Hitachi Review
Volume 63 Number 6 August 2014

HITACHI
Inspire the Next

Global IT Solutions for Accelerating Social Innovation

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From the Editor

Three years ago, *Hitachi Review* published a feature edition that presented information technology (IT) solutions from a risk management perspective, and covered Hitachi's response to the rapidly expanding markets in emerging economies. It was a time when people were taking a fresh look at global supply chains, forced by factors such as the sense of uncertainty in the outlook for the global economy that accompanied the emergence of the Arab Spring in December 2010, and the problems with the supply of IT components manufactured in the Tohoku region of Japan, which was affected by the Great East Japan Earthquake.

Although other events have had a major impact on global economic activity since then—including flooding in Thailand and the European debt crisis—the IT market continues to expand steadily against a background of rising consumption and ongoing infrastructure investment in emerging economies.

Meanwhile, the buzzwords in the IT industry keep changing year after year, the latest being "SMAC," meaning "social, mobile, analytics, and cloud," indicative of how the rate of change in the world has become even more rapid. This hectic change has led to concerns that the IT industry in Japan is being left behind by the wave of globalization. Given that technologies such as tablets, smartphones, software as a service (SaaS), social networking services (SNSs), the cloud, and big data have largely been developed overseas, there are growing fears that those technologies that have been successful in Japan will succumb to the "Galapagos effect." The direction being taken by globalization has prompted some people to say that the time has come for Japanese corporations to reexamine their identities.

Against this background, Hitachi's information & telecommunication systems division has set a strategy of using IT to drive social innovation, with the aim of implementing this globally. The company has been restructuring its portfolio of overseas businesses in recent years, expanding the proportion of software and service sales as a percentage of overseas business to above 50%, and building up the infrastructure to utilize the comprehensive capabilities of Hitachi in its Social Innovation Business.

Amid the growing severity of social problems at a global level, including political and economic instability, resource and food problems, the population explosion, and urbanization and environmental degradation, Hitachi intends to achieve social innovation and to contribute to the creation of sustainable societies through optimization by linking together people, IT, and social infrastructure.

This edition of *Hitachi Review* describes Hitachi's information & telecommunication systems division's business to accelerate social innovation across the world in response to the issues faced by society and our customers.

Editorial Coordinator,
Global IT Solutions for
Accelerating Social Innovation Issue

Toshiyuki Fujimura

Executive General Manager
Global Business Planning & Operations Division
Sales Management & Accounting Division Group
Information & Telecommunication Systems Company
Hitachi, Ltd.

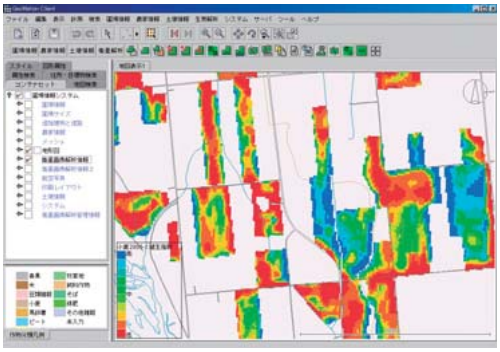
Global IT Solutions for Accelerating Social Innovation

While the world economy maintains its pattern of ongoing growth, a variety of challenges are emerging that include environmental and resource problems on a global scale, along with aging populations and low birth rates in developed economies, and rapid urbanization in emerging economies. If economic growth is to be sustained while also resolving these diverse societal problems, there is a need for social innovations that will transform social infrastructure and systems.
The key to social innovation lies in the use of IT. Through the global supply of IT solutions that link IT with people and social infrastructure, Hitachi is contributing to the creation of sustainable societies that deliver business growth and safe, secure lifestyles through the transformation of social infrastructure.

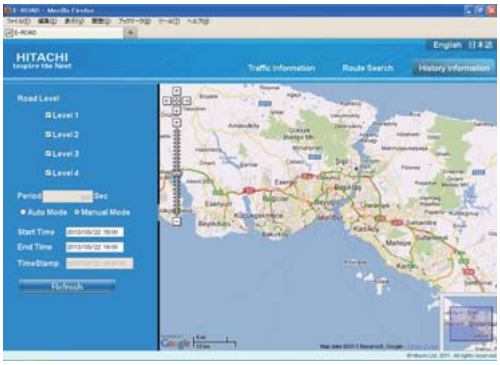
Services based on big data and the cloud (image)

Hitachi Unified Storage mid-range storage

Hitachi Unified Compute Platform



Screen shot from geographic information system used for agriculture (image)



Use of probe data in intelligent transport systems (image)

ATM and other automated systems for the worldwide market

Hitachi Virtual Storage Platform G1000

Expert Insights

Solve Global Issues through ICT Innovations

Yasuo Sakamoto

Vice-Minister for Policy Coordination
Ministry of Internal Affairs and Communications, Japan

Joined the Ministry of Posts and Telecommunications in 1980. Appointed Manager of the Computer Communications Division, Telecommunications Business Department, Telecommunications Bureau, Ministry of Internal Affairs and Communications in July 2001, Counsellor, Cabinet Secretariat to the Assistant Chief Cabinet Secretary in January 2003, Manager, General Policy Division, Information and Communications Policy Bureau, Ministry of Internal Affairs and Communications in August 2005, Manager, Policy Planning Division, Minister's Secretariat, Ministry of Internal Affairs and Communications in August 2007, Deputy Director-General, Minister's Secretariat, Ministry of Internal Affairs and Communications in July 2008 (responsible for Information and Communications Bureau), Deputy Manager, National Information Security Center, Cabinet Secretariat in July 2009, Deputy Director-General, Minister's Secretariat, Ministry of Internal Affairs and Communications in July 2011 (responsible for Information and Communications Bureau), Director-General for Policy Planning, Ministry of Internal Affairs and Communications in September 2012 (responsible for information and communications), Director-General of the Global ICT Strategy Bureau, Ministry of Internal Affairs and Communications in 2013, and his current position in July 2014.

Recently, I begin speeches with a specific topic: Professor Tadao Umesao, a cultural anthropologist, who began writing papers on information industry theory in 1962. He equated the era of information industry with the era of knowledge industry. Using an analogy with the primary germ cell layers in animal embryos, he proposed the concept that: (1) the agricultural age is comparable to the endodermic stage, during which the digestive system develops, (2) the industrial age is comparable to the mesodermic stage, during which the bone and muscle systems develop, and (3) the information industry age is comparable to the ectodermic stage, during which the cranial nerve and sense organ systems develop. Thus you can call this age the "knowledge industry" age. He pointed out that, in this new era, information would bring further fundamental changes to human institutions and organizations; that, at that time, humans would experience a major transformation in fundamental values; and that the information industry should be seen as an extremely significant trend in the history of civilization and therefore should not be treated as just a field of engineering. It was about fifty years ago that he stressed these points. We are now in the midst of an information and communication technology (ICT) revolution (or maybe at its beginning). I believe it is again time to ponder the meaning of Professor Umesao's words.

