Records of Honda Foundation Eco-technology Workshop 2005 in Ho Chi Minh City

Part I. Morning Session

1.1 Opening Remarks of Toshio Ban

Good morning, everyone. Thank you very much for joining us today. Welcome to the Honda Foundation Eco-Technology Workshop 2005 in Ho Chi Minh City.

As you may already know, the Honda Foundation has advocated the concept of eco-technology since its inception. Eco-technology reflects our belief that we need to step away from technologies devoted only for efficiency and profit, and change a paradigm of technology so our activities become harmonized with the environment.

Last February we hosted a symposium in Hanoi under the theme of "Linking Innovation and Entrepreneurship for Developing Countries." It produced a lot of reactions and responses in various circles in Vietnam. Today's workshop is designed as a follow-up for that Hanoi conference.

We have a couple of aims today. One, we invite the same discussants to further discuss the important issues raised in the Hanoi discussions. Two, we should define an agenda for the next meeting scheduled for fall or winter in 2006. Though not decided yet, the venue could be an Indian or Thai city, or once again in a Vietnamese city.

Also we have invited new discussants from Thailand and India to widen and consolidate our research network.

Today's workshop will complete in two sessions: the morning session is a very informal forum of free discussions; and the afternoon session is a bit formal

with representatives from the administration, academy, and industry of Ho Chi Minh City. We anticipate discussions get more specific, perhaps more focused on Vietnamese- or Ho Chi Minh-specific issues.

We basically encourage you to use English, but you can speak in Vietnamese or Japanese if convenient. We have excellent interpreters today.

OK, my time is up. Two facilitators, Dr. Ca and Dr. Sunami, will take in charge of following discussions. Thank you very much for your kind attention.

1.2 Self Introductions of Discussants

Dr. Atsushi Sunami:

Thanks. As Mr. Ban has said, this morning workshop is very informal. So we have decided not to do any specific structure as to the way of conducting the workshop.

In fact I think it's a good idea for us to get together and spend a couple of hours to really discuss not just about the last conference we had in Hanoi, but beyond that to see whether we can have a common theme — not only based on the activities of the Honda Foundation in this region, but also on an idea of an entrepreneurship and innovation in honor of the spirit of Mr. Honda, the founder of the Honda corporation.

There is a multitude of experience in Vietnam, India, Thai; and perhaps we can also include Korea and China as well. But to build a sort of common ground for us, the other important thing is, as Mr. Ban said, that we are planning a conference again for next year and we expect all of us to get together again somewhere in this part of the world with the outcomes of this conference.

I think you have this copy from the last Hanoi's conference. This is a very informal compilation of various papers, but what we expect probably for the next conference is to really come up with this kind of common-theme-based papers that we can even publish and to spread to the world as our message.

In order to do so, I think it's essential for us to get together and first to share what we are thinking and what are the common questions. Of course, the Honda Foundation has been doing this, with a main theme called eco-technology. However, my understanding is that they have based this theme in the more advanced, European, US, or Japan sort of context. What do we really mean by eco-technology in our Asian context? We actually haven't had a chance to talk about it.

Even today I have been affiliated with the Honda Foundation only for less than two years, but we have Professor Uchida, a board member of the Honda Foundation, who knows a lot about the concept of eco-technology and could share his experience. To put the concept really into the Asian context is the very important first step for us to launch the Honda Foundation activities in Asia.

So first of all, I think it's a good idea, since this is an informal workshop, to get to know each other first. Why not each one of us to do a brief introduction in no more than five minutes? Just tell us what sort of affiliation you got, what is your research background, career background and so forth. So introduce yourself to us.

By the way, I have asked Professor Krishnan to give us a special sort of a 15 minute presentation on India's innovation system as an introduction since, in the last conference in Hanoi, we had presentations only from Japan, Thai, China and, of course, Vietnam. But this time we'll have for the first time an Indian experience; so I am looking forward to his introductory remark later. Then we ask Professor Krishnan to be the last one. I think it's better to go

round this way and then come back here. Let me just briefly start with me, I guess.

I'm Dr. Atsushi Sunami, and I am affiliated with a small, actually the smallest national university in Japan — the National Graduate Institute for Policy Studies. My background is really political science and political economy, looking at the science, technology and innovation policy.

My first interest is to understand the influence of other ideas of innovation system on a reform of the innovation systems of the U.S and U.K., particularly looking in 1980s, when they were trying to understand the Japanese model of innovation systems. Whether they really understood it at all is a big question, but they have tried to model after Japan to start large reform movements in the 80s.

Now I am extending this sort of similar questions to the reform of China. I spend many times working with the Chinese colleagues of mine, looking at their policy, innovation, reform, and ideas. They are also looking at other countries' experiences. In fact they are closely learning the experiences from the European, U.S, and Japanese innovation systems, and how they will design the process of their reform is an interesting question that I am personally pursuing at this point.

At the last conference in Hanoi, I have talked about the Chinese experience since we didn't have a Chinese colleague to do the presentation. But beyond that, I am very much interested in looking at the Asian experiences as a whole and see whether they really fit in to this notion of innovation institutional reform.

Also I have been asked to work on the Honda Foundation planning for conference about year and a half now — at the time that the Honda Foundation has decided to take their activities to Asia.

My experience in Asia is fairly limited. I spent many years actually looking at the U.S. and U.K., and my first visit to Asia was China in 1987 when I studied Chinese at Beijing University. After that, I studied at Yonsei University in Seoul in 1988; and then I was absent from the Asian themes for about ten years. But now I spend more time going back and forth and am looking forward to working with you, especially in this activity of the Honda Foundation here. Well, anyway, that's yet for me.

Dr. Hirohisa Uchida:

Good morning, my name is Hirohisa Uchida. I'm from Tokai University of Japan. Last time in Hanoi, I gave a lecture about eco-technology. Actually the Honda Foundation's philosophy is eco-technology; but today this afternoon, I am going to touch on once again the definition of the "eco". "Eco" is not just ecology but also "environment conscious," where "e" from environment and "co" from conscious. I wish we think more in this direction.

I think it's very important to understand environment or "eco," because, if we think environment is not only water and air, but including our family or schools, working places, markets or countries, our economic and political systems, and everything else — all the factors surrounding us are actually our environment. And if we think about, for example, the development of Asian countries or any other country, we should also consider the role of "eco."

Actually my major field is hydrogen energy. From my experience in the field of energy and materials, I am working with a small city in Japan and trying to import a new energy system there. That is what I want to realize now.

While so many people say sustainable society or sustainable development, what is sustainable development or sustainable economy? I do understand the theory, but I actually feel and want to realize such a sustainable society from viewpoint of my major field of hydrogen energy and similar systems, OK?

And this afternoon, I'm going to touch again on some science and technology programs, and also the importance of environment, actually, human environment. I hope we can discuss more about that. Thank you very much.

Dr. Kitti Tirasesth:

Good morning, everyone. My name is Kitti Tirasesth, President of King Mongkut's Institute of Tech, Ladkrabang, Bangkok, Thailand. This is my first time to have an opportunity to visit Ho Chi Minh City, and I am very glad to meet all of you and very honored to be invited here today. And, of course, this is the first time I have joined the Honda Foundation's workshops.

May I introduce to you my background education? I myself graduated from this institute in the 1975 period and continued my master degree at the Shonan campus of Tokai University; and then came back to Thailand to work at our institute. In 2001, I caught a doctoral degree also from Tokai University. During my work at KMTL, I have some experience with the Japanese industry in Thailand for more than ten years, especially in the field of automobile companies and also in electronic companies.

Please allow me to give a brief introduction to the educational system in Thailand and also our university. The educational system in Thailand is 6-3-3, as is the same in Japan, and then from the high school enrolled students can enter the university. King Mongkut's Institute of Technology Ladkrabang, or KMTL in short, is a relatively young institute but the nation's best university in ICT for two consecutive years in 2004 and 2005, respectively.

Having said that, the rapid uprising of KMTL education and research excellence would not have been achieved without generous support from the Japanese government, especially JICA. We are extremely grateful for the support for the past forty years.

In term of research and innovations, many of our professors have developed very good relationships with the Japanese counterparts and have worked together very closely in many projects. Our research center of communication and information technology is a very good and successful example. With the generous help from JICA and Japanese universities, especially the Tokai University, the center has upraised the quality of our education and capabilities in ICT and has produced a sustainable research organization.

I think it is now the time for us to move onto the next step. This too capitalizes on basic research innovations and turns them into commercial products, and encourages entrepreneurship in our university. In fact, we have recently founded the university business incubator's office at the head center to promote and encourage entrepreneurship in KMTL. We are at the very beginning of this learning process and I am very delightful to be at this round table meeting to share the idea about innovation and entrepreneurship.

As the very last note, I would like to take this opportunity to express my sincere gratitude to Professor Dr. Uchida, Mr. Toshio Ban, and all of the operators concerned, and to the Honda Foundations for his generous invitation. And I would like to invite all of you to visit KMTL in the near future. We are located in the East of Bangkok, next to the new Bangkok international airport called Suvarnabhumi Airport. This airport will be opened in the next year. So it will be very convenient for you to visit KMTL. Indeed, I would like to propose KMTL to be the host for the next Honda Foundation symposium or workshop next year. Thank you very much.

Dr. Tran Ngoc Ca:

Good morning, everyone. Probably most of you have known me but I think I have to present my introduction. My name is Tran Ngoc Ca — Tran is family and Ca is first name. So you can simply call me Ca. Actually I'm a deputy director of NISTPASS. NISTPASS stands for National Institute (Insurance)

for Science and Technology Policy and Strategy Studies under the Ministry of Science Technology. To give you a better idea how I am acting my steps, it's like an institute under MEXT in Japan; and to a certain extent, we work like GRIPS. So we are working on policies or strategies for science and technology and innovation.

More recently, just about two months ago, I have to take on another job. This is like a secretary general to the national council for science and technology policy under the Prime Minister. So in that capacity, I just went to visit Japan last week and met most of you there in Japan.

I think we might come to the title later; but because this is quite an interesting issue, I want to talk about the theme of this meeting here. It's quite timely because what I found from many activities, especially from the last visit to Japan, is that the consciousness about environment is so strong everywhere. If we link innovation and entrepreneurship, which are very two important keywords for the purpose of environment and for sustainable development, it would be much timely.

I am mainly doing research in science and technology policy, innovation issues as well as other macro economics. I did my research mainly overseas in Russia, then in Sweden and then in Edinburgh, UK. Interestingly, before going back to Vietnam, I worked with a multinational institute called JETS which stands for Institute for Japanese-European Technology Studies as a fellow. So I want to mention that the European once learned the Japanese experience: that was to learn specifically what the Japanese innovation system is all about. It was kind of a mutual learning process; and I believe that this meeting today is again a mutual learning process where we can complement each other.

So my most specific background is economics. I've worked a lot on innovation, especially at the firm level. Firm is my very much interest of research. Apart

from my task that I have to do a lot work on the macro level, and more personally, I like to do work on firms. OK, thank you.

Dr. Akira Goto:

Good morning, my name is Akira Goto and I am working at the University of Tokyo. My field is economics of innovation. I used to be an economist by training and I used to be a serious economist on applied microeconomics. But when I was with the Yale University many years ago, Yale was a kind of world center for economics of technology and innovation. There were Joe Peck, Dick Nelson, Sid Winter, Alvin Klevorick and Richard Rabin, who is now president of Yale. So I gradually moved into this field of economics of innovation.

Currently, I am working on basically three subjects: One is theoretical and empirical research on innovation process. I did innovation survey with Dick Nelson and Wes Cohen many years ago; and I am still interested in understanding the process of innovation in theoretical and otherwise empirical aspects.

The second research subject I am interested in right now is innovation policy, particularly the role of university, and the role of public research laboratory in the national innovation system. I am almost finished with a book on the role of universities in the Japanese national innovation system. We did a serious empirical research on this subject and I am writing a book with my colleague Professor Baba which will be published next spring. I am also very much interested in the role of public research institutes in the national innovation system. We have learned a lot from Taiwanese experience and from German experience, using government laboratories as a hub of national innovation system. I am thinking of starting a project on this. Maybe we can find a partner here today.

The third subject I am interested in is patents and the economics of patents. Not just economics of patent but I have been building a huge patent database using Japanese patents and I have almost completed building this. It contains all the Japanese patents ever applied starting from the beginning of the history. Next week I think I can make this database public so you can have access to this huge patent database although yesterday I have received an email from people working for me on this subject and they have found still some bugs. So we may have to delay several days. This database is modeled after the NBER patent database built by Bronwyn Hall; and I think that I can provide a very significant infrastructure for researchers on this area.

Another subject involved in this patent research is design of the optimal patent system. I am currently chairman of ITR committee of the Industrial Structure Council under METI. Currently we are discussing whether we have to change the current Japanese patent law, particularly in regard to the adoption of what the French call it "SOLEAU Envelope." They have a very unique patent system called "SOLEAU Envelope," in which, instead of applying for patents, you write your invention and put it in the envelope and just give it to the patent office: and then you can claim later that you have invented this particular technology in particular time on any day. We are discussing whether we should introduce this kind of system, and that is one of the major issues for the Japanese patent system right now.

So that is what I am working on right now and I am very much looking forward to discussing with you today. Thank you very much.

Mr. Tateo Arimoto:

Good morning, my name is Arimoto. I am now a research fellow of the Economic and Social Research Institute, which is attached to the cabinet office of Japanese government. Before I joined this institute, I had been in charge of science and technology policies almost nearly thirty years,

sometimes for nuclear and space development policies and life science programs, and at other times for general science policies.

Until this summer, I was the director general of the Science and Technology Policy Bureau under the Ministry of Education and Science, which is MEXT. So far I have been deeply involved in the preparation of the MEXT five-year science and technology basic plan, which will be effective next year and later approved by the cabinet at the end of this year.

In the new basic plan, we focus upon the reform of Japan's innovation system as one of the major pillars, because Japan is now facing not only big challenges from the world mega-competition and decreasing gross population, but also great changes such as societal transformation from an industrial society to a knowledge-based society.

This is the first time I attend the Honda workshop, and also the first time I visit here in the southeastern part of Asia. I am very interested in various types of innovation systems, dependent upon the stages of economic development in each country.

Another point is, as I said, I am a senior staff of the Economic and Social Research Institute which is a research center reporting directly to the cabinet. This institute accepted engineers for the first time. Being an engineer myself, I still can't communicate with the economists at the institute very well. It is very difficult to talk with people from a different background. So I am actually feeling we need an integration of knowledge of science and engineering fields and social and humanity areas, and put it into future S&T and innovation policies of Japan. That is my background. Thank you so much.

Mr. Kunio Nakajima:

Good morning, my name is Kunio Nakajima. Until six years ago I had worked for MITI for thirty one years. My chief responsibilities include the design and

planning of Japanese industrial technology policies. Meanwhile, I also worked on technology policies for small and medium enterprises, and engaged myself in technological corporations for the developing countries.

Although we have named our last decade “lost ten years” due to economic slump, that decade in my opinion was a confused time for Japan to really evolve into something new. In fact, despite being the second largest economic power in the world, the majority of the Japanese systems and institutions remained almost the same as they were in the period Japan was a developing country. We must immediately shake up such a national systemic fatigue, especially in terms of our innovation system in science and technology, as Mr. Goto and Mr. Arimoto already pointed out.

Now we seek a way to change our system. Nobody discussed it a few years ago, but today we have some light lid on innovation and reform studies. I have been long working to consider what role the national government plays in the innovation system of Japan, but we don’t have a clear direction yet. In this sense I’m still in the process of studying and learning. Thank you.

Mr. Nguyen Vo Hung:

Good morning, my name is Nguyen Vo Hung. In Vietnam we usually call people with first name, so just call me Hung. I am working for the same institute as Dr. Ca who has already introduced about it. My background is operational research. I got a BS degree in economic engineering. Since then I’ve worked mainly in science and technology professional policies. I’ve got a master degree in economics from Lancashire University in U.K..

During last five or six years, I don’t quite get involved in many different projects, but my main interest is still in impacts of foreign investments in the developing countries, especially in Vietnam. Also on that part, we have

conducted some study on the behavior of foreign investors in emerging markets — what it is like and its structure.

