that gets in certain areas of business, provided that market economies – that the free play of voices in a marketplace – are not constrained.

Where you have too much regulation – and this is your point of Europe and I am European, I could speak about my home – there the compensatory effects of creativity and entrepreneurship will be hindered and will not come to fruitful counteraction. Set the world free if you want to compensate for the effects, and they will be compensated, and it will be a better mankind, like my colleague Mr. Saritas has said.

Regarding telecommunications and energy we have this vast rolling out of telecom in poor parts of the world, but not in energy. We are in the energy business; we are one of the big ones in electric energy. The technology is all there. Microgrids are it for us, to generate power and distribute it on a small scale and in small environments in villages, not hauling it in over long distances to scarcely populated areas of the world, which is expensive. You have villages long distances apart, and you have to build the high-power lines to each and every one from a central power generation. That would have been the way of the past, because it was the only way in the past. There would have been one central coal-fired power plant of 600 megawatt and then the radial distribution lines over hundreds of kilometres.

Nowadays, we have the technology. It is there and it is running off so-called 'microgrids'. If there is enough wind, if there is a hill in the centre of the village or close by, you put some windmills up. If there is sun shining often enough, you put in solar panels. That is a little behind, I agree, and you need storage for the night. I would say the biggest hindrance to microgrids is to keep the TVs, shavers and electric cookers on at night when the sun is not shining and when the solar panels will not directly generate power. They will generate a lot during the day that is not used, and then at night, when they are most wanted, they do not have it. We have an answer to storage, so why the hell do we not do it? Storage on the microgrid scale for a poor African village is still, I am afraid, a little too unaffordable. It is still large packs of lithium iron with some electronic control to avoid malfunctioning, explosions, and so forth. The poor African village will be able to afford the solar panels but not the lithium iron storage, including its electronic control, for the night and the power converters,

because it is a direct current and you need to bring it back to an alternating current at the right voltage. All of these controls, electronics, and the storage batteries themselves are coming down rapidly in cost, but we are not there yet to recommend to each African village to buy one, because they would say, "We would love to, sir, but we do not have the funds. Are you giving it to us?" That was on telecom and energy, that was on integrating the poor back in, and, yes, you are so right: let the entrepreneurs get to work to overcome difficulties. Thank you.

A. Galitsky:

But we are speaking about a different topic. We are speaking about the middle classes becoming poorer and becoming less middle class. I am not an economist, but I know that wages did not grow in the last ten years, the last thirty years, in many countries, and the cost of living is becoming higher. I am speaking about African people.

It is nice speaking about technology, but the point is, what will people do when they are replaced by technology? It will be a redistribution of wealth. It is a very small percentage of people who hold all the wealth, and they get in the top managers and business owners, and middle classes are pushed into the poor class, so it is a problem, as I see it.

Greater technology will be developed, people will get more time or simply they will have more fun. They will write more books about the future; they will become more human. I do not know what they will do, but they would like to eat, and so from this point of view, where will they get the money to buy the food? That is not a question about technology.

H. von Grunberg:

Much of your reasoning, not all of it of course, you know much more, is from an article in *The Economist*, "The Future of Jobs: The Onrushing Wave". There you have the probabilities of being displaced from your job by technology, and the highest probability in the so-called middle class where

you see this danger includes people like retail salespeople, accountants and auditors, and telemarketers. To those I have the answer, get back on your backside and learn and learn new things and adapt. You are middle class, you are intelligent enough to be a telemarketer; you are intelligent enough to be an accountant.

A. Galitsky:

This is what I said, but it needs to start from young kids, since you cannot teach an accountant to become a physicist. I spoke not only about this article, I spoke about surgeons. Only 10% of surgeons know how to use the Da Vinci machine. This is a problem.

S. Nixon:

Okay. I want to bring Dr. Fan back in.

F. Gang:

Well, number one, no one can stop the technology progress. If automation is more efficient and more cost effective, then it will proceed anyway. So we have to think about that, we have to pursue it. Number two, in the long run, of course this will be of benefit to human beings. Economies have a problem because we do not count leisure. If leisure is counted in the GDP, then this will definitely be a bigger improvement in human life.

However, in the short run or in the medium run, we have got to think about the distribution effect. The benefit and the cost are not distributed evenly among people, among the groups, among the countries, among the nations, among the developed countries, the developing countries, the skilled, the non-skilled, the educated, the uneducated, the old, and the young. That is definitely the issue that we have to address.

What I mean is that it is important during this process of transition from low-tech to high-tech to pay more attention to middle-tech. I will come to this point again. You know in China, you say that China is the system that sometimes

works best for us, however everybody – the government, the media, the professors – is talking about the high-tech, talking about the educated engineers, the scientists, but we forgot the skilled workers. We forgot the middle group of people. In the past thirty years we have strengthened the universities, but we have forgotten about vocational education. That is why we have an oversupply of engineers, but we have a short supply of skilled workers. Actually those skilled workers are badly in demand. Their income is higher.