The global environment is likely to undergo dramatic changes, such as the total population of the world exceeding nine billion by 2050, of which about 70% will be concentrated in urban areas, with emerging and developing countries accounting for more than 40% of global gross domestic product (GDP) in 2017. The need to resolve global issues such as global warming, energy, food, water shortages, and disaster prevention is now urgent and crucial. Japan is also facing various difficult issues and problems. The human race, fortunately, has ICT as a tool for intensive technical innovation. ICT can contribute to the creation of new added value, and to solving social issues such as healthcare, education, disaster prevention, and resource problems. This means that we have great opportunities for finding innovative solutions to both global and domestic issues through the strategic use of ICT.

As an example, Japan is the world's front runner in confronting a "super-aged society." While we are facing various issues including a shrinking workforce, rising healthcare costs, and the dilution of solidarity in communities, we can overcome these by utilizing the power of ICT, which transcends time and distance. I believe that it is Japan's duty to present a model of a "smart-platinum society" (an aging society made vibrant by ICT) to the whole world.

The Internet has for the first time provided us with a "global space" (cyberspace) that is open to people all over the world. It can be said that the Internet provides a common platform on which all nations can submit ideas to each other and solve the various issues of each country. Although the challenges of cyberspace include information security and privacy, we should not treat these as opposites. Instead, we should look for innovative solutions to the various issues, with the most important basic principle being to ensure the free flow of information.

Now, we should not be engaging in abstract discussions, but looking for a practical and speedy approach to how ICT should be used to solve the front burner issues. The expression I use for this is, "the era of global inventiveness."

Tokyo will host the Olympics and Paralympics in 2020. I strongly hope that Japan will become an esteemed country through the creation of innovations with collaboration among various industries, academia, and the government, and will contribute to solving global issues by the innovative use of ICTs.

Technotalk

Exploring the Best Solutions for Realizing Social Innovation in Our Rapidly Changing World and Business Environment

Yutaka Saito Executive Vice President and Executive Officer, President & CEO of Information & Telecommunication Systems Group and Information & Telecommunication Systems Company, Hitachi, Ltd.

Jack Domme Chief Executive Officer of Hitachi Data Systems Corporation and Chief Operating Officer of Platform Business of Information & Telecommunication Systems Company, Hitachi, Ltd.

Philip R. Parr President and Chief Executive Officer, Hitachi Consulting Corporation

As globalization and borderless society advance, Hitachi sees its Social Innovation Business as becoming the centerpiece of its global business, where it can demonstrate the power of "One Hitachi." Gathering its strengths in manufacturing, IT capabilities, broad expertise and extensive knowledge base, and with all its high-quality products and services, Hitachi is striving to create advanced social infrastructure that is powered by IT to meet the changing needs of communities worldwide. We have brought together some key people in Hitachi who are leading the synergistic convergence of IT and infrastructure to discuss current issues, perspectives, and opportunities for the future.

Demand for Using Information to Solve Social Problems and Seize Business Opportunities

Saito: The world has many problems such as the concentration of population in large cities, aging societies, low birth rates, as well as energy and environmental issues. There are many areas where we can utilize information technology (IT) systems for social innovation. For Hitachi, social innovation is a key component of our growth strategy for global business. Along with consulting work, this requires new IT systems that use large amounts of real-world data. In such circumstances, Hitachi Consulting Corporation and Hitachi Data Systems Corporation will become major players in the Social Innovation Business of Hitachi.

Parr: This is clearly a very exciting opportunity for Hitachi and Hitachi Consulting in the marketplace. We are now really moving quickly into this area of social innovation. At the center of this new strategy is Hitachi technology and unique products that focus on solving major societal issues and problems. We are creating unique value proposition for our customers.

Domme: Health and life sciences is a great example right now because there is political interest and need for cost reductions and innovation.

We have a lot of capability to cut costs and make things more efficient in healthcare by systematizing or automating monitoring and analytics. Instead of always going to a doctor, you can determine a lot of things through a blood test for example.

As a first step, we are working to bring all of our clients' data together. Right now, in any country, a lot of medical data is spread out with different hospitals and different doctors. It might also be spread over many years and might be in many different formats. So if you want to analyze all the data, you have to get that data first.

Sometimes, data is very old. Sometimes the devices that created the data cannot even read it anymore. So we start by getting all that data into a format that can be analyzed for making better decisions and to create better outcomes for patients.

Parr: In the analytics area, one of the business problems our clients have is the volume of structured and unstructured data they are accumulating. They are often not sure what to do with it or how to get useful business information out of it.

Domme: There is so much data in the world now. Our best customers are saying "Help us use that data better. Help us use it with transportation systems. Help us run trains more efficiently. Help us to manage cars and traffic more efficiently." Every customer is looking to Hitachi to create successful business outcomes, to help them have a competitive advantage. It is also about creating a better life for people.

I think that is where Hitachi really stands out. We have the capability to bring so many facets of technology and social innovation together to create innovative solutions, not just for our customers but also for society as a whole, and on a global scale. By combining IT with infrastructure, we can provide the software, services and consulting to develop new technology for social benefit.

Saito: In the past, new services and new solutions required considerable capital investment, but now we can

establish them by using data. Using data, we can make better and more timely decisions in the field. Effective data management is essential for understanding the flow of money, the flow of the people, and the flow of things. By analyzing, visualizing, and modeling data, we can make a highly efficient and safe society and create highly efficient business models. Hitachi Data Systems is now in an excellent position as you have substantial experience in the storage business and many corporate customers globally. You are in a position to expand your business, and your experience and input can help Hitachi's Information & Telecommunication Systems Company develop and deliver new solutions.

Domme: In the surveillance area, there are now some great facial and pattern recognition capabilities to discover someone who is not doing good things who is caught on camera. Then we want to find out immediately, using analytics and search combination technologies, where else that person has been. If we can correlate all this data to provide actionable information, we would have a much safer world.

In the next five years, there may be a video chip on almost everything we come in contact with. It is creating so much data. A large supermarket chain would like to know customers' reactions to a display item in a store. An online payment system would like to know customers' reactions to teller machines, where people are accessing their bank information. You can start to see the application of just one stream of data called video, which is going to take over the world in the next five years.

