How Innovation Drives Japan's Development and Growth—ICTs for New Industry Creation and Global Competitiveness

Coordinator:

– *Waichi Sekiguchi, Editorial Writer, Nikkei Inc.* [1]

Panelists:

– *Norio Murakami, President, Norio Murakami Office Co., Ltd. (former President, Google Japan Inc.)* [2]
– *Asako Hoshino, Corporate Vice President, Nissan Motor Co., Ltd.* [3]
– *Noritaka Uji, Representative Director and Senior Executive Vice President, CTO, and CIO, NTT*

Abstract

During the NTT R&D Forum 2012, a panel discussion entitled "How Innovation Drives Japan's Development and Growth" was held on February 17. Noritaka Uji, NTT Senior Executive Vice President, participated as a panelist. This article reports on the discussion between the coordinator and panelists.

1. Introduction

Sekiguchi: Last year, we experienced a terrible disaster. The Great East Japan Earthquake on March 11 gave us the opportunity to think about this country from different perspectives. In the field of industry, it made us recognize the strengths and weaknesses of Japan when the shutdown of component plants in northeastern Japan halted the operation of many assembly plants in other parts of the world. Today, we will talk about how we can boost Japan's technical strengths. First, I'll ask each panelist to make a presentation and then we'll move on to discussion.

2. Presentations

What the 2010s are for the Internet of Things is equivalent to what the 1990s were for the Internet

Murakami: I think that Japan and the USA are at two opposite poles when it comes to reaction to technical advances. Protest by the Luddites against technological progress in the UK in the 19th century, at the time of the industrial revolution, is well chronicled. The Japanese also seem to have a mentality of resisting new things, on principle—a sort of immune rejection. When a new function is introduced in Japan, it is disabled by default. This is called *opt-in* in the world of

Waichi Sekiguchi, Coordinator

Norio Murakami, Panelist

Asako Hoshino, Panelist

Noritaka Uji, Panelist

information technology. If you want to use it, you must enable it. In contrast, Americans are typically willing to try a new function and, if anything goes wrong, take remedial measures. That is to say, a new function is enabled by default. If you don't want to use it, you must disable it; i.e., you must opt out.

When we consider technical development against these societal backgrounds, certain dilemmas [*sic*] emerge (**Fig. 1**). For example, should we seek perfection in a product at the sacrifice of the opportunity to gain a foothold in the market through its early introduction? How can we strike a balance between high performance & functionality and cost? If we pursue the development of elemental technologies in earnest, we may fail to achieve superiority in the overall system or platform. Japan also suffers from what is known as the *not invented here* syndrome: a propensity to prefer technologies developed within one's own company, and from the so-called *monkey trap*, a tendency to stick with highly successful products.

Another point where Japan differs from the USA concerns the creation of national strategies. A case in point is large national projects. In around the 1980s, Japan did have such projects, namely the super LSI project and the fifth-generation computer project (LSI: large-scale integrated circuits). Both of these yielded some good results and also revealed some mistakes. But is it right to put an end to such national projects? The USA has DARPA (Defense Advanced Research Projects Agency), an organization that is strategically important to the nation. Although it is connected with national defense, DARPA also plays an enormous role in creating new technologies for the nation. While Japan does not need a similar

Dilemmas in (technical) development.

- Speed vs. perfection
  Should we seek perfection at the sacrifice of time to market?

- Cost (price) vs. performance, functionality, and quality
  How should we strike a balance between the performance, functionality, and quality that consumers demand and the price they are willing to pay?

- System vs. elemental technologies
  We must ensure superiority in the platform (create necessary mechanisms), leaving elemental technologies to subcontractors.

Fig. 1. Dilemmas in (technical) development.

New horizon of the Internet

- 1.9 billion personal computers (starting with iPads toward mobile Internet)
- 5.3 billion mobile phones (from just net access toward smartphones)
- Several billion TV sets (starting with AppleTV/GoogleTV toward smartTVs)

- Unlimited number of devices on the smart grid:
  Smart houses, smart meters, smart appliances, smart cars (plug-in hybrid vehicles and electric vehicles), smart parking, etc.