Besides that, in NISTPASS, we do quite a lot, various respects of technology or innovation policy. Especially in areas in Vietnam that undergo a transition to the market economy, we have to use a lot of so-called institutional reform. We are now looking to developing distribution, market distribution to commercialize science and technology results coming from the public institutions and universities. We look at many experiences and practice of in the U.S. and also a lot about in other countries. We want to follow that part for Vietnam. Right now we do quite intensively on that. This year into 2006, we like to find a way to utilize more effectively research results from public schools and universities.

Besides these policy issues, I'm also very much interested in political study. One of my fields is to try to apply the game theory in oversea research under the context of Vietnam. But what I see is the main issues in development, mostly about transfer of technology, come from social problems, social instability. When you talk about that, this is the conflicts of benefit between different groups. With my background, what I was doing in U.K has a great potential to use the game theory for policy research in this country. I hope next five years we can come up with some interesting results. Thank you.

Dr. Rishikesha Krishnan:

I am Rishikesha Krishnan. Please call me Rishi for short. I am a professor at the Indian Institute of Management in Bangalore in India. My subject is corporate strategy and policy, but my main research interest is the links between strategy innovations and competitiveness. To study these links, I do research at the level of firms, like Dr. Ca, as well as at the broader innovation system level. I am currently writing a book on the evaluation of the Indian

innovations system after the economic liberalization which started in 1991, and I hope to complete this book by the first half of next year.

I have been working in this area for almost fifteen years now since I started my doctoral research work in the early 90s. Being at the business school, I have the opportunity to interact with a number of firms. So one of my research areas, as I said, is the firm level; but I also believe strongly that policy level issues are going to be quite important in shaping the future course of the Indian economy. Therefore, I have increasingly in the last few years got interested in policy level issues.

To further this agenda, I am currently on the National Committee on Technology and IPR of the Confederation of Indian Industry which is India's largest industry body; and I am also trying to have some more presence in policy making. Thank you.

1.3 Dr. Krishnan's Short Presentation

Just to start, I want to give you what the picture of Indian economy looks like before we go into details of the innovation system. What you will see is that the economy is making a transition more to being a service economy. Even though the manufacturing sector never became as prominent as in many of the industrialized economies, the service sector is now more than half of the economy. And as a proportion, this has come at the expense of industry as well as agriculture.

One of the big issues in India is whether we have moved too early towards the service economy; and, therefore, we should really be trying to more aggressively promote the growth of the manufacturing sector. Just to give you a few numbers, as yesterday at dinner time some people were asking me about the Indian GDP and so on, some of the important numbers here is the GNP

per capita in dollars is only 530 dollars. But, if you look at purchasing power, it is almost 3,000 dollars. Still this is much less than even China, and of course countries like the U.K. and the U.S.A., but the important thing is that, for the last ten years or so consistently, we have been having a growth rate of between six and seven percent. So there has been a rapid growth in the economy; and the hope is that this kind of growth rate will continue at least for the foreseeable future.

Also, as you will notice from this slide, the economy's export performance has improved; still the overall export income is considerably less even than that of China. Another important figure which you will notice is the FDI. Its level is still roughly about 1/10 of that of China. There is some dispute about these numbers because, in India and China, we are following different systems for calculating FDI: maybe the level is not actually ten times, but it is still quite considerable.

From the country's point of view, even though we have made very rapid strides in science and technology, we have a very strong nuclear energy program and so on. We also know that there are still very, very big issues in our society.

A major issue is the incidence of poverty. Since we have a population of more than one billion people, when you have a poverty incidence of 26.1 percent, it means you have more than 250 million people who are below the poverty line: that is a very, very big issue of concern.

Also, though the literacy rate has improved over time to about 65 percent, it still means we have a very large number of people who are not literate. If you look at the health indicators, there has been an improvement, but again there is a big gap with many other countries in the world. And if you look at other social issues like accessibility of good water and sanitation facilities, once again you will see that there is a big gap.

So one of the big issues in India is, although we have a very big S&T infrastructure as I have mentioned, how much this S&T infrastructure is really contributing to solving the big problems of the country. This is one of the constant demands which people place on the S&T system: they have many expectations, they want to see very tangible, very obvious results from investments in science and technology on many of these kinds of parameters. But, as you know, in the science and technology institutes' research programs, many of their agenda have nothing to do directly with these problems. So that disconnect always exists, since we are a democratic country where the politicians are constantly under pressure to show results to the society. This brings about certain pressures as far as the allocation of resources to the innovation system is concerned.

Where I'm trying to move is…, I have a constraint because I have many slides for my presentation, but the time we have available is quite short. I will therefore have to go little fast, and I will try just to focus on the major points.

During presentation, I am just trying to answer these questions:

・How the innovation system in India has evolved?

・How has the economic liberalization process started in the early 90s and changed technological capabilities in India?

・Has the innovation system become more dynamic and strong, or has it become more weak and dependent?

・What are the future challenges in strengthening the engine for innovation?

・In India there is a lot of discussion about knowledge society; that is, can India really become a knowledge society in the immediate future?

The structure of my presentation is largely in four parts: I will first talk a little bit about innovation system before liberalization to tell you what was it like;

and I will tell you a little bit about what were the policy reforms which have been attempted; then I will describe to you some features of the innovation system after the liberalization process; and finally a little bit about what the future is likely to be.

Pre-Liberalization Era

Before 1991, as many of you would probably know, India largely focused on import substitution; and self-reliance was considered to be an important goal. So as long as you could do something in the India, within the boundary of India, that was all that mattered; efficiency as you see was not as important as here at all. This process was driven largely by the public sector by government-owned enterprises and research laboratories.

Though the private sector was not stopped, there were many constraints on its functions. We had a very elaborate industrial licensing system, which made it very difficult for companies to expand their capacity, introduce new products, get into merger and acquisitions, and do any kind of industrial activities. There were a lot of constraints on these activities.

Also there was government dominance on the R&D activities in terms of finance and allocation of R&D work. Though we had good institutions for higher technology and learning, the benefit of this was not really going into the industrial sector. So there was good capability, but we did not see the result of this in the industry sector largely because the industrial sector was constrained. There was very little competition, so there was really very little pressure on the industrial sector to really innovate.

Liberalization Process

The economic policy reform, which was traced back to 1991, actually came about because of a crisis. This is not strange to us because we all know that many times big policy changes happen only when there is a very serious situation; otherwise the government often doesn't need those changes.

So in 1991, there was a very acute financial crisis, foreign exchange reserves had come down to an all-time low, the government had to go and take a loan from the World Bank and IMF. And as part of this whole activity, many of the structural issues got addressed.

More specifically, I'd like to draw your attention to the second point: the licensing system was relaxed; imports and exports became much easier; and technology flow was also facilitated. One of the important objectives of the reform process was to make the industrial sector more dynamic technologically.

And now the reform process has moved beyond this, towards what we call "second-stage reforms." As you know, India is a federal country consisting of the central government and states. Now that the central government reforms have been carried through, a lot of the reform activities have to happen at the level of the state governments.

Post-Liberalization Era

What happened after 1991? What we find is that after 1991, the government support for technological innovation did change. Before 1991, there was very little direct support for R&D in the industrial sector, except in the public sector; for the private sector R&D, there was very little support.

But after 1991, a number of new schemes were started, for example, to absorb imported technology, to commercialize local technology, to help technology entrepreneurs, and to fund commercialization and development. Most of these are in the nature of soft loans, loans that carry reduced interest; the only grant scheme is actually the technology-based entrepreneurship program. Also a number of new tax benefits were started; for example, income tax and indirect taxes. But in spite of all of these changes, what we see is that the national expenditure on R&D still remains in the range of 0.7 to 0.8 percent of the gross national product.

However, one major change has been in the private sector. Its contribution has really increased overtime from about 14 percent now to about 22 percent though the R&D intensity of industry still remains quite low. We don't have very current numbers, but the numbers available are actually quite low.

So just to put this in a kind of dynamic form, what you see is…, if you look at the base of academic research and public research laboratories, on the left-hand side, you will see the government support directly through the budget, running of different central universities, Indian Institute of Technology, space research, atomic energy and so on; and a little bit of support for center of excellence in private colleges, and new schemes which have started a few years ago. This is at the base level. As you come to specific project level of support, you find it is through the science engineering research council of the Department of Science and Technology. The government does fund specific research project again in academic institutions and public research laboratories.

Then as I already mentioned, there is some support for start-ups through the "technopreneur" promotion program, and a more recent scheme to support technology business incubators in engineering institutions. We then have some support for scale-up of technologies which is through the Home Grown technology program, and some support for commercialization through the technology development board. There is also a new initiative called the New Millennium Industry Technology Leadership Initiative, which started a few years ago to support research between research institutions and companies.

However, the interesting thing is, if you look at the level of funding across the various activities, you will find that actually it decreases very sharply as you go from left to right. I just give you an order of magnitude: if the support for the academic research public laboratories is above hundred, then the support for research projects is above ten; and, if you come to the extreme right, it is

above one. I just give you the order of magnitude, not giving you the exact number. But if you just look at it, it is something like hundred to ten, or one. As you go closer towards industry, towards commercialization, the government support is actually much less. And many of us in India have been arguing that we need to start changing the equation: we need to start with a more emphasis on the right-hand side, rather than only focusing on the left-hand side.

OK, I have already talked about this.

Let me just very quickly take you through what happens in the innovation system after 1991. One thing you find is that the level of productivity in the Indian economy continues to be low. One study which was done by McKinsey Global Institute, which is a think tank, found that, if U.S.A. productivity level is 100, then Indian productivity level in the modern sector of the economy is only about 15; that is, only about 15% of the best productivity level achievable.

But the more interesting part is actually what they said is the potential; that is, you could actually move from 15 to about 40 just by some managerial changes. If you were to attend to rationalizing labor, you would reorganize your factories and their organizational functions and tasks, make investment in better technology, and address other factors like the improvement of the quality of your suppliers, the economy of scale, design for manufacturing, then your productivity would actually move from 15 to above 43.

What this suggests is that there is a big challenge for management of companies in India to move from this level of 15 actually to a level of 43. And this is actually something that depends on internal managerial decisions. So for people like myself or professors, or management, it is our challenge to move from that 15 to this 43. But this doesn't have much to do with policy; this is actually a variable under the control of the management of companies.

However, one interesting development in the post 1991 era has been that some companies have dramatically improved their competitiveness. Just to take one example, Tata Steel is a hundred-year old steel company that started in the early part of the 20th century. But when our liberalization process started, Tata Steel's future was considered to be bleak and it was not very competitive at that time. However, over ten years from 1991 to 2001, Tata Steel has actually changed its performance and today is one of the most efficient manufacturers in the world. In fact you can see that to produce one ton of steel they used to use about 4.8 tons of inputs today they only use about 3.7 tons. Earlier, they produced 79 tons per man-day, today they produce 189 tons of per man-day.

This is a kind of development which in a way is consistent in terms of what we are talking about today because eco-technology is also about using resources more efficiently, not wasting resources. We can actually improve the productivity. That is also a way to conserving your resources and using your resources in a more responsible manner.

Another important development in the last ten years has been product development and innovation in certain sectors of the Indian economy. I am just drawing your attention to three of them: one is the automobile sector, the second one is two-wheelers, and the third one is the pharmaceutical sector. These three sectors have seen a big change in the kind of innovative activity.

So you find today that companies like Tata Motors, which is a part of the Tata conglomerate that design cars for the Indian mass market. Today the company is the number three in the market after Suzuki and Hyundai. TVS Motor, which is a company that had earlier a joint venture with Suzuki to produce motorcycles, today develops its own motorcycles and one of their products, "Victor," has been one of the most successful products in the Indian two-wheeler market.

And in the pharmaceutical industry, companies like Ranbaxy and Dr. Reddy's Laboratories have been setting up new R&D facilities, trying to move into innovative drugs and creations. They have started getting market shares in the US and also started addressing the US generic market very aggressively.

In term of the research lab and higher education, we also find that the research labs have become more external and commercially oriented. For example, the largest group of government-funded laboratories is what we call CSIR, Council of Scientific and Industrial Research, which has thirty-eight laboratories: patenting activities has increased, cash flow has increased, and this is an important number today, about 18 to 20 percent of their revenue actually comes from the private industry. And we find that some of the laboratories like the National Chemical Laboratory have become a trend sector in this kind of activity.

If you look at some of the top engineering institutes, also you will find that, for example, IITs in early 90s hardly had any income from consultancy or sponsor projects. But by the time of 2002-2003, still they don't have a very big number in dollar term, but at least compared to what they were doing earlier, there is a substantial increase in their earning from industry.

Of course, a development, as many of you would know of, which is also something we are very proud about in India is that in the 1990s, we also saw the takeoff of the software industry. So much so that today it is the largest export item: in the current year we are expecting in India to achieve 18 billion dollars in the software industry exports with employment of about one million people, and that accounts for more than three percent of the Gross Domestic Product.

So they have become, in a very short time, a very important part of the Indian economy. It started largely as an export of man power, but today it actually

consists of what is called offshore development, that is the people in India located in India actually writing software for foreign customers.

This is actually been helped by the global demand and trend toward outsourcing of non-core activities. It started just as being based on low cost because labor cost in India was much lower, it just started based on the labor cost advantage, but over time there has been strong organizational capabilities and this is the source of their competitive advantages.

Government has supported this activity but I would not say it is a policy-driven activity: a lot of factors actually coincided to actually make this happen. From the innovation system point of view, I'll just give you a snapshot of what had been some of the major influences which help the creation of the software industry because I am sure, particularly in Vietnam and Thailand, you will be very interested to know what are the things that would have done in India to make this kind of development possible.

If you go back over time, the national laboratory, the atomic energy program, the manufacturing companies for telecom and defense and so on, were actually set up in the 1950s; and at that time there was really no expectation that we would ever be doing something like the software industry. In the 1960s, the Indian Institute of Technology, which is a top-level engineering school, and Indian Institute of Management, like the one to which I belong, were set up and the program was launched; but the actual software activity really started only in the 1970s when the first major software company, Tata Consultancy Services, was actually started in 1971.

The first multinational software company to be started in India was the Texas Instruments in Bangalore in 1985. Why did they choose Bangalore? One of the reasons is because these public-sector high-tech companies and laboratories were all located in Bangalore. So there was strong man power

availability in this area with people who already worked in high-tech industry and had access to computers.

One of the top companies today, Infosys, was founded in 1981, and other top companies went into the hardware area in the 80s and moved to software only in the 90s.

But the industry actually took off in a big way only with the liberalization process after 1991. That provided the right environment for the software companies getting ready to take off. And this was helped by a global move towards what is called client-server technology. So a lot of software had to be reengineered for the new platform and there was a global shortage of software skills. This demand was met by a number of new software companies that were set up. The engineering colleges in the private sector grew rapidly to provide the required manpower.

And one of the important government support measures which helped the development of the software industry was what is called Software Technology Parks Scheme, which is a government-sponsored program to provide good telecommunication infrastructure to software companies. This is a very interesting program because, while it's called the software technology park, it is not actually a physical park: you locate your facility anywhere in the Indian city and get permission from the government to use it as a software technology park. So you have all the benefits of an export processing zone just in one building, and all you have to do then is to connect yourself to the park of the IT network through wireless communication system, and then you can directly transmit yourself to everywhere in the world.

So this is a very innovative scheme started by the government: the government has only set up the infrastructure, and gives certain benefit of the export processing zone to people wherever they were located. So this gives you a kind of historical idea: part of the success in the software industry goes

back to decisions made in the 50s and 60s when there was no idea at all we would go on to software.

OK, let me just skip some of all these things, and just draw your attention to one thing; that is, though software is a big industry in India, only 27 percent is actually from MNC software companies, and 70% is actually from Indian software companies. Many of the clients of course could be outside India, but it is not dominated by MNCs.

One of the concerns in the software sector, however, is that the R&D spending, or R&D intensity, actually is quite low. This is largely because they don't really need to do much R&D. The software activity in India is writing software code; that is, people are developing software to specifications decided by the clients, so you don't need to do much R&D. It is actually a lot of routine activity and a lot of the Indian focus has been on things like quality management, improving processes and so on, which are not very R&D-oriented activities.

In fact, one of the challenges of the software industry is really going to be how they will move to higher value activities. Currently, of course, Indian software companies do enjoy good margin; but, increasingly over time, there is going to be pressure on gaining those margins, and then the challenge is going to move into activities that allow you to get greater value addition like consulting, like product development and so on.