Parr: Gartner is predicting that by 2020 there will be 50 billion devices attached to the Internet. That is just six years from now. IT has always been important in business infrastructure, but it is been nothing like we are starting to see today. And the speed is just going to accelerate. We are all going to have to stay in front of it.

Domme: Our current competitors are moving fast, and we will have new competitors as well.

We have just seen an Internet company that is now producing a smart car with all the software and intelligence to drive itself. They have also just bought a company that controls the devices in people's home. An online retailer is planning to create drones to fly products individually to people's doorsteps. They are talking about putting video systems on drones for surveillance or for security systems flying over people's homes. They know how to get to the market fast and invest heavily in those kinds of things. The marketplace is going to change dramatically, and there are going to be some really strong players.

Our biggest challenges and opportunities are to de-silo ourselves and look for integrated solutions that are provocative and innovative before customers ask for them.

The Changing Landscape of Consulting and the Role of Information Technology

Saito: Companies from various business backgrounds are utilizing IT to create new services, not only IT vendors.

Our competitors in this new era will be companies that know infrastructure very well and have electrical and mechanical technologies as well as other expertise in that field. Using information technology, they will create solutions that correspond to our Social Innovation Business. Previously, Hitachi Consulting was mainly providing consulting services for corporate IT systems, such as enterprise resource planning (ERP) or IT strategy, but now you are also involved in consulting for the social infrastructure field.

Parr: The focus of the consulting business is shifting. 10 years ago, it was all about offshoring your IT capability to lower delivery costs. It is not just that anymore. It is all consulting services, completely, across the board.

Yutaka Saito

Executive Vice President and Executive Officer, President & CEO of Information & Telecommunication Systems Group and Information & Telecommunication Systems Company, Hitachi, Ltd.

Joined Hitachi, Ltd. in 1979 and was appointed General Manager of Information & Control Systems Division, Information & Telecommunication Systems Group in 2006, Chief Strategy Officer, Chief Technology Officer and General Manager of Strategy Planning & Development Office, Information & Telecommunication Systems Group, President & CEO of Information & Control Systems Company in 2009, Vice President and Executive Officer in 2010, Senior Vice President and Executive Officer, President & CEO of Infrastructure Systems Group and Infrastructure Systems Company in 2012, and Senior Vice President and Executive Officer, President & CEO of Information & Telecommunication Systems Company, Information & Telecommunication Systems Group in 2013. He was appointed to his current position in 2014.

All the business process, the information technology, knowledge processes, industry vertical expertise, all your analytical capabilities are being outsourced now.

Now clients want services that support full sets of business processes, the functionality, the software, and the infrastructure underneath. They are starting to think of business process solutions as a service. I think that we can package client offerings like that to serve demand.

Domme: It is our expertise in some of those areas that computer companies may not have. They do not build proton beam therapy products. They do not build magnetic resonance imaging (MRI) machines.

Our vertical expertise over the years allows us to create analytics that help extract useful information from all that data, make some decisions, and create some helpful business outcomes from that data. I think that is a major advantage that Hitachi has.

Parr: We are really starting to tailor our consulting services around Hitachi products and services and identifying new opportunities for Social Innovation Business solutions. We have established a global footprint and the capability to support and deliver solutions that are integrated with Hitachi. We have 4,500 people worldwide, and large scale customers in over 50 countries. We are working with other Hitachi Group companies to develop business solutions. There are all kinds of components involved in that. One of the groups that Hitachi has established is called Hitachi Global Center for Innovative Analytics, and Hitachi Data Systems and Hitachi Consulting are working together with others in the center. It is kind of a place to incubate ideas and come up with solutions for our clients that are re-usable.

With the Cloud, the Future Becomes More Borderless and Limitless

Saito: These days, business and social life are systematized. There are smart devices everywhere, connecting people as well as machines in systems over networks, the Internet, and more. Japanese manufacturing companies have achieved high-quality manufacturing through improvement activities (such as just-in-time manufacturing) in their factories. In our modern era in which people and systems work together, I believe there is a need to develop an extensive knowledge of the workplace and to utilize the know-how of the people who work there so that this knowledge can be utilized to further improve the systems. The just-in-time system is one example of this, and it is the companies that can provide these systems that will grow. There is a demand for such systems from companies and other parts of society, and Hitachi has the practical experience, know-how, expertise, and technology for social infrastructure that can meet this demand.

Domme: The cloud is changing business environment. In many respects, the ability to reach a lot of customers globally is something that we can take huge advantage of.

The biggest, the fastest growing banks in the world are basically virtual banks. They do everything over the Internet and through a transaction on a computer or mobile device.

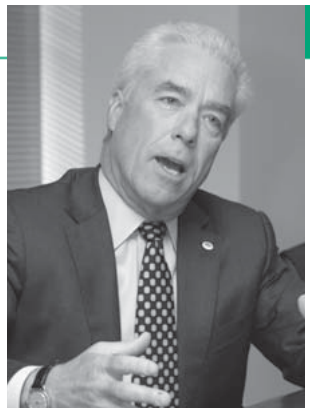
In our construction machinery business, it is no longer just a matter of selling the large tractors and backhoes. Now it is about selling the entire solution. Hitachi developed a system for a trucking company where all the equipment information is captured dynamically, automatically. They can just log in and know the efficiency of their trucks, their maintenance schedules, everything. It is all in the cloud.

The cloud will reach every home. Will people in emerging markets ever buy a disk drive or have a computer in their home? Or will every picture they take be stored somewhere in the cloud? That is a big opportunity for us. We can store their information,

Jack Domme

Chief Executive Officer of Hitachi Data Systems Corporation and Chief Operating Officer of Platform Business of Information & Telecommunication Systems Company, Hitachi, Ltd.

Jack Domme was named CEO of Hitachi Data Systems in April 2009 after serving two years as the company's chief operating officer. He was also named a corporate officer of Hitachi, Ltd. in 2013 and COO of Platform Business of Information & Telecommunication Systems Company, Hitachi, Ltd. in 2014.



Philip R. Parr

President and Chief Executive Officer Hitachi Consulting Corporation

Philip Parr joined Hitachi Consulting in July, 2002 and was named CEO of Hitachi Consulting Corporation in April 2009 after serving three years as the company's U.S. Chief Operating Officer.

whether it is in the health and sciences field or it is personal information and so forth. We can now reach many more consumers based on the changing dynamics of the cloud market. Cloud services are going to enable us to deliver even more on a global scale.

Saito: The cloud provides a platform for developing and delivering new services, such as asset management and the operation and maintenance of social infrastructure equipment. This has the potential to further differentiate our company.

Using big data, mobile systems, and cloud computing, customers now want us to provide new systems that are more efficient.