That is what I think we should pay more attention to. We should think about the whole spectrum of job creation, not only in high-tech. We have to pursue the high-tech, and at the same time we must think about the seven billion people on this earth who need jobs. Someone has to get the food, some might get better food, but it needs to be food anyway, basic food. Inequality in the whole is growing, and we have to pay attention to that.

S. Nixon:

Thank you for that. You raised the question of distribution, and that there will be different winners between different countries in terms of the distribution of gains, but I am glad you raised that. Ms. Marinescu raised the issue of Europe and the question of whether the labour rigidities in Europe would make it a loser in this technological world. At the same time you also raised the subject of entrepreneurship, which is clearly crucial, and I am wondering from people on the panel, is it just a matter of labour rigidities, or are there other issues that will be important in terms of enabling economies and countries to benefit? What about issues of governance, issues of law, issues of research and development at universities, of free-flowing information of ideas? Does anybody have any thoughts on what are the other wider societal aspects that might enable countries to do well on this?

P. Sjatil:

If I could just make a quick remark, partly to what you said and partly to the discussion about inequality – I agree, of course, that inequality is a huge issue. It has also become a very important issue in the West, as we have seen growing inequality in the US and to some extent in Europe. My personal view is that we need to be a little bit careful not to blame all of that on technology. I do actually believe that what you just mentioned, access to education, access to capital, also the lack of restructuring, sometimes holding on too much to old structures, not allowing even in Europe, I would even go so far as to say, things like the real estate market, which we are not really allowed to be restructured and so forth – these things are also as important, or likely, more important reasons for inequality.

Also, I think when you talk about the middle class we should not forget that while we might see this inequality transfer we have talked about, the growth in middle class in the last ten, even twenty, years has been very significant. So now it is 2.2 billion. There was not 2.2 billion ten years ago.

S. Marinescu:

They are all at the lower level.

P. Sjatil:

So there is a particular challenge in Western Europe and partly in the US, too, when it comes to middle class, but if you just look at the globe, I still think we should recognize that actually as a total in terms of the middle class, it is not that big a part of it.

S. Marinescu:

Just very quickly to react to that – it is true, but unfortunately the increase of the middle class is still at the very low end of the middle class. We define the class in terms of income, and income for the middle class is from USD 2–13 according to the World Bank, USD 2–20 according to the rest of the world. Most of them are at the very, very low level.

I just have two comments here, very quickly. Yes, indeed, solutions that you have put on the table with technology for Africa are expensive and unaffordable. This is why international development organizations, businesses, all actors come together to define funding schemes that make a solution possible. That is why this dialogue needs to continue. There are solutions that are aid funded, that are funded by governments, and that are funded by businesses. Once electricity is available business growth will happen naturally. When you say that people should adjust and should change to a different set of skills if they are affected by technology, the problem is, have you created a system that allows for that? There is no system for everybody to be able to adjust quickly. That is why the entire vocational training, the technical education, should be revised to have a different governance system to allow for businesses to contribute to that in an institutionalized manner that helps to increase your production costs and to make a contribution.

Japan has a very good system for that in which students, while continuing their education if they wish to, also attend vocational training, gain skills, and can fund their education moving forward.

The system needs to change and Europe needs to change its social model to remove all the rigidities. There is an unemployment trap in Europe. People would prefer to stay for nine months in unemployment, because if they go back to work, the tax, the net income is too close to the level of the unemployment benefit. There are social safety net traps. People who are left without jobs are assisted with social safety nets. Not enough pressure and effort is made to take them back to the labour market. This old social model needs to change. The market cannot afford, anymore, such a model, or if we can afford it, it is not going to be a long-lived joy. Thank you.

S. Nixon:

I want to bring Vladimir Mau into the discussion. You were unable to be with us at the beginning, but you heard some of the flavour of the debate here. You are Rector of the Russian Presidential Academy of National Economy and

Public Administration. In particular, Ms. Marinescu made some points there about the role of governance in terms of creating a framework for people to adjust. Do you have any thoughts on that?

V. Mau:

First of all, I want to stress that, to my mind, governance does play a very important role in the transformation of middle class. The middle class is very resilient, and whatever experiment a government does for its people or businesses, the middle class survives by changing its form. Moreover, I would say that even in a time of severe economic crisis in Russia, the middle class did exist, because the middle class is not just the amount of income, it is a style of life, it is a type of behaviour. I would say it is adjustable. From this perspective, the middle class is the class which is most suitable for adjustment. This is a group that will find how to work, how to survive, whatever automation happens and whatever faults in economic policies governments make.