In addition to conventional support for communication between people, the Internet now supports communication between people and things and between things.

Smart grid = Internet of Things (IoT)

Fig. 2. New horizon of the Internet.

organization, its strategy for science and technology should take the absence of an equivalent organization into consideration.

We are now witnessing a change in the tide, in that the entire world is heading in a new direction. There is a new horizon appearing in the form of the mobile Internet (**Fig. 2**). Japan blazed the trail toward enabling Internet access via mobile phones, thereby paving the way for smartphones. SmartTVs are expected to make their debut this year. Personal computers are becoming even smarter. Houses and meters are also getting smarter, with smart houses and smart electric power meters being connected with smart grids, which are intelligent power grids. They are ushering in the Internet of Things (IoT), in which communication takes place between people and things, and between things, in addition to conventional communication between people. What kinds of applications will run on the IoT is yet to be seen, although it is clear that the first application will be the visualization of power consumption, followed by demand response and demand-side management to control power consumption. While some people suggest that the third application will be remote care services for elderly people who live alone, what will follow it is completely unknown. Mind you, we must

be alert to the possibility that there are some clever people who have already foreseen what will come next and have begun to write code in American university dormitories. What the 2010s are for the IoT is equivalent to what the 1990s were for the Internet; namely the decade when the Internet began to grow and blossom. We should seriously consider encouraging the creation of new industries through information and communications technology (ICT) and strengthening our competitiveness.

Engineers' understanding of customers makes a difference

Hoshino: I'm often asked what I do in the Global Market Intelligence Department, where I work. My colleagues think that I'm foreseeing the future by looking into a crystal ball. Actually, I analyze information about the world at large and provide the technical team, product development team, and marketing team with intelligence regarding international, regional, and local trends: how they will develop and what actions we should take.

Let me start with two examples of charismatic chief executives. The first is Steve Jobs, one of the co-founders of Apple. He is famous for having been anti-market-research. For example, on the day he unveiled the Macintosh, a reporter asked him what type of market research he had done. Jobs replied, "Did Alexander Graham Bell do any market research before he invented the telephone?" He also said, "Customers don't know what they want until we've shown them" and "You can't just ask customers what they want and then try to give that to them. By the time you get it built, they'll want something new." These remarks may seem to be a rejection of market research but my interpretation is that he meant that he needed a crystal ball.

The second example is someone very close to me, Carlos Ghosn. He came to Nissan in 1999 and told us that the problems that had plunged Nissan into crisis at that time were: lack of profit orientation, lack of customer orientation, lack of cross-functional and cross-border work, lack of a sense of urgency, lack of a shared vision, and no medium-term plan. The most important message from him was that all processes must be customer-oriented.

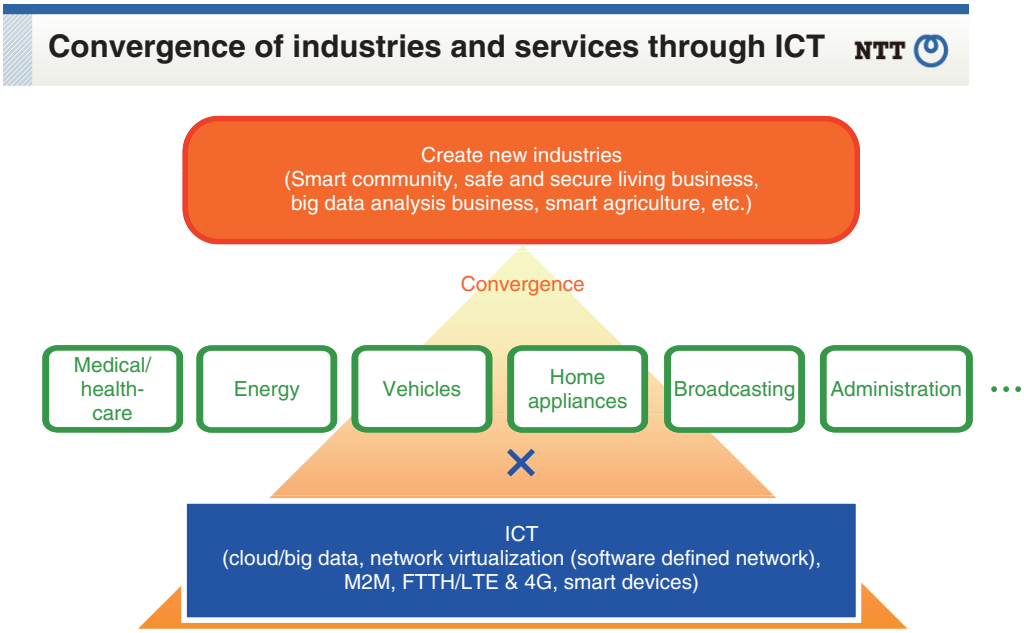
I'm in charge of market intelligence. While developers of elemental technologies look five to ten years ahead, we provide them with information about what the global market for mobility will be like ten to twenty years ahead and about how technologies should be developed. People in product development are engaged in projects covering a five- to six-year timespan, so we provide them with information about what the world will be like in five or six years. Marketing people look only one or two years ahead, so we provide them with information about current hot trends. For each group, we provide appropriate insight and foresight that are appropriate.