In Japanese, we say to reduce "muri muda mura," the three M's. In English, this means reducing overburdening, waste, and inconsistency. We achieve optimization and rationalization using control technology. Customers are demanding that kind of system, and that fits with Hitachi's mission.

Parr: I think that we are really at the front end for bringing the Hitachi products and services together in integrated solutions. Infrastructure is in every part of our daily lives, whether it is traffic control systems or home energy consumption monitoring.

Learning Locally and Providing Solutions to Customers Globally

Saito: We not only own IT, we also ourselves develop IT products, systems, solutions, and services. That is our strength. Now we are combining IT and social infrastructure to provide comfortable and convenient systems. This is what society and businesses expect. We want to use IT to provide easy-to-use social infrastructure to all people, including both the general public and our customers, end users, and employees.

Domme: Hitachi is known for quality products. We are also known for having a culture of respect. People like to deal with Hitachi. There are so many advantages. Our opportunities are so vast and so numerous and potentially one of our dilemmas is "what do we do first?"

Parr: Customers are really looking for global support from their partners for their businesses beyond IT. They are looking for specific business solutions, and are becoming increasingly interested in a single service provider for these needs.

As we speak with our clients about consulting services we offer, we are now introducing the rest of Hitachi's global products & capabilities, which is creating market interest and really changing the conversation in a way our major competitors cannot have.

Domme: Customers who have a global presence are looking for a global partner and a long-term partnership. They are looking for a company that is been here for a long time and is going to be around for a long time, like Hitachi. Our customers tell us, "We love your technology, but we really love your culture. We love your people. We love your ideas. You are a sustainable company. You are a 100-year-old company, and you are reinventing yourselves to make sure you will be here for the next 100 years."

Our customers respect Hitachi, but they do not know how to take advantage of everything that Hitachi has developed to help them become better organizations and gain a better competitive stance in their markets. We have got to find solutions that are really going to change the world. Hitachi has brilliant technology for water treatment. How do we get that into every country? How do we get our trains into every country? That is our advantage and our opportunity.

Saito: That is why when we go into emerging countries, we need to become insiders there. Of course, a global viewpoint is necessary, but we should energize industry in those countries and contribute to their development. We should build manufacturing bases and hire people there. That is our policy. That enables us to have many friends all over the world.

Domme: When we do that, we get different perspectives. Sometimes the emerging countries are more advanced in thinking about new things. They are able to learn lessons from what others have gone through already.

In communications, they went directly to cell phones, skipping over the whole wired communication phase. By working with them, we learned how to develop high bandwidth over wireless.

In transportation as well, local people can actually give us a different set of requirements in the way they want to grow. I think that is very beneficial to Hitachi.

Saito: That is "reverse innovation."

Parr: Yes, that is a great term for it. And if we do things right, social innovation has high growth opportunities. As we are moving into the future, we are looking at converging or consulting services with Hitachi and really tailor our solutions around Hitachi's products and services.

Saito: We have people in many areas of specialization, including research and development. We have a wide range of technologies and a wide range of experience and expertise. That is another kind of differentiation from other companies. We need to get these people together to collaborate and work around the same table, looking at real information and real data. We are committed to developing new solutions and new services that fit the needs of society.

Overview

Global Deployment of IT Solutions that Contribute to Social Progress

Sunao Ehara
Wakana Kasai
Isamu Nishikawa
Shinichi Matsuoka

SOLUTIONS THAT TIE TOGETHER PEOPLE, IT, AND SOCIAL INFRASTRUCTURE

WHILE the global economy continues its robust growth, societal problems are becoming more severe, including worldwide resource and food shortages, environmental degradation, inadequate social infrastructure in emerging economies, and the aging of social infrastructure in developed economies along with shrinking workforces due to aging populations and low birth rates. With the aim of building sustainable societies, Hitachi operates its Social Innovation Business for solving these societal problems by linking together people, information technology (IT), and social infrastructure while also achieving economic growth.

SATISFYING GLOBAL NEED FOR SOCIAL INNOVATION

This section gives an overview of global economic trends and market needs, and describes the role that IT can play in bringing about innovation.

Growing Need for Social Infrastructure and Social Systems

A number of multilateral free trade negotiations are currently in progress around the world. Chief among these are the 12-nation Trans-Pacific Partnership (TPP)(a); the TTIP(b), a free trade agreement (FTA) between the USA and Europe, and the 16-nation RCEP(c) that includes the Association of Southeast Asian Nations (ASEAN), Japan, China, and South Korea. While the progress of these economic partnership negotiations has been mixed, economic activity by corporations from different countries is responding to the trend toward liberalization by becoming more actively international and complex.

Projections by the International Monetary Fund (IMF) estimate annual growth in real gross domestic product (GDP) by developed economies and regions over the next five years at only about 2.5%. Their forecast for emerging economies and regions, on the other hand, is continued growth of more than 5% (see Table 1). If progress can be made on reducing or abolishing non-tariff and other barriers to trade, investment, and services in the future, it is anticipated that this will lead to a further acceleration in the movement of people, goods, money, and information at a global level.

Whereas many companies have in the past established manufacturing facilities in emerging economies, the rise in income levels in these nations as their economies develop means that they are also coming to be seen as new markets. Unfortunately, emerging economies may also suffer from inadequate provision of basic social infrastructure, such as electric power, water, roads, and transportation, and also of social systems such as government, finance, healthcare, and social security, meaning that their continued economic development will require things

(a) TPP
Trans-Pacific Partnership. A multilateral economic partnership with a high level of liberalization between nations in the Asia-Pacific region. It began in May 2006 as a free trade agreement between Singapore, New Zealand, Chile, and Brunei, with the USA, Australia, Peru, and Vietnam joining negotiations in March 2010. With the addition of Malaysia, Canada, Mexico, and Japan, negotiations aimed at agreeing on a new framework are currently in progress by a total of 12 nations.
(b) TTIP
Transatlantic Trade and Investment Partnership. Negotiations aimed at establishing a comprehensive free trade agreement (FTA) between the European Union (EU) and USA commenced in 2013.
(c) RCEP
Regional Comprehensive Economic Partnership. A wide-ranging and comprehensive economic partnership incorporating an FTA between Japan, China, South Korea, India, Australia, New Zealand and the ten ASEAN nations. Proposed by ASEAN in November 2011, official negotiations commenced in November 2012 following meetings by the 16 participants.

TABLE 1. Projected Growth in Real GDP
The table lists the projected growth rates for real GDP compiled from the October 2013 edition of the World Economic Outlook Database published by the IMF.