What is a real problem – well it is an issue, I would not say it is a problem – is polarization. In Russia in the 1990s, we believed that polarization in Russia was a problem of Russian transition. Now we see that polarization, the income gap, is a typical phenomenon of current economic performance, particularly in the developed world, and Russia in that perspective is a developed country. It does not mean that it will destroy the middle class. Until recently we all believed in the Kuznets curve, according to which in the period of early industrialization, polarization increases, then it begins decreasing. Now we see that it is a wave, it is not just a u-shaped curve of development. It is likely that during some stages of economic and technology development polarization could increase.

I do not think that the matter of automation is a big problem. I do believe, and I am sure that previous history says, that the middle class found a way to solve this problem. We can observe, at least from the Russian perspective that automation, that technological performance, creates new jobs for the middle class more quickly than the system of education can provide new skills for

these people. This is a problem of the rigidity of economic policy, especially of the labour market, which we can see in the case of Europe.

I see two important areas of transformation, two important areas which could, if not support, then stimulate and enable the development of the middle class. One is the transformation of the welfare state. To my mind, in this current crisis, the crisis of the welfare state, like the crisis of the 1970s in the Western world, the crisis of industrial society, we cannot have the same pension system and medicine which emerged in the early 20th century in a completely new demographic and economic situation. It is a difficult discussion, but deep structural problems exist in the welfare state, and the welfare state is an area for the middle class.

One of the important points of the development of this welfare state, to my mind, is the increasing role of private payments. Twenty years ago, we thought that the privatization of the welfare state area is the result of the poverty of society or the collapse of the government budget. Now I understand that the richer a society is, the more inclined people are to pay for their health and education themselves and for their children. It means that the role of private money will sharply increase, and it means that it will create jobs for the middle class. This is a very important transformation. Governments should liberalize these markets and should understand that pensions are not something that the government has to pay. Pensions are the individual track of a middle class person regarding his or her plans to live when he or she becomes older. It is the same for medicine or education.

Another important problem is international competition for the middle class. The challenge, say, for Russian development now, to my mind, is the strategy of the middle class. We have a real migration challenge in this country now, when those who live worse off than in Russia try to move to Russia, those who want to live better. The transaction cost of changing the place of living is very low. That is why people move from east to west, they move from Tajikistan to central Russia, from central Russia to Moscow, and from Moscow to London. This is the real challenge. It is mostly about the middle class. You

cannot keep the middle class by police or forced measures. You have to make something attractive to the middle class, and this is, to my mind, maybe the most important challenge, much more important than automation for middle class development now.

S. Nixon:

Thank you very much. Mr. Saritas, you wanted to come in?

O. Saritas:

I moved from Manchester to Moscow, so I wonder if I am still middle class?

V. Mau:

Are you a tax resident of this country?

O. Saritas:

I am, actually, since last year. So I am wondering if the next step will be Tajikistan after this.

Actually it is all true. I can just support that without saying anything else. I can see that we have great agreement around the table, other than a couple of minor issues, but I would like to actually come to the conclusion that, as was said earlier, it is basically too simplistic to blame technologies in this case. It is not only the technology itself. It is a systemic kind of problem, and there are a lot of factors which interact with each other. This ranges from the education system – which we have spoken about several times already – to the economic system, the kind of system which is based on more and more manufacturing, and the governance of technology and policy and so on and so on. We actually need to see the big picture, in that sense, and see how all these different factors come together and interact with each other, because it is easy, probably, for policymakers to blame technology and say, “The middle class is declining because of technology; we did not make any mistakes. It was all technology’s fault.”

But it is actually not quite like that. It is about the system itself. There is a systemic problem, and it needs some kind of systemic approach to solve the problem. At the same time, for example, we saw the replacement of the manufacturing sector from developed countries to China and other places because there are more people there who may work like a machine. They still imitate machines. There have lower living standards, and the global system actually allowed this to happen. Then suddenly the middle class in developed countries is facing competition from some workers in China, which was probably totally unexpected, although they could see some of these trends happening.

Probably in the mid-term, we will see some of these manufacturing systems or infrastructures coming back again to the developed part of the world, and there are several factors in that. One of them is, of course, we have higher unemployment rates in developed countries, in Western Europe and in the United States, etc. And then also in China there is a growing middle class, and they are actually demanding better living standards and better conditions, so this is likely to increase the costs of manufacturing in China also.

At the same time, even if the manufacturing industry comes back, it will not be the same manufacturing industry it used to be in the past. It will probably be more service-oriented. Today we have started seeing that with some car manufacturers, for example. They are not only producing thousands of cars and then selling them to the end user. They are also providing some services related to them, so there are some street cars, electric cars, for example. People do not need to own a car today, really. They can just use the car on the street which is maintained by some companies and things like that. Automotive companies are really actively involved in these processes.