The strength of Nissan today is that it has created a stringent process whereby top management must approve our insight and foresight and no project can move onto the next milestone unless our prognoses are verified to support decision-making. Back in 2002, there was a general mood of apathy in the air. People tended to say, "It's no use listening to customers, and it's a waste of time looking at previous data." We, in a position to project future trends, were told that market research and analysis were unnecessary. This mood was the very source of the lack of a customer-oriented approach, which is what brought Nissan to crisis point. What pleases people? What should be done to please people? How can we excite people? You need to understand the market to know the answers. You need to have engineers who think about how to excite people. To put it in a nutshell, it is only through good technology and good understanding of your customers that you can create hit products. Once engineers understand their customers, they exhibit tremendous power. I think that one person who did it alone was Steve Jobs, and one person who tries to do it within an organizational framework is Carlos Ghosn.

Convergence of industries and services through ICT

Uji: The key words that symbolize the business tides in the ICT world are paradigm shift, service convergence, and globalization. Among these, I want to focus on service convergence in my presentation. Let's get an idea of what that means by taking as an example something that we use every day: the mobile phone. It was originally designed to be a tool for conversing and transmitting messages via a network. However, today's mobile phones do a lot more. You can listen to music, watch television, read books, use it as your commuter pass, and even use it as a pedometer. On top of all that, you can use it as an interpreter between languages such as Japanese, English, Chinese, and Korean.

Starting with the INS Concept in 1985, NTT has announced a series of visions from time to time: multimedia, global information sharing, and, most recently, service creation. We are now moving into



M2M: machine-to-machine
FTTH: fiber to the home
LTE: long term evolution
4G: fourth-generation mobile communications

Fig. 3. Convergence of industries and services through ICT.

the age of convergence. A variety of industries and services will converge (**Fig. 3**). For example, up to now, a vending machine has merely been a device for selling and dispensing merchandise but, combined with ICT, it can manage inventory in real time and enable communication between the machine and the shopper. If a camera and a display are attached to it, the vending machine can recognize what type of person is standing in front of it and make appropriate recommendations. ICT can completely change what a vending machine is. When an automobile becomes an electric vehicle, it is no longer just a means of transport. It is also a mobile battery. When combined with ICT, a car can take on a bigger role. For example, it can become a sensor and can provide the driver with information appropriate for the particular situation. Interworking and convergence of broadcasting and communication are accelerating. Last year's business plan for NHK (Japan Broadcasting Corporation) clearly referred to the convergence of broadcasting and communication. NOTTV, a mobile multimedia broadcasting service for smartphone and tablet users, will start in April. Now let us turn our attention to energy issues. Since the earthquake in March last year, power supply shortages have emerged. Today, energy policy should involve not only energy suppliers but also energy users. By combining energy use with ICT, it is possible to visualize energy consumption and, by incorporating demand response, it is possible to optimize energy supply and demand. These innovations will lead to the development of smart communities.