Nation or region \ Year	2013	2014	2015	2016	2017	2018
World total	2.9	3.6	4.0	4.1	4.1	4.1
Developed economies or regions	1.2	2.0	2.5	2.6	2.6	2.5
USA	1.6	2.6	3.4	3.5	3.4	3.1
Japan	2.0	1.2	1.1	1.2	1.1	1.1
Eurozone	–0.4	1.0	1.4	1.5	1.6	1.6
UK	1.4	1.9	2.0	2.0	2.1	2.3
Emerging economies or regions	4.5	5.1	5.3	5.4	5.5	5.5
China	7.6	7.3	7.0	7.0	7.0	7.0
India	3.8	5.1	6.3	6.5	6.7	6.7
Brazil	2.5	2.5	3.2	3.3	3.5	3.5
Russia	1.5	3.0	3.5	3.5	3.5	3.5
ASEAN	5.0	5.4	5.5	5.4	5.5	5.5

GDP: gross domestic product IMF: International Monetary Fund ASEAN: Association of Southeast Asian Nations

like financial aid from international agencies and investment or know-how from developed economies. It is anticipated that total global investment in social infrastructure will grow at an average annual rate of 5% over the 15 years from 2010 to 2025, with the bulk of this to occur in emerging economies (see Fig. 1).

Leading Role for Use of Information in Social Innovation

Modern society seeks to resolve social issues and achieve economic growth in ways that are conscious of the environment. Innovation is what makes this possible, and the key to innovation lies in the use of information.

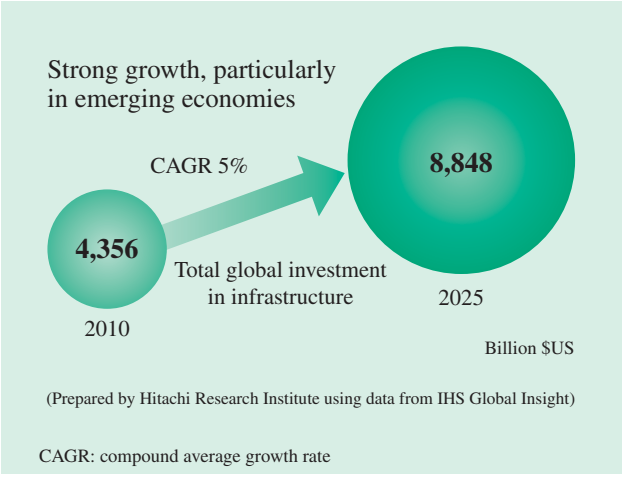


Fig. 1—Growth in Social Infrastructure Investment.
It is anticipated that investment will grow at an average annual rate of 5% over the 15 years from 2010 to 2025, with particularly strong growth in emerging economies.

Advances in IT mean it is becoming increasingly feasible to collect and analyze large quantities of different types of data in realtime. This "big data" encompasses not only e-mail, office documents, business data, and other conventional forms of information, but also information generated by people, including video, images, audio, and social networking service (SNS) usage data; information generated by machines, such as equipment monitoring and operation logs; and environmental and weather data. By creating new value through the use of the latest IT to collect, search, and analyze this data, and to make predictions, it is possible to deliver social infrastructure innovations, business growth, and a safe, secure lifestyle.

Hitachi aims to contribute to growth in Japan and internationally by using information as a resource to work together with society and customers to identify the issues they face, and to bring all parts of Hitachi together to work on resolving them. To achieve these social innovations, Hitachi supplies IT platform services for putting information to use, consulting services, and industry-specific services.

The next section describes activities by Hitachi in its Social Innovation Business for the information and telecommunication systems sector, and the specific measures being adopted.

GLOBAL OPERATIONS IN INFORMATION AND TELECOMMUNICATION SYSTEMS SECTOR

Along with changes in the market and business environments associated with ongoing globalization

and the growing severity of societal problems, the issues faced by society and customers are becoming more complex. Recognizing these changes in the state of society, Hitachi operates its Social Innovation Business that supplies new customer value by combining a wide range of products and services and making full use of IT. As part of this, by understanding the issues faced by society and customers, offering solutions, and putting these solutions into practice, Hitachi's information and telecommunication systems business has an important role as a driver of its Social Innovation Business.

Responding to Globalization of Customers

With aims that include establishing the capability to supply solutions and services worldwide in response to the globalization of its customers, and expanding its support organization to work more closely with customers, Hitachi is working to establish the infrastructure for supplying total solutions that extend from consulting to system development, maintenance, and operation.

With a presence in about 100 countries or regions already, Hitachi's information and telecommunication systems business now intends to proceed with its Social Innovation Business by contributing to advances in social infrastructure such as electric power, railways, and water treatment, while also supporting the globalization by its customers of manufacturing, logistics, finance, and other activities.

Specifically, it is planning to operate globally based around an IT platform business centered on the storage solutions of Hitachi Data Systems Corporation, and around the consulting business of Hitachi Consulting Corporation.

In addition to IT platform solutions based on the storage solutions that have been a mainstay of the company, Hitachi Data Systems Corporation is also strengthening and expanding its software services business. Also, based on its "Big Data for Tomorrow" business vision for FY2015, Hitachi is expanding its solutions for using big data (which has an important role in its Social Innovation Business) to include not only the collection and management of data but also the supply of solutions with greater added value, including applications designed for its customers' specific industries or business sectors.

Hitachi Consulting Corporation supplies management, IT, and other consulting services worldwide. In the future, it intends to strengthen its business portfolio by (1) expanding the range of solutions it offers, and (2) extending the geographical coverage of its services through mergers and acquisitions (M&A) and other measures. Hitachi Consulting Corporation has also been seeking to strengthen its management consulting through the acquisition in December 2012 of Celerant Consulting of the UK, which has customers in a wide range of industries, primarily in the social infrastructure sector, and extensive project experience. In the future, Hitachi intends to contribute to social innovation by strengthening its consulting in the social infrastructure sector.

Achieving Greater Social Innovation

Hitachi set up the Hitachi Global Center for Innovative Analytics (HGC-IA) in June 2013 to accelerate the global deployment of uses for big data. HGC-IA aims to make innovations in collaboration with customers throughout the world. With a focus on the healthcare, communications and media, energy, transportation, and mining sectors in particular, it is delivering services in the form of solutions and developing innovative applications for customers' specific industries by consolidating the development of big data solutions and building up experience through demonstration projects and other activities aimed at solving problems. Based around its operations in America, Europe, Japan, and elsewhere, HGC-IA intends to contribute through the use of big data to business innovation by working closely with customers' business operations.