There are some other issues which continue to be of concern in the Indian context. I told you that there were a rapid growth in engineering education in the private sector, but one problem of this is that we are moving from having about 80,000 students graduating a year to about 350,000 students graduating a year. Quality is a big issue. Because with such a huge growth in the engineering colleges, we have insufficient faculty, infrastructure problems, and quality issue continues to be more serious. In fact one survey found the

170 of the new institutions to be deficient on one of the parameters of the others.

Entrepreneurship is also a challenge because traditionally in India there are some issues regarding with attitudes towards business whether entrepreneurs are really respected or not: there is some kind of hesitation about business, that it is not a good thing for people to go into. Luckily, with the new economy, these are changing but there is still an issue going for it.

Another issue is the regional development. This is a problem which China has also faced with. If you look at a lot of the economic growth which have happened in the last 10 or 15 years, most of us live in the big cities. For example, the city in which I live, Bangalore, has become very crowded; the traffic jam is just terrible. The city has become very prosperous, but the development is not spreading to other areas. Particularly in a democratic system, this can be a big problem going forward, so one of the problems we are trying to address is how you deal with this issue.

Some change over time is that the labor movement actually lost much of its bargaining power in the last 15 years, but we have seen some return of this because, as some of you might know, currently the communist party is supporting our national government, so they are trying to enhance some of the bargaining power of the trade unions.

OK, I will just skip some of these things. Just a kind of sum up: how the innovation system has changed? I think what happened is that the liberalization provided the opportunity for the organizations to bring up capabilities and find new market values and output. That's why we see the capabilities have got enhanced in certain sectors, like I mentioned, in pharmaceutical or the automobiles.

These sectors have been characterized by very rapid demand growth and changes in the competitive environment. For example, our Indian emission regulation has become very strict, so that promotes a lot of innovation in the two-wheeler industry. There have been a lot of competition; and a lot of role models like Dr. Reddy's Labs provide examples for others. More companies are becoming more competitive. The software sector has been very successful in leveraging a resource base to exploit the market opportunity.

But one of the problems which we still see is there is no joint working between the manufacturing and the software sector. The software sector has been very export-oriented, externally focused, looking for customers in the US and other countries, while the manufacturing sector is largely domestically focused and there is not much link between the two sectors. But for our innovative system, this is one of the challenges going ahead.

Future Perspective

A far as the future of the innovation system is concerned, there are a few challenges that I think are important: One is we have to sustain growth in employment intensive service businesses like the IT sector that I talked about. We have to maintain competitiveness through constant upgrade of capabilities, and this is particularly important for the manufacturing sector. There are some traditional sectors, like textiles, where we used to be very competitive globally, but we have lost them. We need to recover competitiveness there, particularly with things like the Multifiber Agreement having been abolished.

With new markets opening up for textiles, we need to move much more rapidly and overcome the loss of market share to China. China, as all of you would know, is extremely well in the textile industry, but we haven't been able to do that. We need to go forward, enter and succeed in a few selective, high technology industries, too. We also need to revise innovation system and agriculture and health care particularly because agriculture is related to about

60 to 70 percent of our population, which even rules the area; and health care is very important to improve these standards of living. Yes, there is a lot more I could talk about, but I think I will stop here. OK, thank you.

1.4 Q&A Session with Dr. Krishnan

Dr. Sumani:

Thank you, Dr. Krishnan. Can you stay there for a while, because there might be a few questions for you, I guess? Any of you have a question?

Question:

I have a question. Dr. Krishnan, who do you regard leads the science and technology policies in India, local government or national government?

Dr. Krishnan's answer:

In India, science and technology policies are largely decided at the national level. So when I talk about the government in the presentation, 95 percent of time is about the central government. The central government decides industrial policy. It decides S&T policy. So the central government has a major role in the innovation system. Historically the state government has played a very small role in the innovation system.

Question:

First of all, I'd like to thank you for giving us a very clear view of the Indian national innovation system. I think it was an excellent presentation. Thank you.

I learned a lot. One question I have is: though maybe you have mentioned it, and I may have missed it, you did not speak much about the role of Indian universities in the national innovation system. For instance, I would like to know what role the Indian university plays in your famous pharmaceutical industry.

Dr. Krishnan's answer:

OK, to do that, I have to take a couple of minutes because I have to explain a little bit about the structure of the university system.

India has about 270 universities, but most of these universities are largely in the activity of education and training. They are not very active in the research. The technology institutes are different from the universities like NIT, National Institute of Technology. These are not part of these universities. These separate specialized institutions have a much stronger research focus. But the traditional universities unfortunately over time have become largely teaching institutions.

To address your specific question about the pharmaceutical industry, my guess is that the university system is not very involved in the pharmaceutical research. There are only two or three parts of the public innovation system which are involved with pharmaceutical research: One is two labs under the CSIR, Central Drug Research Institute in Lucknow, and the other is the Indian Institute of Chemical Technology in Hyderabad. These two institutes have important pharmaceutical research going on within the labs. And the government also has a program which I did not talk about because it is quite small to support joint work between these labs and the pharmaceutical industry.

There is only one university which, as far as I know, has a strong department involved in chemical and drug research. That is the University of Bombay, what is now called the University Institute of Chemical Technology (UICT). They have a strong chemistry group which is involved both in chemical research as well as in drug research. But I think, if I go on the general level, I would say the universities are not much involved in the pharmaceutical industry.

Question:

My name is Kitti Tirasesth from KMTL. You mentioned about the three sectors. So you define them as a part of service or industry?

Dr. Krishnan's answer:
In that definition it's part of service.

Question:
Actually your presentation is very impressive, especially you mention about that India move too fast into service. I just wonder, can you give us some kinds of key reasons or some determinants why it happened? Why India, as you call it, move too fast into the service?

Dr. Krishnan's answer:
OK, when we talk about the growth of the service sector, first of all I should clarify that the service sector growth has come from many different parts of the service sector. It comes from telecommunication which is the one very fast growing in India. That comes from financial services, again which is after liberalization grown very fast; and of course activities like software, also.

One of the reasons I think these service sectors grown very fast compared to the industrial sector is that the service sector has had less constraints in growth. The manufacturing sector I think is more dependent on a lot of physical infrastructure, and the physical infrastructure in India, to be honest, has not really developed as far as it should have during the liberalization period.

The public investment in infrastructure has not been adequate. So we have problems with power, we have problems with water, we have problems with land, and all of these infrastructures are very important for any kind of manufacturing industry, whereas the service industry does not depend on these infrastructures to the same extent.

Many of the software companies have their own backup power supply. They are communicating directly with clients abroad, so you don't need to worry

about infrastructures much. So I think one reason why our service is growing very fast is the constraints to entrepreneurship and service business have been much less.

The telecom industry, for example, was deregulated by mid 90s. So during last ten years, we have very rapid growth in telecom industry. So I think today, for example, if you talk to one of students from my institute who wants to set up a new business, he will definitely choose the service business. He will not set up a manufacturing business because he knows that there are too many headaches even after liberalization. Still there are more regulations that will inspect somebody. They will come and check for pollution control; for you know there are so many different things, whereas software is very simple.

I just rent an office and put the computers and tomorrow I start my business. I have a personal experience, though I did not mention in my introduction, my father used to run a manufacturing company for twenty years. He has done the manufacturing company, so I actually worked with him. It is quite tough, but three or four years ago when one of my students asked me to join him, we started a software company in two weeks. It is a different matter; we did not succeed for some other reasons but it is quite simple to start a software company, very little regulations, very easy. So I think these are some other reasons why, you know, the service sector has grown much faster than the manufacturing sector.

Question:
May I share the opinion about the growing of the ITO (IT Outsourcing) software? I think one of the key is that the language is English because Indian has a very good and high potential in that language.

Dr. Krishnan's answer:
I should also mention that increasingly one of the other big growth areas in India is what is called Business Process Outsourcing. It is back office

operations like data processing, call center, transcription — all these activities have been rapidly growing in the last four or five years. That again is using, you know, what he is talking about, using English language skills. Good English language skills and very smart people are available at low cost.

So many MNCs are shifting their entire data processing and call center activities to India. Many of the insurance companies and financial service firms have shifted. And from the employment point of view, that is growing very fast, but again you mainly find them in big cities because it requires English language skills for call center activities. You won't find them so much in small towns. Small towns are more local language based, but good English language skills are in big cities without which nobody can be hardly successful.

Question:

Thank you very much for the contribution. My question is concerning more of your point. You mentioned a large increase in productivity and competitiveness. But I want to point out the concept of cost, for example, production cost. When major Japanese companies are thinking about cost, it means production cost. They think about a final price. But if you produce one product and someone uses it, at the end of its lifecycle, you have to recycle it or throw it away. This costs you money, too. And nowadays some European automobiles companies are already thinking the cost should include the penalty for polluting the environment and so on, and I think it's very important. Otherwise, later you must pay much more money. Do you have such a point in your process in India?

Dr. Krishnan's answer:

First thing I should mention is that India is not very consumption-oriented. If somebody buys a car, he will use that car for a very long time. They may sell it to somebody else, but there is no concept of junk heap. Until the car absolutely breaks down, they will not stop using it. So people don't throw

things away easily in India. One good thing about that is that there is not so much wastage of resources.

But to answer your question specifically, so far there is not much of emphasis on recycling actually, because there is not so much waste of goods. People do not focus so much on recycling.

But in certain industries, the environmental concept has become very strong. In automobile we have adopted European emission regulations of exhaust gas, and the pollution is actually reduced. In some of the large cities now, we have moved away from using diesel to using compress natural gas, which is again more environmentally-friendly because the combustion process is more complete. So something like has happened, but in terms of recycling, I don't think so much has happened so far. It will happen over time, but so far it has not happened.

Question:
I heard you said about the concern that India is growing too fast to the service economy. Rapid growth of the service sector is also one of my concerns.

The main topic of the Honda Foundation seminar is eco-technology and I think that concept comes mainly from traditional sectors like automobile, chemical and things like that. So my concern is whether or not there is an issue about eco-technology in service sector like IT, because I think many kinds of the resources: human power is the key resource. And we may be very much involved in the situation where the IT sector creates some kind of waste, or the wasteful use of main power; then what is the kind of pollution in this industry? It is one thing.

And another thing is that when we move into the service sector it creates many new problems, new issues that we don't expect. And when things go too fast, the society may not be able to adapt to its pace. And if we, just recently

about two months ago, there is a case in Vietnam, one man died because he spent about two days playing games online. We never expected that sort of things. Do you call this a “pollution” or things like that?

And from what you say it just comes into my mind, that maybe one of the topics we need to discuss is: what is eco-technology in the service sector? And even the automobile sector is more and more removed from the concept of traditional sector: it is now involved in much of high-techs and more service-oriented than traditional industry.

Dr. Krishnan’s answer:

One issue is the movement toward the paperless office. I think that is one environmentally-friendly activity they are trying to achieve, but they have their own waste problem. They have electronic waste, for example. People are talking more and more pointless things on the Internet, and this is so much waste of signals and data. Your point on human capital, I think, is a very interesting point.

There are full of occupational problems which come up with software titles of work. For example, your overwork: people are having problems in managing their family life. Lots of this business process outsourcing I’ve talked about happen at night because it has to happen during the daytime of US or other countries. So people work at nighttime and it raises their own issues about biological clock getting kind of shifted because they have to work at the strange time of the day.

But to be honest at the moment, people are looking more at the economic opportunities. They think there is an opportunity. They try to exploit that and they are not very worried about these problems. In some point of time, it may become very serious. They will be addressed, I think, at their point of time. But today people are not worried about that too much.

As for the other point, I paraphrase it as what is the best way to exploit the potential of human beings. Well, I think software industry in India has given a good opportunity for people to exploit their potential. Indians are quite good in math, good in English language. Software industry has given them an opportunity to do that and also earn a good living. I mean the kinds of salaries you get in software industry in India are much higher than the average salary. It is a good standard of living for people in a poor country.

So I think, you know, on the balance, I would say yes, software industry has been advantages to people but we need to look at future challenges like value addition giving more opportunity for creativity, more opportunity for innovation, allow people to realize their full potential. That will come if we move into more value-added activities.

Question:

Let me introduce myself again, my name is Nguyen Tri Dung; and I actually thanks very much for your very wonderful presentation. I see many similarities between India and Vietnam. Dr. Tran Ngoc Ca is also here from Vietnam, and here are our friends from Japan and from Thailand. Actually I see a movement towards the software sector now in Vietnam, and I want to ask your comment on this issue. In Vietnam people try to build up high-tech parks. This is the question of clustering; and in HCMC and Hanoi, you see the process of urbanization.

Today I have a counter advice to the government: I said, instead of going to clustering like the high-tech park, we should have a network of high-tech parks, or a network of the industry in Vietnam. Now in Vietnam, the government has waited for ten years to formulate the concept, and then went to implementation. We have talked about the high-tech park for the last ten years, and now in HCMC they stopped to implement that, and it's not yet in operation. They said they need a more of few years.

As our friends here and you said, manufacturing is a very difficult issue. Before I work with the UN, we discussed a lot about the development issues. At that time, all my colleagues saw India, I must sorry to say that, as an example of the Asian trauma. And we talked a lot about it.

But for the last twenty years, I have seen the growth of software business in India as the main contribution to the India economy. You can see it as one kind of the exit for the 60s to emerge into the year 2000 and after. Actually what we want to learn from India is the government policy in term of liberalization.

Like you say, people can have a kind of building, and the government can see it as an export processing zone or something. Here we have activities in our complex. I provide this concept here. We are the first to go to the high-tech production here in Vietnam. Quite ahead of the government movement, we try to do, we try to persuade, we try to get. I think liberalization is not a process of giving where the government gives it to the people, but actually it is a process of challenging where the people should work their way. And then in Vietnam, we have attempted to persuade the government, but they reject us because they don't they have such a policy. And actually we started here from the handicraft business; and then, you know, our staff members, after they received training and worked hard, now export the high-tech product.

So this is a very practical case and what has happened in India? That means to go to such an extent, you have a lot of what is called case study: I mean the experience of Indian, experience of Thai, and experience of Vietnam. Dr. Ca may give some more comments, but I think you get my viewpoint: I don't know what happened in Thai or in India, but in Vietnam the government just concentrates on the high-tech park or the industrial zone, but doesn't see the country as a whole.

The development is also seen in such a clustering place, so I want to give the counter advice to the government, claiming that they should have the network of high-tech parks. Suppose a small place like us here is like the terminal and the high-tech parks are the server, then we link together and work together. If you think, for example, about biotech-technology, we should not have the biotech-experimental research in the high-tech park. The biotech-technology should be done at the place of production: it should develop in the right production or in a kind of innovation-driven environment, not in the park itself. What is your comment on this? Thanks and also I'm sorry for my long discussion.

Dr. Krishnan's answer:

I think it depends a bit on the kind of industry we are talking about. One of the reasons why countries have supported high-tech parks and science parks is because they believe there are some benefits of clustering in what they call economic liberalization and joint working between companies. I think these countries are largely impressed by big success in the Hsinchu and other science parks in Taiwan or some of the other well-known industry parks in other countries. So I think that is one of the reasons why people have emphasized the importance of creating the science park or the industrial parks.

But, in the software industry, one advantage and I don't know what you call it so, is that most of the companies do not require too much networking with other companies. Each company pretty much does its own activities; so that's why the joint location has not been very important.

At the same time, in India we have a lot of problems because the land is privately owned. When the government wants to set up a technology park, they first have to acquire the land from people. Because we have the democratic system, the moment the government tries to acquire that land,

people will go to the politicians or the court, and challenge the land acquisition. So setting up any industrial park or any activities take a very long time because of the time for the government to acquire all the land and convert it into industrial area and so on.

So I don't know who has the blame to it, but somebody realizes software is all that is required. In the realm of software, all that people need is access to a good telecommunication. It does not need wire either, because wireless facility is possible. You can use microwave, or you can use other communication facilities. So they just came up with the idea to just create a system, in fact, a very simple one: you have one building, and you have only to apply to the software technology park with a registration number. You put it up outside the building, saying this is my software technology park, recognized by the director of the software technology parks; and then you become an export zone. So, if you are importing something, you can import it without custom duty as long as it's located within that building. If you want to take it outside the building, then you have to maintain some registration format, also. It's a very simple system and it works very well.

So anybody who wants to set up a software export-oriented company, he just applies for the permission. Every quarter at the center he reports to the software technology parks, saying I export it, and this much software during the last quarter, and so on. That is the only reporting requirement. And because there is no physical movement of goods, it is quite simple to operate in this quality, but I don't know if it can work in every other thing.