The NTT Group is undertaking a wide range of research activities, including ICT, that will achieve the convergences that I have just mentioned. To bring research results to the market quickly, we are organizing teams tasked with bringing a comprehensive commercialization orientation to research and development (R&D). What we call *producers*, who are in charge of this initiative, build the service concept and business model, conduct market research, analyze the latest technologies available around the world, and set up collaborative arrangements with various industries. Where necessary, they seek collaboration with venture capital providers and foreign companies. They definitely play vital roles in creating innovation.

Our laboratories are also pursuing leading-edge

research that can bring breakthroughs to the world. We have many excellent personnel involved in basic research, which includes communication science and materials science. Their papers are published in Nature, Science, and other leading scientific journals. Thomson Reuters in the USA published its list of 2011 Top 100 Global Innovators. NTT was one of the companies on the list. Japan, with 27 Japanese companies, followed the USA in the number of companies listed [4]. This is a sign that Japan has more potential to lead the world than it currently exhibits. ICT accelerates the convergence of industries and services, providing opportunities for existing companies to expand their businesses. It provides horizontal integration among different communities, industries, and organizations. The convergence of industries and services will give rise to new industries. Since R&D is the prime engine for boosting international competitiveness, the NTT Group, as a leading ICT company, will continue to pursue R&D.

Question: How should the Japanese companies compete?

Sekiguchi: The three companies that have led the home appliance industry in Japan expect to record a huge combined deficit of 1.29 trillion yen in the business year ending March 2012. In contrast, in our next-door neighbor, Korea, Samsung is steadily sharpening its competitive edge. Made-in-Japan home appliances once dominated the global market. Surprisingly, thirty years on, these companies are still competing the way they did decades ago, engaged in a futile battle of beating each other domestically and sticking with home-grown technologies, resulting in ever-lower prices, and shorter product lifecycles.

I am also concerned about the recent malfunctions in mobile communication services. They are said to be due to the network's failure to keep abreast of the sharp rise in the use of smartphones. The question is whether or not the communication industry can swiftly and technically cope with the emergence of smartphones.

Some companies have achieved success by incorporating new technologies. Apple is one example. Steve Jobs briefly left the company, but when he returned, he threw out the whole existing product lineup, focused on the iMac, and began meeting the demands of the market by providing color variants of the product. Apple successively introduced the iPod, iPhone, and iPad: new information appliances that give the user access to the Internet. Within a short time span, Apple's business performance recovered. In 2001, personal computers accounted for 80% of the company's sales. They now account for less than 20%. This transition is the secret of Apple's latest success. By contrast, Japanese companies have neglected to explore unbeaten paths.

It is forecast that, by 2015, the number of smartphones in use worldwide will top 1 billion. In Japan, smartphones are expected to account for more than 70% of all mobile phones in use by 2015. A source of concern is mobile devices from Japanese vendors. Although the domestic market is growing, the share of mobile devices held by Japanese manufacturers is falling. We are concerned that Japanese ones do not sell in overseas markets, and we refer to the isolated domestic evolution of these devices as *Galapagosization*. Our concern is exacerbated by evidence that even the domestic market is being taken over by foreign companies.

The penetration of mobile devices is generating explosive growth in information volume. The volume of data exchanged by mobile devices today is around 0.6 exabytes (10^{18} bytes) per month. This is expected to grow to 10 exabytes over the next five to six years. The generators of this huge volume of data are smartphones, tablets, and home gateways together with IoT and machine-to-machine (M2M) traffic. There is a great business opportunity to be grasped in providing solutions that can handle this huge volume of data. If you look at the geographical distribution, data volume is growing fastest in the Asia-Pacific region. Japanese companies should do all that they can to expand business in this region.

The reason Japanese companies cannot currently win in world markets despite having adequate technology, funds, and human resources is that their approach to business is flawed. For one thing, they rely too heavily on the assets that they built up during the era of analog devices, neglecting to adapt to the world of the Internet. For another, they have been lulled into complacency by past successes and have failed to discard earlier business models, with the result that they have fallen behind in technical innovation. Both technology and the business management to control it are hard pressed to make the transition from the past to the present.