LATEST EXAMPLES OF MAKING SOCIAL INNOVATIONS

The social infrastructure essential to our daily lives includes energy, water, urban development, logistics, transportation, healthcare, and finance. Hitachi is seeking to deliver "social infrastructure innovations," "business growth," and "safe, secure lifestyles" by using IT for optimization and to link people and social infrastructure. That is, through social innovations that use IT to solve issues faced by customers and society. To this end, Hitachi intends to combine the products, technologies, and know-how it has built up over time to identify the issues faced by society and customers, and to proceed with implementing solutions to customers' problems (see Fig. 2).

Hitachi's information and telecommunication systems business uses IT to drive social innovation. The following sections introduce the articles in this issue of *Hitachi Review* that describe what Hitachi is doing in this field, grouping the articles into the above three categories.

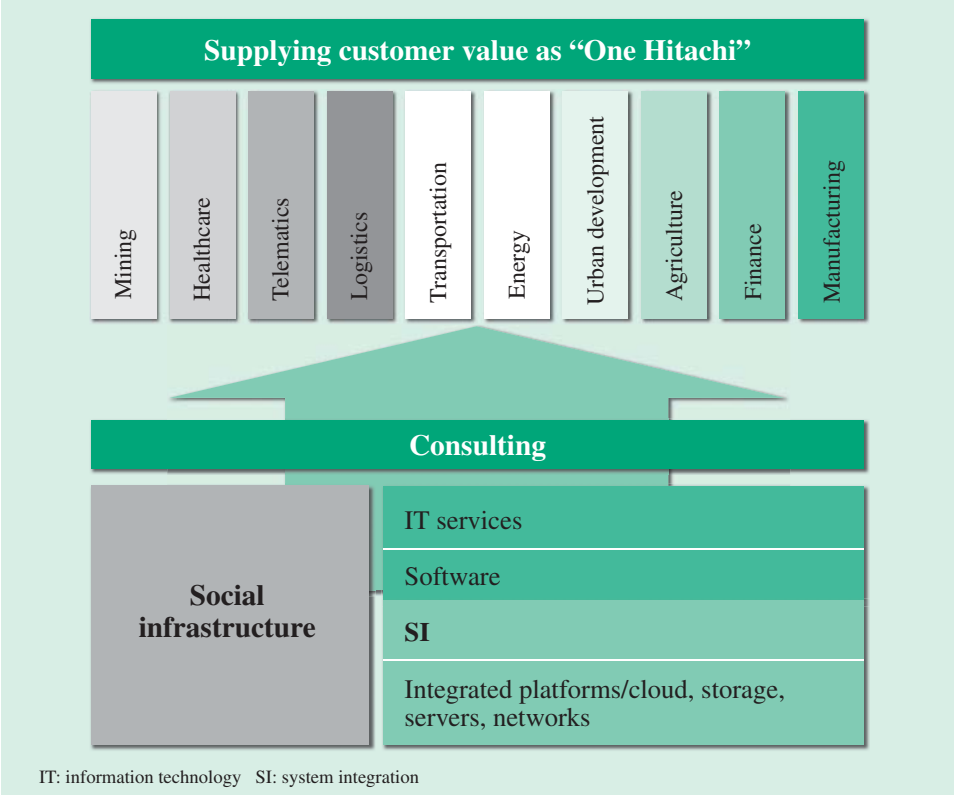


Fig. 2—Overview of Social Innovation Business Activities. Hitachi is achieving social innovation by supplying customer value as "One Hitachi."

Social Infrastructure Innovations

The first article (p. 18) looks at the platform solutions that have an important role in using IT to underpin social infrastructure.

Subsequent articles describe the global deployment of Intelligent Operations(d), which utilizes information for innovation in social infrastructure (p. 22), and case studies of the overseas deployment of solutions for using geospatial information systems to manage energy, agriculture, and other forms of social infrastructure (p. 27).

Another article (p. 31) describes the work of HGC-IA, which is developing big data applications and solutions throughout the world.

Business Growth

The information and telecommunication systems business works with customers to identify the business issues they face in all areas of operation, including manufacturing, logistics, finance, and telecommunications, and contributes to customers' business growth by supplying solutions that combine products, services, and IT.

One example (p. 38) describes enterprise solutions that support the accelerating globalization of Japanese multinational companies, including enterprise resource planning (ERP) and leading examples of work in the automotive industry, while another article (p. 42) looks at examples of the deployment of IT solutions in China and Southeast Asia that draw on know-how built up in Japan.

Next is a case study (p. 47) of the deployment in Asia of solutions for the finance industry that can reduce exchange rate risk and cut fees.

Another article (p. 53) describes a consulting project that enabled a North American customer to save energy.

Safe, Secure Lifestyles

An article (p. 57) describes the use of probe technology(e) for road traffic management to help achieve "safe, secure lifestyles" in emerging economies, and the implementation of a smart mobility solution based around a probe information system.

Another (p. 62) describes the technology and global deployment of cash management solutions based around banknote-recycling automated teller machines (ATMs) that make life in society safer and more convenient and trouble-free.

(d) Intelligent Operations
Hitachi's name for its consulting, services, and other products (platforms and technology) that accelerate the adoption of smart practices by society, companies, and customers through the use of big data and other leading-edge IT.

(e) Probe technology
Technology for the generation of road traffic information by collecting position, velocity, and other actual driving information from vehicles.

DRAWING ON COMPREHENSIVE CAPABILITIES TO USE IT TO DRIVE SOCIAL INNOVATION

This article has described the global operations of the information and telecommunication systems business as it responds to changing market conditions. This issue of *Hitachi Review* provides some examples of what the information and telecommunication systems business is doing to use IT to drive social innovation.

As it looks forward to its next 100 years, Hitachi intends to contribute to the creation of sustainable societies by making social innovations in numerous countries and regions, and in various industries.

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Featured Articles

Innovate With Information

—The Role of IT in Social and Business Innovation—

Mary Ann Gallo
Douglas Howatt

OVERVIEW: Raw data becomes more useful as its connections, clusters, and context are revealed. Data generated by business, humans, and even machines is groomed into content and ultimately into information and insight. The Hitachi Data Systems strategy integrates layers of technologies and solutions with industry-focused applications to help organizations find, evolve, use, and cultivate value from information. Ascending regional organizations and 82% of Fortune Global 100 companies use Hitachi Data Systems (HDS) solutions and services to develop data into information that they use for innovations large and small. Medical organizations use Hitachi technologies to connect disparate data to make faster diagnoses. Retailers turn customer data into new revenue opportunities. Government agencies connect information globally to make the world safer. Hitachi is proud that its technologies help to form the fabric of business and of society the world over.

INFORMATION FUELS INNOVATION

INNOVATION is the essential engine of positive change, and information is its fuel. Intelligent innovation lets you lead your market, grow your company, and change the world. Hitachi Data Systems Corporation helps you store, manage, access, search, and correlate your information across different sources. And Hitachi is the trusted partner who helps you innovate with information to make a difference in your world.