Even those very hard manufacturing sectors will involve some kind of service provision, and this will create more demand for new jobs. The middle class will still exist, it will not disappear, but it will change its format and the skills required. They will be more service-oriented, and we will use our strengths as

humans: creativity, interaction, problem-solving capacity and things like that. I think there are great opportunities there, in that sense.

There is also another breakthrough technology. There are several of them, but just to give you one example which may actually make some of the robots who are expecting to take over some the jobs of humans a little bit frustrated, like, for example, editing, manufacturing, or 3D printing. Some people, and there is some truth in it also, see this as a new industrial revolution, because those traditional manufacturing lines might disappear in the mid- to long-term future, so manufacturing will be more distributed and we will start manufacturing not standard products, or one million units of them at once, but we will actually start producing some more customized products. This will also involve some services, and this will create lots of opportunities for design and for creativity. We can see an increase in industrial design and related jobs, where all these things that are built in massive amounts would actually need to be customized and produced in a more distributed way.

S. Nixon:

Thanks. We are running out time, so just very, very quickly.

V. Mau:

I wanted to emphasize that there are some other important economic institutions, important from the perspective of the forthcoming development of the middle class. We mentioned the welfare state, which is very important, but I would add also the labour market, because the labour market with the current middle class is substantially different from the industrial middle class. It should be much more flexible, much less dependent on trade unions than in the traditional form.

But another point: the tax system has to be changed, because the more free-working people we have who are middle class, the less they could be taxed, the less they could be payrolled, and it is not about the capability of people to avoid the tax system, to not pay their taxes criminally. They are just not

accustomed to deal with this tax system. When you have customized services, when you have a customized society, you have to have a customized tech service, which is much more flexible and much less rigid.

S. Nixon:

Thanks. Very, very quickly because I have one last question for the whole table.

S. Marinescu:

Very, very quickly. I think we will continue to grow. The problem is that we do not grow together. If we do not grow together, the big companies will face a major sustainability issue and crisis because people are unable to consume. Sustainability is what we are aiming for from the micro level to the macro level, and sustainability means inclusiveness, it means giving opportunities for people to make an income so that they will be able to consume. So that, from technology to any kind of sector, is a valid aspiration and a valid goal, and that is where the international community is interested in partnering with the mid- and large-size businesses, to ensure that while sharing the same world, accessing the same resources, we make possible a shared growth and a jointly enjoyed sustainable global system. Thank you.

S. Nixon:

Thank you. We are right out of time, so I just want to ask the table, very quickly, one question. What technologies are you most excited about for the future in terms of this debate for the middle classes, and which countries or geographies do you think are best placed to take advantage of the opportunities of new technology? What is the technology that is going to be most important, do you think?

H. von Grunberg:

The common denominator of all these breakthroughs is a higher level of intelligence. It is software, more powerful hardware, the human steering method, artificial intelligence, so we can also automate, to some degree, and support the knowledge work. This would be the common denominator. Who would benefit the most? Entrepreneurial independence, less rigid regulation would be the way of taking full advantage. Education – a country with good scientific capability will have a better future than one without. I am not concerned about having not enough skilled workers, because for those, I can put in machines. I am not worried about that, and I am not worried about having abundant engineers because that is what we need very much for this more human future to make life more worth living.

S. Nixon:

No names, then. Does anybody else want to come in quickly?

O. Saritas:

Actually I have already spoken about some of those technologies, which are editing, manufacturing, and 3D printing. I think these will be revolutionary in terms of manufacturing, logistics, and design. Also big data seems to be a very interesting field to consider, to understand trends, dynamics, and so on. I think the biggest innovation probably will be the rediscovery of humans and the rediscovery of creativity. Thank you.

S. Nixon:

Yes, Dr. Fan. The last word to you.

F. Gang:

I would say biotechnology and any extension of human life would be valuable, and that would be fundamental for changing human life, improving human life.

A. Galitsky:

I will say that all changes will come with quantum physics in that we will have the ability to manage molecular layers. It will change biotechnology and many other technologies. It is what we need to look for in the future. But in current times, I would say, the benefit will be felt by a country that has produced a lot of science, a country that can adopt science for commercial use. Which country? It is difficult to say, since even with the iPhone we have 23 countries that are participants in this tiny iPhone. The countries that have adopted the best value chain production will be the winners. So, how many countries? I do not know, 12, 20, 25 or 40? But definitely it will not be one dominating country.

S. Nixon:

Will Russia be one of them?

A. Galitsky:

Not yet, but I hope so, yes.

S. Nixon:

I think we have to leave it there because we are actually over time, so thank you very much to the panel for a very good discussion.