3. Discussion

Change in the sense of value driven by a sense of urgency and diversity

Sekiguchi: First, I'd like to address the business management issues. Why was Nissan unable to solve its

problems, and why, when Ghosn came to Nissan, was he able to do so?

Hoshino: Among the five problems he identified, the most deeply rooted was the lack of a sense of urgency. By nature, people tend to resist change. At that time, Nissan was on the verge of bankruptcy. Ghosn launched a campaign called SHIFT_. It was a top-down program to educate employees that it was worthwhile to change things. "You never do the same thing." "Anyone who has thought of an idea that is different from past practice is to be lauded." It was critical that they accept this change in the sense of value. Another top-down action was to instill a sense of urgency. "This company will go under. Yes, it will, unless we change!" I think people, at heart, didn't like the idea of achieving synergy with Renault. "Without doubt, the cars we make are better." However, it was this attitude that brought Nissan to the brink of bankruptcy. It was essential that they sincerely felt the sense of urgency and believed in the idea of trying something new.

The move to change the sense of value was aided by the introduction of diversity. Diversity was brought to Nissan when a foreigner came to take the helm. When the only people in meetings were Japanese men, they just nodded in agreement with many issues, but when foreigners and women, people with completely different perspectives, faced such issues, they asked why. These men, comfortable with a shared sense of value, suddenly found themselves having to explain what they had thought to be obvious. Through being required to explain, they had the chance to discover that they had been wrong or to strengthen their ideas.

Japan's problems: Weaknesses in developing superior systems and attaining de facto standards

Sekiguchi: I would like to try and identify the weak points of Japanese companies. What caused them to fall behind?

Murakami: I think their weakness lies in their obsession with perfection, performance, and elemental technology. It slows the introduction of products to the market, raises the cost above what the market can accept, and erodes the supremacy of the total platform, even though individual elemental technologies may be excellent. Why has this happened? Japanese companies have been caught in the monkey trap of experience that earnest pursuit of perfection, performance, and elemental technologies brought about the great recovery from the devastation of the second world war and impressive development thereafter. Such a strategy may have worked once, but these companies appear unable to identify the next strategy. To make matters worse, Japanese enterprises are not ready to accept charismatic leadership. Their decision-making process consists of prolonged meetings. This has remained the same for ten or twenty years. The time to revise this attitude is long overdue.

Uji: With respect to Japan's weakness, I'd like to stress the importance of international standardization. Remember that de facto standards are just as important as de jure standards. Japan is not good at attaining global de facto standards. Japan may have excellent elemental technologies but it cannot assemble them into superior systems. NTT is no exception. While the individual elemental technologies we have are fine, we frequently have to discuss the need for a systematic approach.

Sekiguchi: Why is Japan not good at developing superior platforms or systems?

Murakami: The first reason is that Japan has a population of 120 million people. This large market grabs the attention of Japanese companies, which close their eyes to the global market. The domestic market is sufficient to yield a reasonable return on investment. You can maintain a respectable market as long as your elemental technologies are good enough. If the domestic market had been too small for your business to flourish, you would have looked at the Asian market, at least, and would have optimized your marketing strategy on that basis.

The second reason relates to *Galapagos cell phones*—ones finely adapted to the Japanese market alone. Interestingly, when Google put Android on the market, it learned a lot from Galapagos cell phones. However, by mocking Japanese cell phones as Galapagos cell phones, we are assessing the products too early and too lightly. We tend to label products too quickly when we really need to evaluate them more carefully. Just looking at what's bad and disregarding what's good is like throwing the baby out with the bath water.

How to sell products and services abroad

Sekiguchi: I heard from an Apple staff member that they learned from Galapagos cell phones. If Japanese technologies can penetrate the global marketplace, why can't Japanese products and services?

Uji: Back in around 2000, we tried, in vain, to diffuse our i-mode service overseas. We learned that simply investing money isn't enough. It's important to follow up. With that lesson still fresh in our minds, NTT has, over the last few years, been working on reinforcing

existing initiatives and launching new ones for globalization. Watch this space.