Hitachi contributes to business and to society by helping its customers convert huge stores of data into information they can use to innovate. Useful innovation ranges from a simple improvement in an internal procedure, to a dramatically different product that changes everything.

INFORMATION

Data, the building block of information, is everywhere. It is everywhere you can think of: your smartphones, your cars, and the Internet. And it is everywhere that you have not thought of: cash registers, trains, factories, farms, and your doctor's office. Big data is one of the most important revolutions since the Internet.

Big data is a collection of several different kinds of data and information (see Fig. 1). It is business information that comes out of companies' processes and procedures. Like your company's accounting records. It is human information that we generate when we communicate with each other. Like Twitter[*1], Facebook[*2], or email. It is also machine data that the world's infrastructure systems produce. Like security cameras and equipment sensors.

Big data is made possible by the combination of three emerging factors. The first is the massive increase in the amount of data generated in the world.

*1 Twitter is a trademark or registered trademark of Twitter, Inc.
*2 Facebook is a trademark or registered trademark of Facebook, Inc.

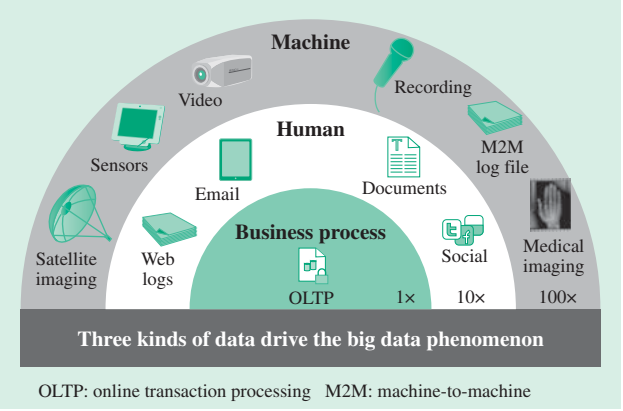

Fig. 1—What Is Big Data?
Today, data is created by an ever-growing number of devices and processes.

The second is the advancement of technologies that let every kind of data be analyzed into information in huge volumes at high speed and low cost. The third factor is the value within big data's information, which draws the people and companies who need to perform better and better by all available means.

With all of these forces in action, it is no surprise that big data is growing not only in size but in importance. In companies today, big data is mostly the analysis of business data and social Internet data for insights that help sales and marketing. Business captures data and then analyzes it for useful information: Data in, insight out. Insight can increase the customer base and revenue. Insight can help companies cut costs and be more efficient and profitable.

Of course, companies have been capturing and analyzing data for years. But not at this scale and not across such a wide variety of sources. What is new today is the sheer volume and variety of data that companies now need to analyze. Also new is the speed at which information is being generated and demanded by companies that need those insights.

Saint Elizabeth hospital in Canada works with Hitachi solutions to make health information available to mobile and remote clinicians and patients. With accurate and complete information at their fingertips, Saint Elizabeth's medical experts spend less time on paperwork and more time on patient care. Their interactions not only became more personal, they became more professional and effective too. Data migration and mission-critical performance are improved with HDS modular storage hardware enabled by sophisticated HDS software that includes Hitachi Dynamic Provisioning and Hitachi Replication Manager. The collection of technologies is tuned and the hospital staff is educated by HDS services groups.

Fig. 2—Technology Drives Business Value.
Technology that stores, manages and analyzes data helps businesses perform better.

HDS also works with a 300-store regional electronics retailer in Europe who uses SAP HANA[*3] and Hitachi systems to understand customer behaviors on their websites and in their stores. They mine this data to respond more quickly to trends so that marketing and inventory meet fast-moving customer interests. Their Hitachi solution is based on Hitachi Unified Compute Platform, which has strong data analysis capabilities and is optimized for the SAP HANA platform for "scale out" capabilities. The solution includes Hitachi Compute Blade, Hitachi Virtual Storage Platform, and Hitachi Command Suite software.

INNOVATION

Without fresh thinking and new approaches, an endeavor stagnates and is soon passed by. Innovation is not only the mandate of businesses and customers, it is the foundation of any organization's future. With the right information in the right places, company experts can make the right decisions to uncover new opportunities. Hitachi helps business discover, analyze, and use data for new competitive advantage (see Fig. 2).

Of course, innovation is vital to business and society. A study by the European Commission (EC) on disruptive innovation in the European Union (EU) transportation and logistics industry finds that information and communication technology is "one of the most important technological innovations ... to improve efficiency and effectiveness and even gain competitive advantage." The EC finds that information technology is "a key enabler of innovation" and is responsible for the industry's trends of new services, new competitors, and new alliances. Hitachi has seen this same effect among its customers in many other industries.

When people can extract information and insight from their data, they create the ultimate value: useful innovation. To build the path for information development, Hitachi focuses on analytics, integration, intelligence, and big data solutions. The fundamentals include the ability to combine structured and unstructured data sources, manage that data as it scales in realtime, analyze data to gain valuable insights, and correlate information from multiple sources. Hitachi information solutions use the single, virtualized Hitachi

*3 SAP HANA is the trademark or registered trademark of SAP AG in Germany and in several other countries.

platform for all data types to ensure seamless access, protection, and management of all information assets.

Australia's Saint Ignatius' College uses Hitachi technology to expand its innovative digital education. The college strives to teach each student to manage and understand information in its many digital forms. HDS helps to make their curriculum possible, with support for their information infrastructure and ready access to video, multimedia, and other information-rich applications. When students are prepared for today's world, they help to create tomorrow's. The college's data infrastructure supports a virtual desktop capability, using HDS modular storage systems and Hitachi Device Manager and Hitachi Tuning Manager software.

Illumination Mac Guff is a movie studio in Paris that creates movies such as The Lorax. Using Hitachi technologies, they have developed an agile information management system to support hundreds of artists and render 90 Tbyte of computer graphics. The system lets creativity flow faster in order to make the movies closer to the artists' original innovative vision. To create this high-performance network storage platform, Hitachi NAS Platform uses massive computing parallelism and Hitachi NAS Replication software. It creates tremendous system performance and scalability, with up to 8 Pbyte of usable capacity.

SOCIAL GOOD

Why are all of us in business? Is it for profit, for a sense of worth, for discovery? It is for all of these reasons, but most importantly it is to make a difference. Our families, our neighbors, and our society depend on innovation to improve the human condition.