We have a similar scheme for hardware that does not work as well. Just like the scheme for software technology parks, we have the Hardware Technology Parks scheme. I think you can also do with it well, but that have not taken off so well.

So I think the idea is you have to be a bit flexible. You have to see what works because you know that the market outside is changing very fast, but the government moves very slow. There is a big gap between the pace of the changing in the market and the pace of government decision making. So the government has to move more in a more flexible manner. That's the only way to deal with the uncertainty which is there in the market, but it's difficult: the government needs quite time to understand the process.

Dr. Sunami

Thanks, you gave us a very good starting point for later discussion in the morning session, and I wish we can talk about the high-tech park in the afternoon when we will have had a HCMC presentation on their policy. I think we'll have a short break. Thank you.

1.5 Follow-up Discussions

Dr. Sunami:

OK, let's see. I think the presentation by Dr. Krishnan gave us a lot of good idea as to where we start our discussions; for example, the roles of public research institutions and universities, and, more broadly, the science and technology infrastructure before the reform of 1991; and how that was really translated to the strong growth of the R&D in general.

You can find a similar type of questions in China as well, where you have sort of an increasing contribution by R&D, the industrial sector's R&D. But if you measure the intensity, it is very poor. I don't know what is going on there, but there are a lot of times when the institutional reform of public research institutions has not just been transferred to the private industry. I can't give you statistical numbers of R&D activity in industry now, but it really doesn't translate into the strength of R&D capability of the industrial sector.

Other things like entry cost and social institutions deserve our discussions as well. Why do we have the growth of software industry? Because that's where the social and the entry costs are the lowest; and this is a really interesting starting point. If you look at some Asian countries of different institutional background, the cost factor is really playing a key role in giving a very interesting characteristic of their development strategies. I mean there are so many things we can talk about.

But going back to the Hanoi conference, we had the whole conference divided into three sections: one was looking at the role of entrepreneurship and innovation from the start point of the macro economics and institutional innovation system.

And the second section was really from the policy side, and there was also a interesting question raised as to whether, you know, the way the growing activity of R&D innovation occurred whereas there is no policy involved. So this is another sort of question we can talk about.

And the third section focused on the eco-technology aspect as to whether the content of the technology and whether I'm not quite sure this sort of three section format is worthwhile to continue. But, Dr. Ca, maybe you can start by giving your impressions from the Vietnamese point of view after hearing experiences from Thai, India, and Japan.

Dr. Ca:

Thank you, Sunami-san. Actually I believe, for each of the Honda Foundation symposium, which is to be organized in different places, there could be a chosen theme, right? For this year the chosen theme is "linking innovation and entrepreneurship for developing countries." This theme might change. It depends on circumstances, depends on the orientation, and depends on where we are going to organize this. But despite these changes, I believe this key issue remains. We might rename or reform it one way or another, but this is

the key because it's crucial for not only for Japan or Vietnam or Thailand, but it's kind of a common concern or common interest of so many organizations and nations around the world. So I believe that this should be the main, if not specific, theme of our future conferences, right? From the Vietnamese, more Vietnamese perspective, I got some strong kind of impression or response from different kind of stakeholders who are involved in this symposium.

First, I will talk about a little bit about the policy makers — people coming from ministries and from the cabinet office or from the national assembly, which is similar to the parliament in Japan. They quite like the idea of putting this thing because this is the forum where they can learn experiences from other nations of the world, and they have the chance to talk and mingle with people from different background and to make policy making process more real. Certainly there are strong interests from the academic circle. People from research institutes, from universities — they learn a lot and they exchange a lot. They get more contacts to develop. But last but not least, it is coming from the enterprise sectors, especially from the third sector on the eco-technology, which might have been associated with the presentation of a new kind of motorcycle model at the conference. I believe that there are very much strong interests from the firms and from the people.

OK, you talk about the policy and you talk about the economic theory concept, but here is the thing that they want. They can see it, they can try it, and that would be a lovely thing. And I reckon that in the last symposium in Hanoi, we have the last contingent of people from the mass media and as usual they pay a strong interest and attention to this kind of event.

The question is what we go beyond this symposium. I believe that, OK, we produce this volume which is a very good product. But I believe that the impact of this kind of symposium does not stay in this volume it goes beyond that. It is increasing earnest developing contact, networking. Like Mr. Dung

and others said, networking is important and there could be several kinds of follow-up programs after this kind of symposium: one is that we could think of some kind of joint research project. This is more interest for academic people, like people from Tokyo University and Tokai University, and people from Vietnamese or Thai or Indian research-based organizations.

That is one type of thing, and the other type of format is of more macro kind of, more exchange of ideas among politicians, among the members of parliament, among the members of the cabinet office to develop the bilateral or multilateral collaboration. Why do I mention this? Because again I want to refer to my latest visit to Japan. Before we went to Japan, we met Mr. Koji Omi. He is a member of the Japanese parliament and he said he actually wants to run this kind of idea forum in Japan; and when we were in Japan, we met him again. But not only him, we met people from the MEXT, deputy minister, and we met Abe-san from CSTP (Council of Science and Technology Policy). All of them expressed a stronger willingness to develop collaborations between Japan and Vietnam in particular and with Asia in general because so many things are happening for the last few years. This kind of level I would think this kind of forum could lead to.

The third follow-up format is that more industry-based activities. Here comes the role of companies like Honda, like Honda Vietnam, like Japanese association of business in Vietnam or in other country because, whatever you do, what kind of policy you introduce, it should lead to, you know, economic benefit. It should lead to an increase in competitiveness or performance of the firm and more collaboration.

For this kind of follow-up, we can touch upon issues like FDI or techno transfer or subcontracting agreement. I understand, for example, one of the concerns of many multinational companies in Vietnam, especially the Japanese firms, Honda for one example, and Toyota for another, is lack of

local supply in term of good human resources. Whenever we talk to them, they say it is very difficult to recruit good Vietnamese skills in terms of engineering, in terms of labor, and in terms of supply of parts for the assembly. So I think it's the kind of thing we can do about: development of supporting industry for multinationals, development of networking of large multinationals and small enterprises in Thailand, Vietnam, and India. It's indispensable when you argue you want to revise manufacturing strength, for example, in India. That is the key issue. So you know the follow-up format should be a kind of mixture: it could be academic, it could be more enterprise-based, it could be at the more macro-level, in order for things to just fit together.

Then the question is, how you want to go about that and to what extent we want to develop this kind of things? But, so far I think that it could be three pillars, we might want to call it, for collaboration and networking together: there could be an academic pillar, an industry pillar and a government pillar. Actually there are all kinds of components in so-called innovation system. Maybe I should stop here with my reflection.

Dr. Sunami:

I guess we can ask some comments from Mr. Arimoto and Mr. Nakajima from the policymaker side. But I actually hear the inspiring idea of research collaboration about the entrepreneurship. I think we can take the notion of entrepreneurship a bit beyond what we used to think in term of the western sort of concept.

Here we talk about the entrepreneurship influenced by social and political infrastructures as well, where you see the entrepreneurship really taking place, in the place we depend on the kind of the policy, regulations and deregulations and so on. And if you are given the idea that there is entrepreneurship everywhere to begin with, we see a certain sector in a

certain country that has more entrepreneurship activities than the other. It really depends on that kind of policy and institutional arguments and I think that could be another.

So we focused on the entrepreneurship. Last time I remember we talked about it in the Conference in Hanoi because Vietnam was transforming from the planned economy, self-sustained economy to a market one. I think to give an example of how the firm or one entrepreneur, in this case Honda, to develop the kind of the technology and the innovation that really affect the entire social eco-system, it is just like giving an example of the kind of introducing a new actor to the scene, and I think entrepreneurship is really the system as a whole, may be that could be another further discussion for the next round.

Mr. Arimoto:

I want to make some kind different viewpoints than that just Dr. Ca said earlier. So you had the chance to talk with Mr. Omi and Mr. Abe who are the highest-rank policymakers in Japan. I think when they're talking about innovation, they are thinking about the way how to get competitiveness — not only competitiveness but also they want to get social stability. They want an innovation of not only economic growth, but also of social stability, public values, and maintaining the traditional diverse values etc., etc.. That's the public policy.

Of course the Honda workshop is focusing upon the way how to get money by private companies. Policies depend upon the scope of innovation, and the definition of innovation. So, before we talk about the innovation, we should think about the frame of the innovation. After that, it's OK for us in future Honda workshops and symposiums to focus upon the way how to get money by private companies. Of course such a way is supported by each country's government, depending upon the stage of economic growth. Japan is leading

and the China follows the leader, and it is the kind of development. Anyway, my personal view as a government official in Japan, the Japanese government officers and high-rank policymakers are having a broader viewpoint about the innovation policy. Thanks.

Dr. Sunami:

I think the focus of the activities of the Honda Foundation is really that sort of broader one as Professor Uchida mentioned earlier when he talked about eco-technology. I think it's really about that. Also the situation in India where, you know, the role of science... S&T institutions are now increasingly demanded by the public to solve the problems beyond the competitiveness of dealing a company. That's what here we are talking about the challenges ahead, and I think it's something that may be in line with what we have talked about, reflecting on that last conference.

Mr. Nakajima

As Mr. Arimoto has mentioned, there are many different responses and reactions at the point of the Japanese government.

In my classification, there are three different type of research: the first segment, as you probably agree with me, is academic research. This is what we have been conducted in the university. The second segment is basic research for social infrastructure or foundation of researchers. For example, there are global and meteorological observations, and you could also include in this category the work of measurements and standardization. This type of research has been conducted in Japan mostly at national institutes for the last 150 years since the inception of our modernization. Entering the 20th century, the national institutes started researches for the seeds for industry, seeking beyond knowledge for social infrastructures. The third segment of research is R&D that everybody might be most keenly interested in, and this is what companies have been conducted in most of the cases.

These three segments of research have been sort of isolated from each other. But in the 1990s, when Japan faced with a lot of economic difficulties, economic confusions, we had to rethink about how we could sustain development for the future. Government and industry began to place pressure on national universities and institutes so their researches get much more linked with practicality and commercialization. Especially national universities have considered themselves to be civil servant as the drive force of academic research, and basically prohibited their scholars and researchers from close contact with the private sector. So we started some deregulations in that area at the beginning of the 21st century.

This is only a general sketch of researches in Japan, and we have met with great challenges, especially in terms of government's role. For example, how could the government support these three segments and in what proportion? Do we need to enforce new regulations, particularly with regard to environmental issues? This may sound a bit retrograde, but certain regulations are required to protect the environment. And how are we able to promote the third, new segment of researches for the future? I think it's really the task we have to tackle for the future; and, by the word "challenges," I meant this kind of situations in Japan during my self-introduction at the beginning. As Mr. Arimoto mentioned earlier, what he just said is really correct for the last five or six years: Japan has been trying to strengthen on technology and industry in order to improve its international competitiveness in the world. However, I believe that these three areas of research that I mentioned here have to develop in a balanced manner. Otherwise, we will not be able to compete in the world's mega-competition; and, at the same time, we will not be able to make contribution to the developing countries.

And last but not least, I'd like to thank Dr. Krishnan for his insightful presentation. I think he has given us a great traction toward the way how

future researches should be conducted as well as this conference should be held in the future. Thank you very much.

Dr. Sunami:

Thank you. Dr. Ca, would you give us a brief comment after hearing the discussions in the last conference in Hanoi?

Dr. Ca:

Yes, I have an impression in Hanoi that most people do not have the concept of eco-technology. I think it's a little difficult for participants to make discussions based on eco-technology, including myself. The concept of eco-technology was not clear at that time. But now we have had several occasions, and I really hope this afternoon we can think a little more eco-technological — how we can think eco-technologically of our future progress of industry or management of the people because the environment itself contains so many factors than anything else. So this is not so simple on the one hand. But, on the other hand, it is very important because our science and technology paradigm includes not only information, material, and energy, but also life, especially human life. This is very broad but essential, I think, because we are just human and science and technology are just for us and we should control them, not science and technology control us. This is my point. Thank you very much.

Dr. Sunami:

OK. Mr. Kitti, may we have some reflection from Thailand after hearing what we have been talking?

Mr. Kitti:

Sorry, last time I didn't join the seminar in Hanoi. I think I should listen to your opinion about last time first.

Dr. Sunami:

OK. Then Professor Goto, do you have any comment?

Mr. Goto:

OK, I have two points. One is eco-technology. Everybody mentions eco-technology is the way we should go. To develop eco-friendly technology, we need a private sector capable of development in learning. I think there are two fundamental themes for this kind of enterprise: eco-technology and entrepreneurship. I think it's time to start thinking of combining these two, thinking of, for instance, eco-friendly business model and things like that.

My second point is a bit different. I think the most difficult thing for the developing countries who are trying to catch up today is that they have to deal with the WTO-TRIPS agreements which did not exist when Japan, Korea, Taiwan, and China started their catch-up efforts. So there is area difference. We need to think about appropriate ways of technological capabilities in consistent with the TRIPS. You have to deal with this sort of difficult agreements, but you have quite a room. I think you can find an appropriate way to do your catch-up even under the TRIPS.

Dr. Sunami:

Thank you. That is an important point. Especially when we talk about the Japanese experiences, we often forget about the differences sorts of goal in such a global economic environment that developing countries today face — not just technology, the Internet, outsourcing, and even linking the open US economy to certain parts of the region, Taiwan, Shanghai, and Bangalore. And all these new phenomena are what the Japanese, I think, will not face with. Even the Taiwanese or the Korean won't experience the same challenge. Ten years ago there were a lot of studies about how the Taiwanese and the Korean pursued their industrial development on different strategies. But today I think it's important to have that notion at the beginning — we are in

an environment which really links everything under this new global economic trend. Mr. Krishnan, do you have some comment on that?

Dr. Krishnan:

First, I'd like to say that Dr. Goto's point is very important. I think the policy environment created by the new TRIPS is going to put a lot of constraints on the developing countries in many areas. And I think there is a very clear implication of this. The clear implication is that the government has to be much cleverer, much more capable, and much more flexible because even WTO, for example, allows a new kind of government support in the field of R&D. So government needs to take use of those provisions to support the local technological development wherever possible. Government had to become cleverer and more innovative in term of using those agreements to actually promote the local industrial activity; and this means for government there is a new way of thinking. They have to start looking at a more promotional role.

Second point which I would like to make is that I think we should do not limit the idea of innovation only to technology — that's what we are talking about just now. It suggests that the innovation has to extend to government, it has to extend to organization, it has to extend to management — in every dimension of the economic activity or even social activity, we need to have the idea of innovation.

If I can just take one minute just to give you an example. In the software industry, many of the software company in India are working for multiple foreign customers, and each foreign customer wants his intellectual property not leak out to some other company, or even it should not move out from the group of people who are working on the particular technology.

So Indian companies create a new concept called "offshore development center;" that is, within their software development center, they create one part

of the company which only devotes to working on a particular company. Within those offshore development centers, it's like being in a customer's plant: they have staff of the company, IP policy of the company, and everything of the company. People who are working for that client work only for that client. So this is a very simple example of an organizational innovation to address the concern of the client. I think, more and more, if you want to be successful in the global market, you have to also think of a new way of organizing your activities.

The third point I would like to make is just in term of eco-technology. There are two dimensions here: One dimension is that government policy is important because companies will be pushed to actually look for eco-friendly means of doing things. If there are strong regulations, government has to use its regulation power to push company into more ecologically friendly activity. We have many examples: Scandinavian countries, for example, are leaders in many of the environmentally friendly technology because those countries were some of the first to put in place very strong regulations; and I gave earlier an example of India's automobile industry. A lot of innovation has been driven because of the increasing environmental standards. This has pushed all two wheelers to move from two-stroke to four-stroke engines, from four-stroke engines to further improvements.

The other dimension of eco-friendly technology which I think we need to stress is the link between being eco-friendly and being efficient, because the moment you are eco-friendly, you waste less resources. It also improves your efficiency, productivity, and competitiveness. So there is no contradiction between being eco-friendly and being efficient. That's important to stress that there may be a short-term cost because you invest more to improve your efficiency and to be more eco-friendly, but, in the long term, that's the benefit even for the company — I mean, I'm not talking about the society; I'm talking

about the company. So we need to emphasize the eco-friendly not because it's something fashionable, but because it's something efficient and beneficial to the company.