In order to introduce products and services to overseas markets, it's necessary to adjust them to suit local market conditions. Just because something was well accepted in Japan, there is no guarantee that it will also magically work overseas. For example, East Japan Railway Company's prepaid card, Suica, can be used with ticket machines made for the private railways' system PASMO and can also be used as electronic money. It's very convenient. However, while Suica's high quality and convenient service may meet the expectations of Japanese commuters, their counterparts in other countries do not necessarily demand such high quality. The story is the same for mobile phones. For example, it is said that, in India, what they want are simple, low-cost cell phones that can make only phone calls. Needs differ from country to country. Japanese products and services may have some features that do not suit the needs of local markets abroad. That said, there are cases where our products do meet local needs as they are. For example, we have digital cinema, which, with its 4K resolution, boasts higher definition than the conventional high-definition TV. When we introduced it to Hollywood, it perfectly matched their needs. Products tempered in Japan's demanding market can have high potential in focused markets around the world.

Hoshino: Nissan and other Japanese automakers focus on the global marketplace rather than the Japanese domestic one. So, we have no tradition of undertaking technical development from the perspective of the Japanese market in isolation. Today, China is the largest available market. So we are looking at China, and also India. Because the Asian region has the fastest growing economies, we watch Asia very closely. We also, to a slightly lesser degree, keep an eye on Africa and the Middle East, whose growth rates are tagging along behind that of Asia. The requirements in these regions are quite different from those in Japan.

We do not think in terms of simply taking something attractive that we have manufactured in Japan to overseas markets. We need to adapt our products to individual markets. For us, it's important to involve ourselves in a particular market (observe it, talk with local people, and understand the future prospects of the market and the sense of value of the local people). People who can successfully do this we define as globally oriented businesspersons. It's not simply a matter of having people who speak fluent English. It's timely to ask what attributes are needed to be a globally oriented Japanese businessperson.

Murakami: Speaking of Google having learned from Galapagos cell phones, let me mention one globally oriented person: John Lagerling. He came to Japan, joined NTT DOCOMO, and was entrusted with the task of diffusing the i-mode service globally. He traveled around the world in this capacity, and then moved to Google Japan. He was well acquainted with the Japanese mobile phones that evolved in isolation from the world. Drawing on his deep knowledge about the pros and cons of Japanese devices, as well as his experience of the difficulty of trying to spread a particular service globally, he now leads global deployment of Android at Google Head Office. It's wrong to think that every aspect of a certain human resource or technology is good or, conversely, that every aspect of the Galapagos cell phone is bad.

High expectation for smartTVs

Sekiguchi: What fields should Japan focus on, and how should it approach them?

Murakami: Today, the Internet is seeing a new horizon appear. The International Consumer Electronics Show held in Las Vegas in January was symbolic. It was apparent that there are two different trends with regard to making things smarter. One is the trend from personal computers to smartTVs: Samsung and LG Electronics are the frontrunners in this field. The other trend is toward smart-grid devices: again, it was Samsung and LG Electronics that unveiled smart appliances. Even though Japanese manufacturers were the first to introduce the concept of information appliances, Japan now lags behind Korea just when these appliances are taking off. However, Japan still has a chance to catch up in the area of smartTVs. The TV industry has a layered structure. Receivers make up just one layer. There are others: the platform layer, application layer, and content layer. There is still scope for Japanese companies to penetrate, depending on how skillfully they go about it.

Among these layers, the most important is applications. And what heads the list in the application layer is something that may cause you to think "What? That one?" Yes, it's Apple's iBooks Author. Although iBooks Author is said to be a tool for editing textbooks, it is also capable of handling cross-media content. Will the advent of authoring tools in the application layer of smartTVs make it possible to present cross-media content in totally unforeseen ways? TV programs today are said to be uninteresting. Could these tools make them more interesting?