Dr. Ca:

Yes, reflecting on that, actually in Vietnam there are some policies, or may I call, policy actions toward promoting so-called "ecological" aspect of technology. Have you read the latest report by the Minister of Industry about how to implement the new regulation on the importing car assembly? Actually a lot of car assembly isn't qualified because they do not meet certain criteria. That could be a good movement in preventing us from wrong doing in this area. You may want to add something about that?

Mr. Arimoto:

Whenever it comes to such kind of policy, there are always some political issues involved, and here comes the bargaining power of different groups. If there are those who can not satisfy that kind of standard, they are strong enough; they can delay the implementation of the standard. We experience that in motorcycle industry in this century. So a lot of things here is not only technology, but also the awareness of the society, and also some political interest of different groups.

That may go beyond the theme we discuss here, and that's why earlier in my introduction I said that I see great potential to use game theory for analyzing this sort of behavior. If we can create a kind of structure that is for the benefit of the stakeholders, they will go for eco-technology — that's the ideal. We need to create a system or structure that is the equilibrium of eco-technology; but, given all that complexity, how we can get there is a difficult problem; but I think, since any problem can have some solution, we can hope for that.

Dr. Kitti:

Well, yes. I am glad to share some experience. I have spent about one year to study about the technology road map for the national research courses of Thailand. The project is called “the technology road map for computer and energy,” and we have made a ten-year road map starting from next year. During the process we found several key factors. As we focused on social technology and environment economy, we finally found that government policies and politics are a big factor to go on or to stop the reality. This is what we have learned from the technology road map.

But I would like to find out the adequateness of the road map. First you need to think about the whole scenario, and after that it’s quite good to make the priority of necessary technologies and then to focus on the key technology. That is one possibility to go on this topic, I think. Thank you very much.

Dr. Sunami:

Thank you. I think we have to wrap up this session in five minutes or so, but I have a clear idea at least about the naming of our conference, which should be like “linking eco-technology and entrepreneurships for developing countries under the new global economic system.” This is a very fundamental theme that I think we can all agree on; and, within this, we can talk about two larger sections instead of three last time. The two may be forcing innovation for government and forcing innovation for business-firm level which includes stuff like eco-friendly business models and so on and so forth.

As for the government section, you mention about the technology road map. We have regulations that are playing an important role in India, Japan and Vietnam situations. We can also include things like the procurement and the role of government that should be more innovative in terms of including a kind of policy not just giving the subsidies or support for a particular type of industry, but also having the regulations, efficient procurement, and so forth — that is another important role of government.

Also it needs to include Mr. Nakajima's point about strengthening S&T institutions, which is the institutional infrastructure. This doesn't really link directly to the kind of objective, but that's very important to understand they play a very important role. You might want to jump onto this, or anybody?

Dr. Ca:

Well, actually I think so many of you gave some very quick idea on how we are going further, and I agree that we should make eco-technology become more all there, all the time. It is only there all the time, but we could make an even more centered focus with link to the entrepreneurship; and I agree entrepreneurship is the key because we all know that policy is important. But no matter how good policy is, if there won't be enough degree of entrepreneurship in each society, or if there is not all that hand to nurture entrepreneurship, very little thing could happen. We need good policy, and it is kind of a two-way thing. Is there any other comment?

Dr. Nakajima:

I just would like you to remember what happened thirty years ago at the Rio de Janeiro summit. At that time "Three E balance" was discussed: energy, environment, and economical development. And I believe eco technology is really the very thing to solve that issue of balancing those three E's. Actually environmental and energy issues are inseparable.

Let me take an example about the refrigerator or freezer that has been used in Japan. The energy consumption for freezer in Japan has become the 1/7 of that of 10 years ago. So I'd like to say that, if the economical effect efficiencies go up, the usage of energy goes down; and, along with that, the environmental issue can be reduced. That would make possible with a combination of several elements including the advancement of electronic industry technology, the development of better raw materials, as well as industrial efforts to make better materials.

The direction of the symposium for the future for further development will be that first the companies, under this wonderful banner of ideal, will take their role at the activation of eco-friendly industry; and, at the same time, for the same purpose, the government is going to provide the support for the private sector; and also, university-academia has to provide the theoretical basis for efforts to construct eco-friendly businesses that enterprise would like to establish. Thank you very much

Dr. Sunami:

Ban-san, I think we have a new title for the business conference.

Mr. Ban:

Well, thank you very much for the presentation and discussions. I think it's about the time to end the first section of the program for today. And I'd like to thank you for your very sincere discussions; and if you are not fully satisfied with the outcome of the first section, probably you are going to have more spirited discussions in the afternoon with participation of some more people.

(End of Morning Session)

Records of Honda Foundation Eco-technology Workshop 2005 in Ho Chi Minh City

Part II. Afternoon Session

2.1 Opening Remarks of Mr. Toshio Ban

Good afternoon, everyone. Welcome to the eco-technology workshop 2005 in Ho Chi Minh City. My name is Toshio Ban, managing director of the Honda Foundation. Before we get started, I'd like to thank all of you for joining this meeting today.

The Honda Foundation has advocated the concept of eco-technology since its inception. Eco-technology reflects our belief that we need to step away from technologies devoted only for efficiency and profit, and change the paradigm of technology so our activities become harmonized with the environment.

Last February we hosted a symposium in Hanoi under the theme of "Linking Innovation and Entrepreneurship for Developing Countries." It produced a lot of reactions and responses in various circles in Vietnam. Today's workshop is designed as a follow-up for that Hanoi conference.

This workshop could not have been made possible without generous support from the Vietnam Ministry of Science and Technology and Saigon High-Tech Park. I would also acknowledge the Minh Tran Corporation has provided this wonderful place for us. It is indeed very nice that we can discuss the future of science and technology and industry of Asia in such a beautiful garden with the great traditions of Vietnam.

And today we have invited leading figures in the administration, academia and industry of Ho Chi Minh City. We have the presence of Mr. Truc, President of Saigon High-Tech Park (SHTP). Mr. Nhan, Vice Mayor of Ho Chi Minh City, is going to participate in the meeting from the reception. We

also have an honor of having Dr. Son, Vice President of Ho Chi Minh City University of Technology.

Also, in addition to the presence of the discussants from the Hanoi meeting, we have newly joined discussants from Thailand and India, Dr. Kitti and Dr. Krishnan. I'm sure they will be able to have even more practical, specific discussions. We have interpreters prepared for Japanese to English and Vietnamese to English, so that you can use both languages. Vietnamese and Japanese can also be spoken during the discussion. Now let's start the discussion and I'd like to introduce two facilitators, Dr. Ca and Dr. Sunami. Thank you very much for your kind attention.

Dr. Ca

Well, I think Mr. Toshio Ban already introduced the key participants and let me just to follow the order of the program. May I take apology to introduce Mr. Arimoto to have a speech?

Mr. Arimoto is a principal research scientist from an economic research institute — Economic and Social Research Institute under the cabinet of the prime minister. Before that, he was the director of the science and technology policy department under the Ministry of Science, Technology and Education (MEXT) of Japan.

2.2 Keynote Address of Mr. Tateo Arimoto

Thank you. My name is Tateo Arimoto. Thank you for giving me this opportunity. I want to make a little bit introductory remarks. It's my great honor to open up this workshop on eco-technology in this beautiful and busy city of HCM, a blend of tradition and modernity.

Last February the Honda Foundation and Vietnam's National Institute for Science and Technology Policy and Strategy Studies (NISTPASS) co-hosted

the symposium on “Innovation and Entrepreneurship for Developing Countries” in Hanoi. In light of science and technology policy making, the Hanoi symposium has become an important starting point to think about further development of Vietnam, Japan and the rest of Asian countries.

Today’s workshop in my understanding is meant to be a bridge between the Hanoi meeting and its sequel scheduled for next year. In the next several hours, we will discuss how Asia should advance from now and what type of innovation policies is required for secular growth. We will also talk about how we can intensify coalitions in Asia for our prosperity. Before starting my discussions, I would like to thank Minh Tran Corporation, and welcome all participants from Vietnam, Thailand, India, and Japan.

Honda Foundation is an establishment funded by Mr. Soichiro Honda, one of the most well-known entrepreneurs of postwar Japan. Consistently advocating the concept of eco-technology, Honda Foundation has hosted conferences in many countries to promote interactions and exchanges among researchers and experts around the world. Honda’s mission is to help them build a ‘compassionate’ civilization on the earth.

I believe it is an indispensable role of Asia to shift the paradigm of science and technology and make economic growth and environment protection compatible. I hope, as well as am convinced, that today’s discussions would serve late Soichiro Honda’s last wishes that are reflected in the concept of eco-technology.

Aichi EXPO

From last spring to summer this year, Japanese government hosted the first world exposition in the 21st century in Aichi, Japan under the theme of “Nature’s Wisdom.” As you know, Aichi is a region where the nation’s strongest economy is enjoyed right now, and the Aichi EXPO 2005 drew to a very successful close.

Many organizations from 121 countries, including Japanese government institutes and private companies, gathered and the picture here shows the Vietnam pavilion. Many people visited here and were strongly impressed by the snapshots of Vietnamese everyday life, their efforts for modernization, and the scenic nature surrounding them.

Five years out, EXPO 2010 will take place in Shanghai, China. Chinese government is making careful preparations. It is anticipated the Asia-Pacific, including Vietnam, Thailand, and India, will achieve a remarkable advancement in coming five years. I hope exhibitions by Asian countries in EXPO 2010 will be further elevated and attract more people.

Change in Paradigm of Science and Technology

Science and technology in the 20th century have too much focused on the production of knowledge, and lacked appropriate ways of its use and application. Although living standards of humanity at large have improved, there is a multitude of the adverse legacies passed on to us; to name a few — deterioration of environment, depletion of resources and energy, North-South gap, and spread of infectious diseases like AIDS and bird flu. A new paradigm of science and technology is required now.

In this light, the World Science Conference 1999's Budapest Declaration, here, lays out the basic commitment and direction of science and technology in the 21st century — better use, rather than mere production, of knowledge toward science for peace, science for sustainable development, and science for society at large. In other words, the declaration holds the world needs to harness the functions of science and technology for predicting, recognizing, and addressing the serious challenges we do and could face in the future.

Let's take a look at a statistics here. It shows how GDP per capita has changed in East Asia and Sub-Saharan Africa for the past fifty years. In spite of many adversities, East Asia's growth at large looks great. Science and

technology were no doubt the foundation for the green revolution to take place and for public health to improve. So the next challenge for East Asia is how we sustain economic growth without harming our environment anymore.

However, the underdevelopment of Sub-Saharan Africa is still a chief world concern as the UK economic summit this year reminded us. It will be the responsibilities of East Asia to use a half-century accumulation of knowledge and experience for a better tomorrow of these African countries.

Importance of Capacity Building for Modernization

Japan is the only non-Western nation that succeeded in modernization at a relatively early stage in the latter half of the 19th century. Looking back on 150 years after the Meiji Restoration, the speedy establishment of education and S&T systems within the first few decades seems to be the chief engine for Japan's success.

Meiji government first hired capable foreign experts from the West with a salary higher than Japanese ministers. It then sent many students abroad to Europe and US to absorb the advanced knowledge, technologies, and administrative systems. Returnee students gradually replaced the foreign experts and consolidated Japanese own systems of human resource development, beginning in elementary schools and ending at the university level. It took only thirty years (1986 to around 1900) for the Japan's domestic system of capacity building to complete and begin to produce world-class research findings and performances.

Excuse me, this is just in Japanese. An article of Asahi Shimbun, one of the most popular newspapers in Japan, mentioned yesterday about the Dong Du (Go East) movement. Just one hundred years ago Mr. Phan Boi Chau, who was the most famous Vietnamese leaders of the revolution, had a farsighted, wonderful plan to send about 200 students of politics to Japan, reflecting upon its success in modernization through the enhancement of the education system.

So at the end of October, just two weeks ago in the city of Hue, located about the middle of Vietnam, celebrated the anniversary ceremony that commemorates the Dong Du movement.

OK, going back to again my remark. Five years ago, InterAcademy Council (IAC), an aggregate of science academies around the world, was formed to comply with world challenges by making scientific knowledge reflected in real-world policies. Its first report was compiled and submitted to UN secretary general Kofi Annan. In that report, "Inventing a Better Future: A Strategy for Building Worldwide Capacities in Science and Technology," IAC stresses the importance of building a human resource development system as the most important asset for developing countries to ride on the path to prosperity.

Development of Asia and Horizontal Division of Process

Japanese government's Trade White Paper 2005 makes an extensive analysis of factors to make current Asia's advances possible. I find it very interesting and let me show you an outline:

- For analysis, the White Paper divides production process in three categories: supply of raw materials, manufacture of intermediate goods (parts and processed goods), and manufacture of final goods (capital and consumption goods). Based on this classification and taking into account differential factors like wage, expertise, and added value that vary by nation, the book compares Asian nations in 1995 with those in 2000 in light of the internal structure used for industrial production. The paper shows here a chart called "International Competitive Index."
- In next slide, I want to show you another point of the paper. There is currently an established, and yet growing, economic framework in the world with regard to trade of goods termed 'triangular trade structure,' in which Asia is the supplier using division of process and labor, and EU and

US are the consumer of final goods. In Asia, Japan and NIEs (Korea, Taiwan, Hong Kong, and Singapore) produce value-added parts and processed intermediate goods; and China and ASEAN nations import these intermediate goods from which they assemble final capital and consumer goods for EU and US. Of course, the factors and actors in this triangular framework evolve dynamically year by year.

- According to the paper, because the scale and scope of this triangular trade keeps expanding, the East Asian economies enjoy continuous growth. This is a virtuous cycle where local industries and businesses enhance domestic demands and create greater investment opportunities.

In the wake of this structural dynamism, we need to consolidate our basis for Asia's sustainable development by strengthening human resource development and industrial and S&T bases. In my opinion, these are win-win relations, rather than zero-sum game. The countdown for the Asian market integration has already begun.

Japanese New Approach — From S&T-Concentrated toward Innovation-Oriented Policy

The Japan's new five-year program for S&T policies which will be effective next year is finalized at the ministerial level. One of the main pillars of the program is innovation initiatives probably because of the following background:

The world has entered the period of mega-competition over the past fifteen years after the end of cold war. Japan faces drastic changes in the structures of politics, diplomacy, economy, society, and education. In terms of S&T areas, Japan must substantially reform the education and R&D systems established in its 150 years of modernization, as it shifted from a catch-up player to a front-runner. One typical example of such reforms is the transition of national

universities to independent administrative corporations that was effective last year; and Science Council of Japan also underwent a full-scale reconstruction.

This is my final slide. In the century of intensely competitive market, Japan's population is falling. Transfer of foreign technologies is costly and likely to be a risk, rather than a merit, for shrinking labor. Our leaders then have chosen to become more competitive and enhance goods and services of public interest by spawning innovation after innovation. To do so requires the transformation of the existing innovation systems into optimized, comprehensive systems of creating, using, and managing knowledge and technology.

Such robust national innovation demands a radically new approach: they require not only S&T strategies but also industrial policies complemented by macroeconomic considerations, continued deregulations, reforms of rigid social institutes that cause low mobility of human resources and vertically divided administrative functions, and improvements in various social infrastructures.

In this context, we can see Japan as a precedent model for the Asia-wide development in the making. We all need to build up a research network of Asia that analyzes and evaluates innovation strategies and policies of each nation so we can achieve harmonized advancement in the future.

Conclusion

I would like to close my speech by saying it is imperative for Vietnam, Thailand, India, Japan and other nations in Asia to spawn innovations out of each people's labor and association because it intensifies our competitive advantages in the world as well as bringing political and social stability and peace. Of course we Japanese will strive for stronger S&T coalitions and a deeper complementary economy and the dynamism within the region. I hope

such efforts will be accelerated by the current and future series of Honda's symposiums and workshops.

I want to explain this a bit more in this picture. So basic science is here; curiosity-driven research is here; and from the stage of curiosity-driven research, R&D advances into the creation of economic and public values; in other words, a path to innovation. In order to get final value, we need not only economic values, but also social and public values, as well as intellectual and cultural values. So in the next Science and Technology Basic Policy Plan, which will be effective as I said next year, we at the Japanese government have revised the current systems of research support and emphasized investments in areas that have greater social impacts. For example, we will spend more money for more precise prediction of disasters and their prevention. Focused investment is crucially important to drive the individual phases of R&D to the common goal: to create final, combined value out of economic, social and public values. This is the end of my remarks. Thank you very much for your kind attention.