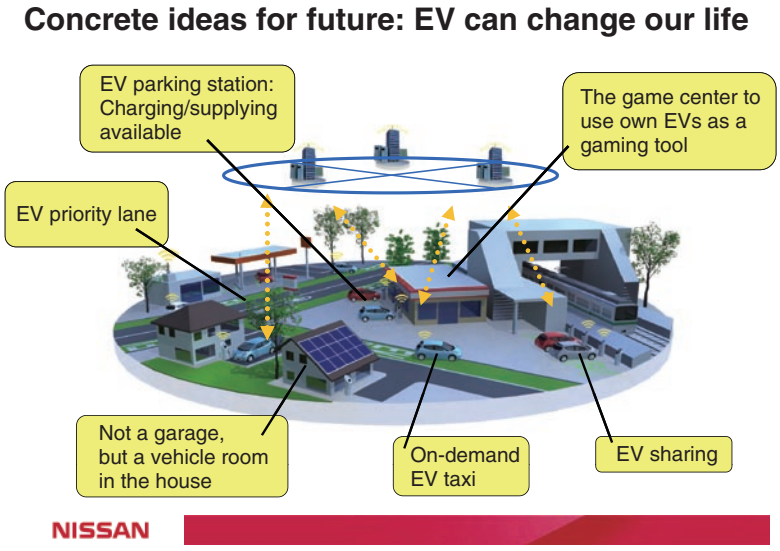


Fig. 4. Concrete ideas for future: EV can change our life.

The application layer is still an unoccupied area. The door is wide open. Furthermore, electric vehicles, which are representative smart-grid devices, can also become IoT devices. Since the age of IoT has just begun, I hope that Japanese companies will try hard to gain a foothold in this field.

Sekiguchi: The development and manufacture of products have traditionally been Japan's forte. Japan may have been overtaken by Korea in the area of mass production, but it should experiment by combining ICT with its elemental technologies while these are still superior.

Japan may be the leader in conventionally powered automobiles, but can it retain its competitive edge in the age of electric vehicles? I don't think it will be easy. Japanese automakers should combine their automobile technology with ICT while they still enjoy the leadership position, to create a brand-new field—that of smart cars—which will be the equivalent to smartTVs in the home appliance industry.

The key opportunities are in the communication field and services for the elderly

Hoshino: Yes, we automobile makers are actively exploring the possibilities of smart cars and smart cities (**Fig. 4**). We think that this is a field in which Japan can demonstrate its strengths. One key to the smart city concept is seamless communication: between cars and houses, between cars and people, between houses and people, and between cars. This is a field where we should make sure that we win. Speaking of communication, it should be noted that many people in advanced countries are still using conventional telephones while people in emerging countries are starting out with smartphones. Smartphone use is spreading at an extraordinary rate in emerging countries, resulting in the odd situation in which the value of communication in these countries is higher than in advanced countries. I'm convinced that, by fully grasping these developments, we can create a winning scenario in emerging markets.

Societies around the world are aging, and Japan is in the front line in this regard. If Japan can produce smart solutions to these issues, it could emerge as a winner five to ten years from now, when Europe and China start to experience what's already happening here.

It's important to continue to innovate

Uji: Addressing societal problems, such as medical and healthcare requirements and aging society issues, through the convergence of existing systems and ICT, and the launch of NOTTV through the convergence of broadcasting and communication, are examples of new industries that can emerge. If these initiatives prove to be successful in Japan, we should be able to successfully deploy them overseas.