Dr. Ca:
Thank you, Mr. Arimoto for your very far-reaching and interesting presentation. May I introduce Mr. Pham Chanh Tuc, director of the Saigon High-Tech Park Management Board.

2.3 Keynote Address of Mr. Pham Chanh Truc

Distinguished guests from Japan and from other countries and from HCMC, ladies and gentlemen, first of all, on behalf of the management board of the Saigon High-Tech Park and the co-organizers of this workshop, I would like to extend my warmest welcome to all of you distinguished guests,

distinguished scientists, managers and scholars from Honda Foundation for coming to share your valuable experiences on the relationship between technology, entrepreneurship and the eco-technology. This is a very topical issue among developing countries including Vietnam and HCMC.

Distinguished guests, ladies and gentlemen, the Saigon High-Tech Park was established by the Prime Minister of Vietnam three years ago with an aim to create a favorable environment for foreign direct investors, especially those operating in the high-tech industry; namely, the R&D activity, the technology transfer, the education and training of the high-tech workforces.

Being a developing country, we fully understand that the only way to increase the technological capability is to enhance the competitiveness of our products and services and through that contributing to the economic role of the country. The only way is to enter into the high-tech industry by technological innovation and by high-tech business incubation; and also, through this, that we can bring about major changes for our country and our people. And it is a fact that many Japanese entrepreneurs have been able to bring the changes to our country over the past decades and among them is Honda.

However, during the course of development, we have also felt the negative impacts deprived on the unsustainable development on the environment, on the ecology, on the human health, and on the overall quality of life of people; and that makes us be cautious to the social economic development in the way that we have to make it sustainable.

The government of Vietnam in general, the administration of HCMC and the manager board of the Saigon High-Tech Park are always determined to see the top priority of development is a sustainable development for the happiness of our people and for the lovely planet.

Ladies and gentlemen, to achieve this goal, first we must have the right understanding and the support from the entire society and the self discipline of the entrepreneurs, the relentless effort by scientists and the bold and predictable leadership of our government.

And I strongly believe that the information and the experiences shared during this workshop will bring the clear insight to the issue of our interests. And thanks to this helpful discussion, I believe that the administration of HCMC and the management board of the Saigon High-Tech Park can set out the right strategy of development to make the Saigon High-Tech Park the first advanced high-tech park in Vietnam toward the development and for the people today and for the generation to come.

And I believe that with the notable mission of Honda Foundation and with the hottest commitment from all of you, this workshop will be the first brick of the foundation upon which the long term relationship between the Saigon High-Tech Park and the Honda Foundation will be built.

Ladies and gentlemen, we can press assure that upon on the very first foundation that in the near future at the Saigon High-Tech Park, we can see many activities organized by Honda Foundation. This is a clear demonstration of the long term relationship between our two people for development of the existing generation and the generations in the future. May I wish the workshop a great success. Thank you.

2.4 Discussions

Dr. Sunami:

Thank you, we have planned to have a presentation by a SHTP official, but instead we will have a presentation by Vice Director Dr. Nguyen Thanh Son. He will give us an introductory remark on the…, I guess you can introduce us something about the Ho Chi Minh City University of Technology?

Dr. Son:

OK. Good afternoon, everybody here. My name is Nguyen Thanh Son as the gentlemen introduced, and I'm Vice Director of HCMC University of Technology, which is one of the oldest universities in the southern part of Vietnam. It was established in 1957, so around forty-eight years ago. Recently we have just celebrated 48th anniversary, the birthday of our university.

I come here on behalf of our director who is engaged today for business activities in Province An Giang, so that what I want to say is to convey the his regard to everyone of you in this meeting; and, on the other hand, we would like to say something about our university which pays a lot of contribution for human resource on enduring subject for industry and for society from the southern part of Vietnam, particularly so far dynamic city as HCMC.

Our university has 26,000 students who are divided into different education system with 16,000 full-time students. That means they need to do four and half years of their study according to credit-based system. We are also the first university in Vietnam using the credit-based system. Why we are doing credit-based system is just only that we want to integrate into the whole society of education, for the first time with a Southeast Asian country, and later on with other universities of other countries all over the world. This is only the way that we can bring our country, our economy up to the level of the Southeast Asia and also for the whole nation.

We also pay a lot of contribution to providing the human resource for HCMC for the southern part of Vietnam, practically for Mekong Delta. We also have around 1.000 staff members — all of them are providing lectures; and we have another 500 staff members serving for other activities of our university. We have totally eleven faculties — most of them are engineering faculties that means we are focusing on engineering and technology.

And besides eleven universities, we also have one faculty which has recently been established. That faculty is called the School of Industrial Management. That also means that we are also aware how important the engineer we provide for society, they need to have also the management knowledge so that they can pay their contribution to the society and to the industry.

Besides eleven faculty of engineering from electrical electronic engineering to information technology, chemistry and mechanical engineering, etc., we also have another eleven research centers. Those research centers play the key role as the gate way between the industry and the society with the scientist working in our university. And I can offer, show a figure that every year we get the budget for R&D 15 billion VND, but the contract which has been signed via those research centers with industry is four to five times higher. So you can imagine how those R&D research centers contribute to their activity for society and industry.

We have very good connection with industry particularly nowadays good connection with high-tech parks, and some are industry zones because we think our students can be evaluated good or bad only via industry. All the companies can evaluate our quality of education so that we make a lot of effort to do, to provide so the achievement which can be accepted by the government. And now some of our students when they graduate, they have been accepted by the accredited, international organizations of education.

We also have some other collaborations with Southeast Asia partner universities like Thailand, Malaysia, and recently we have very good connection with the partner universities in Japan like University of Tokyo or Tokyo University of Technology, so that you can imagine how we develop and our university and all we have done is only to pay the best contribution for the industry development and also the development of the country.

Besides the education research, we are also aware of the importance how to collaborate relationship with other partner around the region and around the world. We suppose that we in this meeting we just keep very brief introduction of our university and we hope that for the development of our collaboration in this table need also a lot of contribution of university and we hope that we can pay contribution for that event. I hope that we will discuss some more later on. Thank you for your attention.

Dr. Sunami:

Thank you very much, vice director. Now we open up the forward to the question for the presentation, introductory remarks by Mr. Arimoto and two other's remarks. Perhaps I can start. I have a very simple question about the high-tech park strategy in Vietnam. I guess what I have learnt is that you are trying to develop two high-tech parks, one in north and one in south in Vietnam. Is that right?

Dr. Ca:

May I response to that and then may other people can ask. In general, as the national level, we have two big high-tech parks: one is outside Hanoi, two kilometers away in the place called Hoa Lac. In fact that place is the feasibility study for that high-tech park is prepared together with support from JICA about nearly 10 years ago. And the second park is in HCMC. The two parks are managed by different organizations: the one in the north is managed and

supported by the Ministry of Science and Technology for the whole country. The one in HCMC is under the HCMC Mayor People Committee.

Having said that, it does not necessarily mean we have only two high-tech parks. These two high-tech parks are multifunctional; what I mean by multifunctional is that they could have different zones or functions in the park like incubators, like industrial production, high-tech bases, like R&D centers and training activities and also some business services. But apart from that, there are some smaller parks or may be they don't call themselves high-tech parks but actually they're working in high-tech area like software center, software zone, or electronic town, or different names. So this is much more normal but in general it's multifunctional.

Dr. Sunami:

Let me continue. The question I am going to ask is what would be a characteristic of the two of national level…, the two multifunctional high-tech parks you talked about. What are the distinctive features of them, I mean, everything could be anything, you know? This morning we heard about the Indian case where they focus on the service sector, a software type of high-tech park where that didn't necessarily involve the hardware, I mean, property that was sort of a network type of high-tech park. It's not necessarily a traditional science park that we see around the world. And you are talking about incubators, and you are talking about the R&D centers. So is there anything that you are trying to do more specifically, theVietnamese strategy or something by nature and I mean the one in HCMC is different from others?

Dr. Ca:

Well, actually to response to this question, I need to refer a little bit to overall high-tech strategy and policy in Vietnam. Actually the Vietnamese

government set up five areas or six; it depends on which documents you refer to, so-called “priority areas” that you want to develop.

First the ICT: it could include hardware and software. By hardware I mean you are producing PC or part of their electronic components; and then biotech is one of the priority areas; automation and then advanced material, too. Hopefully, something on nanotech can be done; and another area to be mentioned more recently is mechatronics, which originally comes from Japan, I think.

Having said that, actually there have not been many activities happening so far in the park in the north. We mention a lot about high cost of clearing the site and that process is a very long process, especially for the park in the north. Because of that, up to now the park in the north got only one tenant. A company from Japan begins to invest in that.

The park in the south under Mr. Truc management is much more successful. Maybe they are more active or maybe the environment here in HCMC is more suitable or more attractive for the investment. And I would say the strategies adopted by the two parks are quite different. So here in HCMC, I understand they’re going more for attracting first their industrial production facilities and activities to build on that. So depending on the rate of success of this park, other activities could follow — like incubators, and like R&D center. I believe, in HCMC High-Tech Park, they have already begun to develop a new incubator program and some plan for R&D. So maybe I’m not in the position to talk about this park because there are a lot people here from the park. They might say on that.

Mr. Truc:
I would like to make a comment to the answer provided by Dr. Ca that the two high-tech parks in Vietnam do share the same goals, but adopt different methods. And the common goal shared by these two high-tech parks is first of

all to utilize the internal strength processed by the local scientists and the research circle in the country. However, the approaches adopted by the two are different based on the different local condition. And for Saigon high-tech Park, we have some following distinctive features:

- First, the SHTP, or Saigon High-Tech Park, is a techno-economic zone based on high-tech as approved by the prime minister government. And that's the reason why we have adopted the approach of first attracting the foreign direct investment, especially the enterprises operating in the high-tech industry.
- The second feature is that the SHTP is a multifunctional zone. It has the production area for hardware and software as well as the high-tech services. And we pay special attention to training the workforce, training for R&D activities as well as for production.
- The third feature is that we provide the different mechanism of incentives to attract different types of high-tech enterprises, based on the pioneering high-tech industry set out by the central government. The industries that we have been so far successful in attracting investment include the production of the short-circuit board and the ICT. We also pay attention to the attraction of the investment in biotechnology. And in the near future with our sistership with San Francisco city, we can attract more biotechnological enterprises.
- The last, and fourth distinctive feature of SHTP is that we create the park an intellectual space where the scientists and the researchers can have a very comfortable and suitable environment for both living and working. Thank Mr. Ca and Mr. Sunami for your question.

Dr. Ca:

So maybe we want to have some more questions from the audience to our speaker from Saigon High-Tech Park or from HCMC University of Technology, which I believe is the main source to provide knowledge workers for the park.

Dr. Son:
Hello, can I say something? What I've just said is only about our university, but as you know there are two Vietnam national universities — this is the new model of education in Vietnam. That means the government launched some kind of the way that they can push up for the education, particularly so far high-technology.

So we moved into Vietnam National University of HCMC; and besides our university, there are also two other members. So not only our university but the main university provides human resource for the industry, but we also have one more university in HCMC.

And as you may realize each year around one million students, high school pupils, they want to enter university but only 200 of them can enter into the state university. So the government set up some policy to open more private university so that the students have the chance to study there. I suppose that in near future a lot of university will be created and set up so that not only our university but some other will provide graduation for the industry and also for the society. That is just something I want to say.

Dr. Ca:
Thank you, Dr. Son. So in the mean time it looks like that we may have some presentation. While we wait for some more clear action, may I suggest that the audience, you may want to have some question to the presentation of Mr. Arimoto? Yes, please.

Speaker Not Identified:

I have one question for Mr. Arimoto, and that's in the new technologies which are emerging now, like biotechnology and nanotechnology and so on. How is Japan trying to position itself in these industries and what has been the progress so far?

Mr. Arimoto:

As was said earlier, we are now in the new idea defined in the Science and Technology Basic Plan. That plan includes people from our universities, industries, and the government sectors; they come together to discuss about the very important point you mention — how to integrate IT, NT, and BT in order to get economic value or intellectual value out of them.

Of course these are separate disciplines, and the researchers separately make studies in each laboratory. So we are now planning to integrate with help from industry. My picture is bottom-up, curiosity-driven researches mainly made by the university. Our plan is not so much priority-driven, rather it includes everything.

As I said, the bottom-up research coming to the next phase, — by next phase I mean the basic technology, not the mission-oriented basic technology — in that phase, individual private companies and university researchers get together to build a platform of research. By the platform, I mean, for example, the case of the university initiatives in the United States, large university platforms like Stanford Bio-X; and other big research universities are now setting up similar platforms.

So in the near future, next year, we are planning to set up several, larger platforms for integrating IT, NT and BT using computer science. I cannot directly make a response for you, but our understanding is these conversions of rights should be integrated by government as well as industry initiatives; and this is an important point. Main players are, of course, University of Tokyo and other big research universities, but AIST, or National Institute of

Advanced Industrial Science and Technology under the Ministry of Trade and Commerce as well as we, the National Institute of Physics and Chemistry will take part in. AIST in particular will play a big role in this platform making.

Speaker Not Identified:
Maybe while people are preparing some questions, may I have one question to Dr. Son from HCMC University of Technology? You may know that recently the Prime Minister visit to the U.S. They visited Harvard and other MIT organization and one of the topics arisen is talking about the creation of the so-called International Standard University in Vietnam, meaning that we need some new kind of university which is a much higher standard than it is now; if not Harvard, at least compared to other universities in the region.

And in relation to this, there are some discussions about how we are going to do that: one way is to create a total new institution, and another is to upgrade an existing one. I wonder, can you give us some kind of thought or may be comment?

Dr. Son:
OK. Well, this is a sophisticated question and I'm thinking whether I'm the right person to answer that question because everyone here may know education is some kind of long-term activity. What you have done today will be effected so in five years or ten years later, but what the Prime Minister did in the United States, I suppose, he did the right thing. We can not go behind the others because education is always the key factor for the development of a society of industry, but I doubt for the time being that how we can implement it. And as far as I know, if we want to bring your education to a standard level, the first thing you need is to have the human resource or expertise. That is the most important thing. Though expertise can be provided in Vietnam, it may take time.

But luckily, we have people living abroad. They left the country twenty years ago for study, or before the war or right after the war; and they are all expertise like Dung or Dr. Khe and other. If we provide a good policy so that they have a chance to come back and to be paid for their contribution, we can have human resource. This is one part.

On the other hand, we also have to send people out to get the technology which is always updated year after year, and I suppose that developed countries like Japan can help us to provide those people; and then we will reach one for faster. It can be feasible for the latter.

And on the other hand, the government also has the new policy to invest for the library, for the university, and for the lab, etc.. If you look into the percentage of the national revenue, then you will realize the government is aware of this, and they will do it firmly. But I don't believe that it can be done within three or year years.

But we can not rely on this, but what we have here so far, we have to do it and keep it going so that what we are doing now in our university is improving step by step, using all the resource we have, using all the relationship we have, and using all the resources we have so far; and we hope that with the good policy of the government, many universities like our universities will reach the standard of education, at least equal to the around region universities. And I think that is all I can answer your question. No more I can, sorry about that. I suppose you accept mine.

Speaker Not Identified:
Thank you, Dr. Son. I like the answer, thank you very much.

Dr. Sunami:
I just have one simple question, actually. As you know in China they have some preferential policy to attract the scholars and overseas students in the

United States or Europe to come back, and my question is to ask Dr. Son about whether the HCMC University of Technology has such a preferential policy or the mechanism in order to attract the foreign, American, overseas Vietnamese scholars to come back and to work.

More specifically, for example, in Chinese university they have a different income level from the local faculty members which create some kind of tension of course. If you come back from the United States, you earn several times better income than other faculty members. Is there such a thing? Or does the government has this kind of policy to attract those overseas Vietnamese scholars?

Dr. Son:

OK, about income, it's also one important factor. But on the other hand, we also have our method, our way to improve our education quality by having collaboration or setting up some joint program with other partner. For example, at the moment we have a couple of joint venture with France, we call the program PFE, Program for Excellent. The whole program will be imported from the partner university, and they will be taught in Vietnamese by the people who graduated from France.

After graduation, students need to defend their thesis in the jury of mix of the expertise from the French and Vietnamese universities; and when they pass the exam or defend their thesis, they will be recognized by French education system.

On the other hand, we also have other program: a joint program with Japan. Tomorrow I will be meeting some representatives from a Japanese university of technology, and talking about twinned accreditation program: a program which can be accepted by both universities, and students accepted are recognized as good students; and if such students want to join the program,

they can do so. And just by that way we can improve the quality of our education.

And one other factor, you said to do that we need also the budget. The government now has launched some programs which help the student to get scholarship abroad. In this program called "VN 322," if an applicant passes the exam and fulfills all other conditions, he will be accepted by the partner university and sent with the budget from the government to study in Japan, Europe or wherever. It's also the way we can improve our education quality.

Mr. Dung:
I think we go through the question of Dr. Sunami. He asked about, as I understood, the policy of the Vietnamese government to the overseas student or the overseas Vietnamese, is it right?

So I would love to introduce myself, also overseas Vietnamese. In my case I have come back by myself, I was not waiting for the government policy. I came back here just after the war, which means 1975. So I'm like the witness of all the changes of the postwar Vietnam. I might discuss about my case lengthily later.

Here I would love to introduce two persons: One, Dr. Nguyen Chanh Khe, has come back from America and he was invited by the Saigon High-Tech Park. He is now in charge of R&D center, the head of the R&D center of the Saigon High-Tech Park. And here is Dr. Luong Bach Van, she has come back here, too. She now has two faces: One is with the national front. She is the vice chairman of the national front. She will explain about that later. She is also the president of a company of high-tech plastic. So maybe Dr. Nguyen Chanh Khe and Dr. Van will discuss a little bit about this. Thank you.

Dr. Van:

May I have some more information after the introduction of Mr. Dung? So as mentioned in the introduction, I studied and graduated in France and I came back in Vietnam just after the war in 1978. Since then I have made a lot of technology transfer for the plastic industry, and now I am in charge in the Fatherland HCMC for the study how to create, or to facilitate, or to attract Vietnamese intellectuals and Vietnamese overseas from outside. As you know, actually we have about three million Vietnamese overseas all over the world. Among them, 300,000 intellectuals are mostly in advanced countries such as France or the United States. Actually we are organizing to study how to create conditions so that they can participate in the contribution to the development of Vietnam. Thank you.

Dr. Khe:

Let me stand up and introduce myself. I'm Khe Nguyen and I came back from the United States. I have spent fourteen years in Japan and I got my PhD in Tokyo Institute of Technology and since then I work in a high-tech firm in Japan for three years. I truly enjoyed working in the high-tech area in Japan. I succeeded in the first invention in the photo-sensitive material utilizing the coupler machine and this was just outstanding; and Kodak recruited me when I gave my talk in Boston in the conference. And I migrated to work for Eastman Kodak in the United States about four or five years in the research lab.

I also had a great time to invent many, many new things there including nanotechnology; and then Hewlett-Packard Corporation and Rico from Japan also recruit me. So I migrated again to California and worked for Hewlett-Packard more than ten years while I did a lot of good work on the imaging technology.

When I met the people from the Saigon High-Tech Park and I think that is a great opportunity to come back and work for the country. So I decided to

leave the United States; and today as a returnee from the United States, I am working for the Saigon High-Tech Park at the R&D research lab. Within the three years in the Saigon High-Tech Park, there are a lot of challenging things, but I still keep the same pace that I have done in a research labs in Japan and the United States.

We have made some development in fuel-cell technology that the Honda may be interested in because, by use of fuel-cell technology, we don't need to use gasoline: we only use the proton exchanges with a few drops of water, we can have energy. So in the future, Vietnam may have to contribute to the world with the highest energy saving cars as well as some kind of nanotechnology.

I just have a really fun time in Vietnam because we don't have everything — it looks like we don't have things available in Japan and the United States: we have to create, we have to use all of our creativity to make the new thing happen, and we were successfully to do that.

Like Dr. Son said, I work together with many students from his university, help them and give them the idea how to be creative; how to work in an environment that we don't have enough equipment like what we had in the United States or in Japan. And now the students become more and more interested in their job, and I don't need to push them anymore.

I just tell them, OK, what we need today is for the world tomorrow. So we need to invent and we need to do more and more things, we have applied for the United States pattern. So in the future we would like to bring those technologies to the market; and we have to do that because the Japanese school and also United States school have taught us how to bring the technology to meet with the need. If we don't see the need from human being, we will not be able to make an invention, and then it will not be useful for the human being. That's all.

Dr. Ca:

Thank you, Dr. Van and Dr. Khe for very live sharing of your own experiences. Is it time for us to have a short break?

Mr. Arimoto:

I'd like to talk to Dr. Krishnan and some persons from Vietnam. In Japan, Japanese central government is focusing upon nurturing the local science-based, knowledge-based, local industrial clusters. We are now supporting more than ten local clusters. In that time, we are considering the integration of indigenous, locally native technology and high-technology which are generated from local universities, you know, to raise their internationally competitiveness, as we have many policies, actually measures about nurturing the local cluster in that point aspect.

I can give you some of the example. As you know, Kyoto is a very old city in Japan but we have a lot of very competitive local industries there. Those industries can integrate their old local native knowledge or traditional technologies and high technologies.

Dr. Krishnan:

In some of the traditional industry, the government has tried to set up, for example, design facilities in all areas where their traditional textile industry has been strong. The government has set up a kind of textile, I don't know exactly what it's called, a textile support center where they have computer-aided design and some other testing and so on, to help upgrade local industry so that they can compete on their traditional knowledge and also do high technology input into that.

Also in some of the traditional industries, the government has helped set up some common facilities like an effluent treatment plant. Through that kind of activity, we can have a group of the firms in that industry that becomes more competitive. For example, while there are already existing clusters in the

industries like leather and textiles, many of them are not willing to make the investment to make their process environmentally friendly. So the government tries to support them by providing some common treatment plants and other centralized facilities to help make these technology more eco-friendly.

These are some of the kind of activities which the government has tried to do. But generally I think there are a lot of scopes for further activity in this area because there are many clusters. For example, we have some clusters in machine tool industry or in the sports goods industry, where these clusters are not performing well. They don't have the right technology inputs and the government has not been able to support those clusters sometimes. I think they need a new mechanism, too. That's where the government may need to put money in.

But perhaps some private-public partnership need to be created to provide those input because sometimes the government doesn't have expertise either, even though it may want to do so. Maybe they can put the computers, but they don't have the right people to do training and nobody who is a really qualified trainer may want to work for the government. He may prefer to actually being an independent consultant. So there is a lot of interesting things in this area, but I think there are a lot of scopes for further activities.

Dr. Ca:
OK, thank you. Do you have any more questions? If not, may I suggest that we have a short break? So can we be back here in about 15 minutes, until a quarter to four?

(Coffee Break)

Dr. Ca:

OK, can we continue our session? I think we have quite interesting discussion and we touch upon quite a few ranges of issues so far.

To continue, may I introduce Dr. Uchida from Tokai University? He will have a presentation on the concept of eco technology, which is one of the key concepts of this workshop. Please.

2.5 Presentation of Dr. Hirohisa Uchida

Thank you. My talk is about eco-technology. If you have proceedings of the Hanoi symposium, please look at page 189. Part of my today talk is going on this theme.

So what is eco technology? Actually as far as I understand, there are may be two concepts: the first one is “ecology” plus “technology”. Most people may think of this first. The second one is human-environment conscious technology where “E” is for environment and “CO” for conscious. This is eco-technology, and I think the second definition is a more general problem. Anyway, independent of the first or second definition, the optimal goal is common.

Today I want to a little bit touch about first our science paradigm shift, and then why we have to consider eco-technology. Please look at the typical science and technology paradigm of the 20th century. Actually science and technology are composed of three factors: “materials”, “energy”, and “information and communication.” For example, we use huge amount of fossil fuel, this is material; we can covert fossil fuel to energy; and also we found that huge energy can be obtained out of a small change in the mass of uranium or hydrogen. And this (fission of uranium) is actually what we apply to get nuclear power energy.

And another example is the history of material. We have used ceramic and metal for a long, long time, but in the 20th century we found the semiconductor and then we manufactured IC and LSI, and consequently came up with computers. They are acting as a means of information and communication which is a very important factor nowadays.

On the other hand, there is a relationship between “energy” and “information and communication.” To send information or signal, we need energy: electromagnetic wave, electron, photon, or whatever. So actually we can extend the use of these three factors of our science and technology paradigm.

Especially information technology has made a great progress. For example, there are so many satellites going around the globe and we can observe natural disasters, weather conditions, military actions, distributions of temperature and desertification, and so on.

I’ll give you one more similar example. Please look at here: we can see a very thin layer here. This is our atmosphere. It’s only 10 km thick. Our globe has a 6,400 km radius, and only 10 km is our atmosphere. We can breathe now that’s only 10 km; it means, if you imagine our globe as a ball with a diameter of 1.3 meter, you only have 1 mm thin layer as the atmosphere. What’s going on when we receive 250 tons of carbons per second in this thin layer? Or in other words, 917 tons of CO_2 per second is increasing in this thin layer. This is a really warning thought for our future.

Some American scientists are expecting maybe we are loosing 600 tons of oxygen per second. This is a more terrible story if it is true, and theoretically we have no oxygen more in 50,000 years, although no one knows about 50,000 years; and of course, when part of oxygen pressure would be lower, we could not live anymore. This is a very serious problem.

OK, this is one scene of the Tsunami attack in Thailand last December. In Japan, our university (Tokai University), the University of Hawaii USA, and the University of British Colombia Canada are cooperating to observe the tsunami movement from the Aleutian area to the Southern Pacific area, using our remote sensing technology. Unfortunately this area, Indian sea, and this area, we don't have any observation possibility. But now in Japan, we are just preparing a new group to observe this area, and I don't know how long it takes, but I hope this group will be established as soon as possible; then we can observe what happened in the big earthquake and how fast, and in which direction the tsunami is going. We can observe from satellites its exact movement. This is also as a result of the progress of information technology.

This is Hurricane Katrina that attacked New Orleans in 2005. Such weather condition was a terrible situation. But at least we can forecast and warn residents by using satellite pictures.

Now I come to what is environment. In this workshop 2, we use so many times the word "environment," but what exactly is the environment? I should say it is not only components of nature such as air, water, plants and animals, but any circumstances. Please look at any dictionary, it is stated that any circumstance surrounding human that influences our growth and mentality is environment. The meaning of environment is so wide. For example, it may be a family where you were born as a baby. The family is first environment for him or her, and then school or the working places or market, culture, tradition, community, religion, country and economic and political system or your living and human right, etc., etc.. So in this point, I should say, environment should be said "human environment." By doing so, we can understand more clearly the meaning of environment.

This notion of environment becomes so important and it is going together with changing science and technology paradigm. What is the trend and how?

As we know exactly, we have many controversial issues such as cloning in vitro fertilization, human embryo or human selection, and the definition of birth or death. In any time of history, we didn't have such problems. For example, what is the definition of human birth? Or what is the definition of death? Once those things were very natural, you know. But nowadays with so high technology, for example, we don't know exactly if he or she is dead or not under a control of life prolonging medical treatment. The body looks very nice but brain might be dead, but how we should say they are alive. OK, in vitro fertilization, we can select certain eggs, and you put them back to the mother, and then have a baby. But the rest of eggs, how can you treat them? Everything depends on each culture or maybe sense of value in local areas? This is a very complicated problem in dealing with human life, but we have to think of it together with science and technology, because these advanced techniques were brought by the progress of science and technology.

OK, we think of some progress in the development of robots. Maybe many people want to have a robot. But what kinds of robot do you want to have? If I have a robot at my home, he or she should react with my feeling. For example, tomorrow we have some plan or schedule, and on next day I have no intention to go. I have fever, and I don't want to go out, but the robot says "you must go. This is your schedule". In fact, I don't want to have such a robot. I want to have a robot, for example, he or she can feel almost the same way I do. I am a human being and the robot is so rational. We are very irrational and we can not live just according to logic. R&D of a robot with a capability to understand irrational feelings of human beings are needed.

I should say I just compare conventional science and technology world with new science and technology world. Actually the new science and technology world should include human factor. In conventional science and technology, in the name of rationality, or objectivity or universality, we have purposely

excluded human factor although it is very important. For a new science paradigm, we should also incorporate irrationality or subjectivity, and it depends on locality, culture and diversity of sense of values of us human. If we transfer one new technology to Vietnam or Thailand or India, maybe the style of technology transfer must be different according to each local area.

I want to show you one example of technology transfer based on eco-technology. If we want to transfer a new technology, we should respect directly local, human values, to which no technology can be universally applied. You know, what is sustainability? If local people don't want to have a new technology, or if they don't wish so, they can not maintain sustainability. Sustainability exists where local people think it is good. The people want to make it, and that's it. Because of their sense of values in a local city, they can understand it and they can feel it well if they would have this new technology. "Sustainability" can be maintained only when the local people feel well and get merits or profits with a new technology. In such a case, a new introduced/transferred technology is harmonized with the local human environment. This is very essential to realize an eco-technology and to maintain a sustainable society.

We have so many words with "high-tech." What's high-tech? Nanotechnology, or semiconductor technology? What is it? OK, if you want to have a new iPod, or new digital equipment, something made by high technology, but, as I told you, each technology is associated with our daily life. But, in general, universal application of new high technologies is not so easy. It depends on each local culture and sense of value.

Innovation, productivity, development should be considered from an environment conscious viewpoint like LCA (Life Cycle Assessment). The law of LCA is including a new concept of cost to prepare for a polluted environment, although the traditional concept of cost has been the one of

production without consideration of environmental pollution, or human environment. This morning I discussed about that. Even about a job in a company, people think about the cost, and it almost always means only production cost.

I still remember the impressive words of scientists of Daimler-Benz in Germany when I visited them in 1975. They had started the investigation of hydrogen vehicles by hydrogen storage alloys. Daimler-Benz invested a huge amount of research budget on the R&D of hydrogen vehicles. I asked them, "Why are you making such a technology research when you don't know exactly if such technology would realize or not?" Then they answered very clearly that they knew exactly, in ten, twenty, or thirty years, the air or environment would be polluted, and all automobile companies all over the world would be required to pay monetary punishment. They should pay such money to repair the polluted environment, but they cannot pay such a huge amount of money. They calculated, then they preferred to paying now and making investments on such a research for an environmentally-friendly technology; and this was a very clear answer at the time.

If you think of technology transfer, it should go eco-technologically — in a way that diversity of local human environments and their intrinsic values are well maintained; and this is very important.

In my own experience, for example, I'm contributing to the realization of a sustainable society using hydrogen technology in Northern Europe as a member of a committee of the nations in that area. They have regular conferences on a project called NORSTORE. I'm just participating as a representative of Japan to these northern nations. This year we had a meeting in Iceland, last year in Norway, and next year we'll have it in Denmark.

For example, in Iceland, it is clear that they want to operate many energy systems using hydrogen: it's OK, but how? That must be our goal. Iceland has

huge amounts of geothermal energy. They will use geothermal energy for hydrogen production and various hydrogen technologies. In this respect, hydrogen technology using geothermal energy in Iceland seems a nice example where all local value, or human environment, is taken into account.

I'm also trying to introduce hydrogen technology into local cities in Japan. I'll explain a little bit about details of the story. This is the energy supply and consumption states of Japan in 1975 to 1997 — twenty years of difference in situations. Of course it has changed very strongly because of increasing use of nuclear power and natural gas. But please look at energy consumption. While we can utilize 30 to 40 percent of supplied energy efficiently, we cannot do so for the rest — 60 or 70 percent, that huge amount of energy, is gone away as waste heat into surrounding air or waste water.

Then how can we utilize this waste heat? Saijo City is a very small city in Ehime Prefecture of Shikoku, a southeast part of Japan, where we introduced hydrogen freezer technology. Why? Firstly, they have very nice ground water. This water is one of the best in Japan. The local people are very proud of this very clean and nice water, and this water temperature is constant at 14 to 15 degrees Celsius throughout four seasons. If we apply this low temperature heat source, and high heat temperature source over 100 degrees Celsius from incinerators or industrial factories, we can drive hydrogen gas from one hydrogen storage alloy to another one. A hydrogen storage alloy releases heat when it absorbs hydrogen. The storage alloy absorbs heat when it desorbs hydrogen. Using these reversible chemical reactions, we can manufacture hydrogen freezers or refrigerators without use of Freon gas. We have actually manufactured two parts of refrigerator: one part goes minus 30 degrees and another goes from 0 to 5 degrees.

The local people in Saijo put many different types of food inside, fish or food or anything, and they're just for testing the freezing/refrigerating conditions.