NTT's technical development teams will innovate

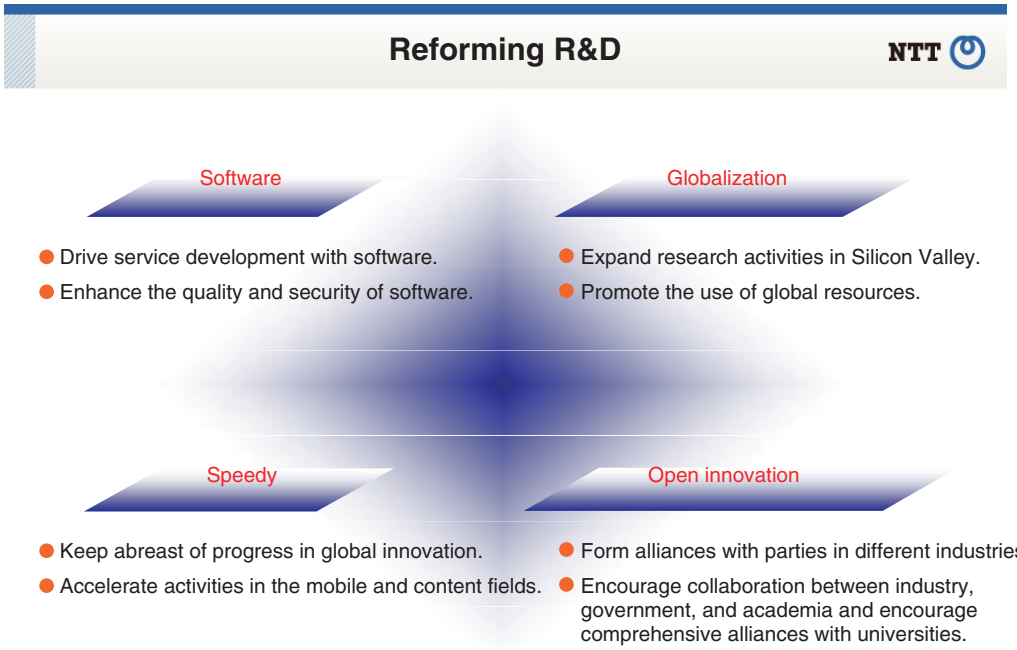


Fig. 5. Reforming R&D.

through active use of software to make new services and capabilities, globalization, increased speed, and open innovation (**Fig. 5**). Ms. Hoshino said that the Japanese automobile industry looks at the world market rather than the domestic one. For our part, NTT will look first at the domestic market, and then broaden its scope to take in overseas markets. As a way to promote science and technology in Japan, the government is advocating *life innovation* and *green innovation*. These are also new industries emerging through the convergence of various fields. Life innovation has to do with health, medical, and nursing care, while green innovation is aimed at addressing environmental and energy issues. But if you just hear these terms on their own, you might think that they completely unrelated to ICT. In fact, to drive these innovations, it is important to ensure convergence between them and ICT. Nissan Motor Company and the NTT Group are jointly conducting a feasibility test of a smart city concept. Such collaborative innovation with other enterprises and industries will become increasingly necessary.

Let me conclude with a remark made to me on the day that the news media reported that Eastman Kodak in the USA had filed for Chapter 11 bankruptcy. This person said, “How does NTT manage to keep its head above water!” If we were still purely a telephone company, we might have gone under. Instead, we have reinvented our business by venturing into the delivery of not only voice communication but also images and video and by providing Internet access and services, mobile communications, and solutions to customers’ business operations. Besides reforming business, we must also reform R&D, which is a fount of business growth and competitiveness, to suit the needs of the time.

Sekiguchi: Although Japan has its weak points, it can change if it tries hard. If Japan achieves success in the fields that it is good at or that it has embarked upon ahead of the rest of the world, such as automobile manufacturing, health and medical care, and care services for the elderly, then surely Japan is capable of successfully deploying them overseas.

Today, we have been fortunate to hear a lot of insightful views from three distinguished panelists. Thank you all very much.

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Profiles of the coordinator and panelists

■ Waichi Sekiguchi

Editorial Writer, Nikkei Inc. [1]

Member of the Research and Development Strategy Committee, Information and Communications Council, Ministry of Internal Affairs and Communications; member of the Information Economy Sub-Committee, Industrial Structure Council, Ministry of Economy, Trade and Industry; member of the Security Measures Council, National Police Agency.

■ Norio Murakami

President, Norio Murakami Office Co., Ltd. [2]

Formerly, Vice President, Google Inc., and President (later Honorary Chairman), Google Japan Inc. He currently serves as a professor at the Center for Global Communication, International University, and as a special guest professor at the Graduate School of Keio University.

■ Asako Hoshino

Corporate Vice President, Nissan Motor Co., Ltd. [3]

Joined Nissan Motor in 2002 after having worked for Nippon Credit Bank, Co., Ltd. and Intage, Inc. She is currently Director of the Global Market Intelligence Dept.

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