What kind of reaction is going and how can value add to the local products? The energy consumption is very low, around only 30 percent of the conventional type using Freon gas; of course, CO_2 emission is also 30 percent of the conventional type. This is very environmentally friendly.

Another example for technology transfer is going for UNESCO. It has made this manual of university-industry-government cooperation. I contributed also as a co-editor and this manual was edited by Professor Aleksandra Kornhauser of University of Ljubljana, Slovenia. Actually she was the Honda prize recipient 1999. She is very active in this field and contributes both inside and outside of UNESCO since the innovation and entrepreneurship are indispensable to developing countries to which UNESCO is contributing much. The innovation and entrepreneurship movements should be made by university-industry-government cooperation.

The content of the manual is very well organized. 17 different universities and enterprises contributed to compile this manual, and the content is about how to make university-industry-government cooperation work and stresses the role of university and government is especially important for developing countries.

As you mentioned earlier, educating or nurturing young people, not only that, intellectual property and also knowledge or research result should be transferred to small-medium sized companies and they should grow up. In this moment the government gives suited policy. This is of course a very difficult point depending on each nation and area. But anyway UNESCO has already compiled this one and I hope that you can obtain this manual even at present. I could ask UNESCO to get them. They don't sell it, but they just deliver this book.

The emphasis is made on the crucial role of university. The book states the university should assist entrepreneur in small to medium size companies with

experience, research and nurturing and training people, and of course here I've just summarized the university-industry-government cooperation.

I myself was responsible for our university's university-industry-government cooperation for six years at Tokai University. According to my own data from 1997 to 2002, we have made around 1,000 research contracts per year with the budget around 20 million US dollars per year. What can university do? We do basic research, seek and identify social needs. By nurturing people, we can contribute to society and industry. The cooperation among academic, industrial and governmental sectors can feedback some effect to education, and I find that this is very important for student education. The government in this scheme should play a very important role.

OK, industry, for example, becomes successful with new intellectual property or new technology. They can get more profit and give more tax. Government gets more tax income. If the government gets more tax income, they could give us more research budget and we can make further research. This could be a great idea but I don't know exactly if it's now working generally in Japan. Anyway we have much experience in this relation among university, society or industry, and government. The Japanese government is really taking care of universities, and also the society and industry are using of this scheme, I should say.

OK, this is also one example at our university. After my experience we have so many different types of collaboration with the government and industry: from cultivation of shellfish or nanotechnology application to various fields like nurturing Olympic athletes. Last year, to the Athens Olympic Games, we sent seven students as Olympic athletes from our university. We have many experts in sports science field. And we are making projects concerning small to medium sized companies.

This is only one application case using nanotechnology. This is from our result, and in combination with the city of Tokyo, we have already had a new solar-wind energy storage system. These need huge energy storage, though a very cheap one. But cheap storage does not have a good property. Then we developed new nanotechnology using a ball milling technique. They run very nice and one company cooperates with us, too.

OK, we have limited time. So I cannot give many other examples, but what is important is eco-technology. We have to think so many things if we think of factors surrounding us. So each nation, each country has its own problems and environmental issues. Therefore, if we apply new technology or if we think about innovation, it must be different according to places, nations and regions. The Honda Foundation philosophy that I introduce to you is the philosophy of eco-technology making science and technology safer, and the Honda Foundation will perhaps further cooperation within our Asian area. Thank you very much.

2.6 Q&A Session with Dr. Uchida

Dr. Ca:

Thank you, Dr. Uchida. I suggest we should have about ten minutes or so for questions from the audience about the presentation.

Question:

Dr. Uchida, I have one question. Can you explain a little bit about the ball milling process electric power equipment? The third one about the concept (last one)

Dr. Uchida's Answer:

If we look for a cheap hydrogen storage technology, the iron-titanium intermetallic compound is a good candidate. This may be the oldest one, but

very cheap. So we decided to use iron-titanium as a compound, but this alloy has a very big problem. If you put the alloy and let it exposed to hydrogen gas, it cannot react to hydrogen gas at room temperature. But usually other hydrogen storage alloys react very quickly. The alloy can react with hydrogen gas at room temperature if the surface is clean. But the surface of the iron-titanium is covered with oxide layers. The hydrogen molecules cannot dissociate on the oxide surface. We changed micro structure of the surface using ball milling. We manufactured the nanostructure outside and inside and we realize a very nice kinetics takes place, and we can utilize such practical alloy. We made two patterns for that, this may be too scientific, but that was the story.

Question:
So you use the ball milling processes to produce nanoparticles and then from the nanoparticles to change the property from the conventional…

Dr. Uchida's Answer:
Yes.

Dr. Ca:
Any other question, please?

Question:
I would like to have a question. I really like one slide in your presentation. It's about the linkage of the three players — university, industry and government. I think in Vietnam, we have all of these three players. However, there is shortage in the linkage between university and industry. So in developed countries, it's very clear about this connection about between these two players. However unfortunately in Vietnam, we have not had that link-up yet. So you need experience and the experiences you have in Japan and other countries, how do you create these kind of link-up given the constraints, the limit that Vietnam especially the Vietnamese government now has?

Dr. Uchida's Answer:

I understand your question. Of course it's not easy to establish a relation between university and the industry. For example, if you are working in a university and just remain sitting in university, nobody comes to you. You should go out outside the campus and visit different industries; and of course you must be nurturing young people in the industry and nurturing contacts and so on. For this relation, university teachers should go out of campus. This is the very important factor I should say, but even in Japan many university teachers still think they just remain and the industry should come to us. Nobody comes. And this is very important especially in technological field, you should go there and you should see what is going on.

For example, you have a very similar problem from 5 different companies but each company has its own problem. You cannot solve generally. Every case you should check and go and look and of course this is a very big work. I think this is a very important first step to realize this relation; and industry people can also observe how university professors behave, and see if they can trust them or not, and so on. These are very sensitive things.

I should say there is no model. Maybe the model is the teachers should go here and check; but not only that. Of course the role of the government is very important. For some in Vietnam, I suppose, you also have to build connections here; and of course the government makes administrative support to industry and sometimes you can call industry people. The government is making such a support. OK, let's try to use this system together. Then someday it may go well.

Mr. Dung:

I think it's a very good question from Mr.An and actually this topic I have done research for the last three years in Vietnam, and they found all the problems in Vietnam. We have the players but we don't have the linkage.

Actually this is one of the issues that the Japanese side should think seriously even for the ODA program or whatever because I think it is very sad that this linkage is not as strong here compared to Japan. I must say this is a very typical Japanese type of development, but this kind of know-how, this kind of experience was not transferred to Vietnam.

I think, during this session, maybe Dr. Ca or Dr. Son, because they are here in Vietnam, that the government gives the budget to the university. Universities do their own research that is not, or very little, in relation with the industry or whatever in the society. I think the case of the Technology University of HCMC is one of the best in Vietnam because I found they've got the budget also from the private sector. They earn on their own research projects much more, five times greater, than the budget from the government. That's very unique in HCMC. That's not for all other universities. But I think five, is it enough? I don't think so. I think the Technology University of HCMC should have 500 times. It's not five, five is too little.

They think that maybe Honda Foundation or universities in Japan should help to clear this kind of linkage program. I think that, and, in this case, I would love to propose this topic in our session very important because, actually in my company here, we do the research, we do the production, we do the training ourselves to show the government this is the case because here we do the high-tech production. I ask the government, where can you supply for me? No one can supply unless you do it by yourself. I think here is the example, and I think it's not in the economic field, but I think here this kind of workshop and we exchange the experience; and that helps each other to have this linkage. Thank you.

Dr. Uchida:

Thank you. I want to make one remark on this theme. I didn't say the linkage is only about high-tech; low tech is also the focus. Industry can ask university.

This is very important, or should I say, the question receiving everyday. It's mostly low tech. It is a model. We can solve it with our experience, very easy, no problem.

For example, one company comes to us. They cannot pay even 1000 dollars or 500 dollars per year, a very small company. It doesn't matter. We are conscious of this kind of company and say, "In the future please come once again." We hope this company grows, really. I think this is very important. "You don't have money, then we can't have any time for you" — we won't say that. Actually, at university we should accept any question, any issue from society. This is very important not only for technology but also for other fields.

Mr. Dung:
May I comment a bit? Last August the government asked about 60 Vietnamese overseas students to come back here in Hanoi, and we had a session. As I said, we discussed about science and technology; and they asked us, "What is our aim?" If there is a development process — phase one, phase two, and phase three, then I think for Vietnam we should serve the phase one first.

I'll give you an example. In Vietnam we now export 4 million tons of rice to the world; we are the second largest exporter just after Thai with the price only 250 dollars per ton. I say, if we go into high-tech, how much we could get from that; but if we increase the price by hundred dollars per ton, then how much can we get from that? I think the question why the price of Vietnam is so low.

We need to research, but for me I give a very direct answer: it is because of the quality of the rice. So if it is because the quality of rice production, then here is the role of science and technology. They can help us improve the quality immediately, and that can give a lot of budget for research for

Vietnam for anything. Now for the case in Vietnam we promote one because we can not ask the government to provide the linkage. We can not ask the industry to provide the linkage. We cannot ask the university, either.

I think that we need to interfaces for the Vietnamese case. We need to interfaces from the three sectors: scientific people, managers from industry, and the government as a team. Actually I propose this to Japan. The Japanese government should think very careful about the role of the interface, I think, to help the three united, to do the job. Thank you.

Dr. Uchida:
You're right. We need to have a coordinator. For example, if our university has one issue from outside, and our coordinator meets the person from outside. If this person wants to make this to, say, Professor A, and if we know exactly Professor A's character and he is not the best person for this particular problem, then we switch Professor A to another professor and so on. You need a coordinator. This problem may be for University A, this problem for University B and so on. We can arrange it. This is very important as you say.

Dr. Ca:
I think Nakajima-san wants to have some words.

Mr. Nakajima:
Right, I heard you mentioned the name METI. Please allow me to share my thought about the role of METI in connection with the current topic.

Actually we at METI have been on the discussion of the contact between academia and private sector. When Japan was in the development phase, the administration played the major role.

You have talked about the platform, and actually up to 1980s, the administration, I mean, the government played major role. In other words, the national government always tried to gather people from industry, from

university, from the media, from banking business as well as consumer groups so that they can come up with a certain program or project. Through this kind of meeting, collaborations between the industry and academia were made possible. The government really helped establish relationships, and such relationships were translated into business or private connections among people, if that was not everything intended. In those days, I believe this kind of the government played a great function.

However, the function of the government which used to be very large is not really functioning to that level recently, due partially to the huge flux of information, because every sector has to manage and protect its own information, as deregulations go on. Thank you.

Dr. Ca:
I think Dr. Son may want to have some question.

Dr. Son:
OK, I would like to say something on the head to the problem: the issue of the linkage between university and industrial society in Vietnam.

I have been working for university for almost twenty-five years and in the same university of technology, and I know that I realize how the linkage has been set up or developed in Vietnam. But we have to specify exactly the functionality of university: what they are doing and what they have to provide for society.

According to my knowledge, university provides human resource for the society and they provide only knowledge for graduation as a foundation of technique, of technology and science. The demand in the society is not only in industry but also in academic institution or other university and it is a wide range so that what the university can do is providing the knowledge for the student with the foundation of science, that's all. OK? This is one thing.

Now what the industrial society expects from those outcomes is quite different from twenty or thirty years ago when technology was quite reasonably low and not so fast. Companies in those days trained the graduates coming from university for at least six months or one year, or even two years before they can work in the industry. But now the industry is very competitive, and companies always want to cut down the cost. You don't want to train the new graduates anymore because, if you train them, you know maybe other company will take them over with a higher salary. Then why should you train those people? So I always ask university to do something about this. This is one thing you have to consider, the fairness. OK?

And what have we done so far? We have provided human resource for the society. But the industry needs to be also responsible. They need to pay contribution somehow by updating those people with newer technologies. In university we don't have a sufficient budget to purchase such technologies for that purpose. Also, the budget from the government is enough only for providing the foundation of science. This is functionality one.

The university's second functionality is research and technology transfer about which we are talking now. I think these have something more to do with linkage. In Vietnam the most important thing is that there is no linkage. No, it exists but we don't know how to manage the linkage so that the whole system can be kept sustainable. That means I do research, I get the achievement, but I don't know how I can sell it to the industry. Industry doesn't know how they can buy it and get the feedback. That is the problem in Vietnam, and particularly in association with the intellectual property laws. And if these problems are solved thoroughly, I suppose that we become to be able to manage those linkages. For example, if we go and sign a contract with a high-tech Japanese company, what they have to do at the very beginning is to write

out clearly about the intellectual property first before we go to next step for the linkage between sciences. So I think it should be considered.

Dr. Uchida:

I want to make remark on this linkage. Actually university is not a research development department of a company, you know; what we can do is limited to basic science research, etc.. Of course we have very nice experiences. Big industry knows exactly what university can do. They come to us, what they ask for is easy, they take a transmission electron microscope or at least ask to analyze components, it is very easy.

But more of the problem lies in the small industry. They don't know what university can do, and when they come to us, they at the first stage ask us things as if we are a R&D department for them. We cannot make it. OK, we can analyze your problem, we divide it into different stages, but this is the end of what we can do for them. We discuss further about the problems and could solve some of them, but we can not receive just a simple request to do development of a commercial product because it's not possible, you know. This is a very important step as university since university is not a development sector of a company. Otherwise, the cooperation between university and industry doesn't work.

And the budget matters. Of course we ask a company for research as their own task. But, as I told you, each company has its own problem, condition, and so on. We may ask the company how much you can pay for this. Of course we do our best; we make a service because doing so is very important. But we cannot say it costs one million dollars. We never say that. We consider at first stage how we can try to solve an issue from a company. This is an important point. Then we classify the issue to elementary tasks, and we decide our directions how we should or we could solve or approach to this issue. In every step, we have to meet and talk each other with the industry people. In

the meantime, we can establish trust with the industry people. This is everything I could say: then they can go further. Maybe I feel this because I am working at a private university. This attitude may be different from a national university.

Speaker Not Identified:
I am glad to talk about the barrier of the linkage between university and society or industry. If the university is to play as a teaching university, I feel that it is not a good point. But if the industry is to play as a manufacturer, it would be best. In this case, industry- university linkage is very difficult. But if university is to play as a research university and the company as a generator of new solutions and key technologies, industry-university linkage is a possibility. However, even then, if you take a look at the parameter, the industry needs a fast and quick response, but university solution may be very slow.

The next one is the intellectual property, IP, in Thailand. I face a lot of problems. Everything starts very good, but finally we are shut down by the IP. And also the trust between university and industry, this is still a problem. So technology transfer from some big company may be not a big deal, but this is a point of issue, thank you.

Dr. Uchida:
Even as a teaching university I think we have a high possibility to link with society. In Japan, for example, in each local area there is teaching colleges or universities. They hold small seminars of history of local area or some economics and so on, so they can collect many people living there. I think this is also a very important linkage of university to the society. Not only technology. We can ask the local university to work together for its local or larger society. Of course, research universities could have more money. But as a teaching university, you can plan quite a new project and this is what you can do with people there.

2.7 Closing Remarks

Dr. Ca:

I was a bit concerned from the beginning about not hearing any questions. I did not expect so many questions coming up, showing great interests of everyone in this topic of three way linkage between industry and university. I don't know if there are any more questions? I see no hands up, so I assume that we may need to wrap it up here. Before we close, I just wonder, Sunami-san, do you want to have some words?

Dr. Sunami:

I think we do have very great interest in this topic of how to support eco-technological innovation by designing a university-industry-government linkage. I think we should not narrow the definition of linkage as technology transfer. I think this great interest in expanding linkage requires a broader view of the role of university, the role of academic conferences, the role of public research institutes; I mean, all these things are interrelated to the creation of very broader and very important connections between the government and university education system and industry.

Perhaps we can discuss this as one of the key theme for the next conference next year, and I like to thank all the participants…, oh, and also another thing I thought interesting to see is the people who came back from United States or Japan to Vietnam. This international movement of human resource is an interesting phenomenon and has something to do with innovation and catch-up. So we can also talk about mobilization of human resources in science and technology in general. It could be another topic for the next year as well.

So I'd like to thank the participants for providing a lot of very interesting questions and I think we have reached some kind of common ground in talking about this for the next conference. Thanks.

Dr. Ca:

Thank you, Sunami-san. May I have the honor to announce that this afternoon workshop is successfully closed? Thank you very much, everyone.

(End of Afternoon Session)