For over 100 years, the Hitachi corporate credo has been "contributing to society through the development of superior, original technology and products." We are all connected. People. Companies. Society. Our planet. Hitachi applies its vast expertise to build community infrastructures that are more intelligent and environmentally conscious. An advanced social infrastructure helps families and communities now and for generations. Hitachi calls this the Social Innovation Business.

Hitachi sees social innovation in all of our communities, markets, and global regions. In our communities, our information technology is used for a wide variety of benefits including the well-being of all us. The Shanghai University of Traditional Chinese Medicine uses one of the HDS cloud solutions to manage the massive amounts of data it generates with its thoroughly modern information infrastructure. Most of the data comes from its smartcard program, its office automation system, its library management system, its public database platform, and its simulated hospital system.

After a successful implementation by HDS Global Services, the university runs all important data on a cloud storage platform that includes Hitachi Virtual Storage Platform, Hitachi Unified Storage, and Hitachi Universal Volume Manager. Teachers and students report that they are more satisfied with the system, and the efficiency of the university's information system. As a result applications have been enhanced dramatically. Students now make better use of school information resources with better access to library materials, online class selection, and so forth.

In addition to education, Hitachi sees significant use of its information technology in healthcare. Seattle Children's Hospital uses information as the lifeblood of its hospital and nine research centers, and has earned international recognition for innovative pediatric medical research. The organization has developed an innovative virtual desktop infrastructure to support the information needs of its many users in many different locations. The system reliably delivers accurate information to staff, doctors and researchers anytime, anywhere. Seattle Children's installed Hitachi Virtual Storage Platform as the centralized storage solution in its primary data center. A portion of this centralized storage uses a dual-node Hitachi NAS Platform cluster to support two forms of data – block and file – in a single platform.

Perhaps the most important community need is for the basics of life. Water management has become a deciding factor in communities' response to an emerging global crisis: the availability of clean water. Not only is water vital to human life, it is necessary for almost all aspects of the global economy, including health, food production, sanitation, energy, industry, and environmental sustainability. United Nations statistics show that water scarcity already affects almost every continent and more than 40% of the people on our planet.

Hitachi technologies are used by communities and industries to find new, efficient means to treat and manage water for the benefit of all of us. For example, Australia's Western Water authority runs an ambitious and innovative program with 150,000 smart meters across the state of Victoria. With water management becoming more critical in the face of the region's growing population and the desert climate,

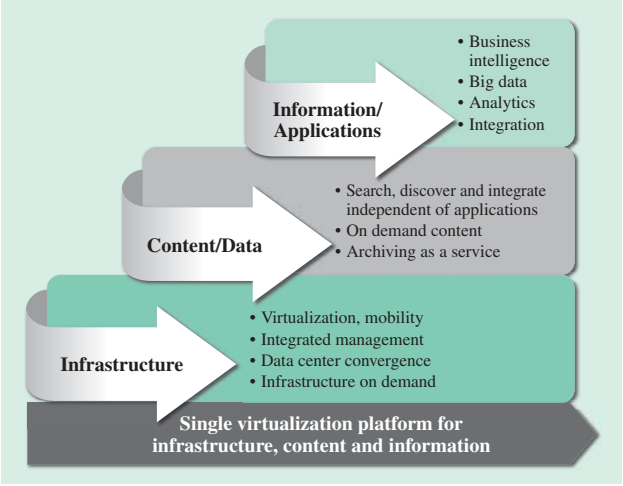

Fig. 3—Hitachi Data Systems Integrated Strategy. By developing and integrating solutions in these areas, HDS helps business succeed and society to innovate.

the smart use of water has become important. With enormous stores of data collected, Western Water develops information to educate the state's inhabitants on how to use water more carefully in preparation for recurring droughts. The authority uses Hitachi Unified Storage for high-density storage, a vital feature for a database that grows by 40 Tbyte each year.

I.T. INTEGRATION FOR INNOVATION

The Hitachi vision is to create a better world through social innovation technologies. The HDS strategy (see Fig. 3) to achieve this centers on integrating infrastructure, content, and information layers with vertical industry applications to help you turn your data into valuable business insights.

Hitachi understands big data today and the big data that will evolve tomorrow, because it builds the machines that create it. Hitachi applies decades of expertise in vertical industries to give you realtime information, useful analytics and decisions, and automated and integrated technologies.

The infrastructure layer is where IT professionals have focused historically. HDS offers a complete suite of innovative, reliable and virtualized infrastructure technologies that free data from its physical hardware or media. The resulting data mobility lets you nondisruptively migrate data – even big data – from system to system, from location to location.

Today, unstructured data is growing dramatically and IT professionals are scrambling to manage it. In the content layer, HDS frees data from the applications that created it so that you can easily index, search, access, and govern it forever.

The future of IT lies in the information layer where data is transformed into information and insight. It may be structured or unstructured, historical or realtime, and it may reside in any location. It may be a new diagnosis or a faster route to market. Understanding and delivering value from your big data creates new and meaningful opportunity.

YOUR INNOVATION

Around the world and in all aspects of life, Hitachi technologies, services, and expertise are used by innovators to make a difference in the world. Innovation is possible when the right people have the right information. With good information and inspired innovation you can help people in organizations, companies, and industries near you and around the world.

Hitachi is ready to do its part to help you do your part. Innovate With Information.

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Featured Articles

Intelligent Operations Utilizing IT to Accelerate Social Innovation

Toshiyuki Moritsu, Ph.D.
Keiko Fukumoto
Junji Noguchi, Ph.D.
Takeshi Ishizaki
Katsuya Koda

OVERVIEW: Hitachi is proceeding with the global deployment of its Intelligent Operations solutions for using information to reform social infrastructure. This extensive range of services is supplied to 11 different industry sectors, including mining, healthcare, and logistics, extending from consulting to the implementation and operation of industry-specific systems that run on IT platforms. Business operators can use Intelligent Operations for the efficient and global provision of uniform services that are closely matched to the needs of specific industries and regions.

INTRODUCTION

MORE than a decade into the 21st century, the increasingly prominent global challenges that face society include (1) the aging of populations, particularly in the developed economies, and the consequent increase in welfare costs and reduction in the workforce, (2) the difficulty of satisfying global demand for resources such as energy and food, and (3) dealing with the extreme concentration of populations in urban areas and the aging of social infrastructure.

Considering progress in information and telecommunications technology, on the other hand, advances in computer and network technology are making it possible to process complex data at high speed and in large quantities without being impeded by regional constraints. Similarly, the falling cost of sensors and other devices, and their online connection to networks, are making possible the low-cost, centralized management of the various different types of information associated with people's lives and business activity, resulting in people taking active steps to utilize information that would have been ignored in the past.

Given these circumstances, Hitachi is using information to reform social infrastructure, placing social innovations that make life safer and more secure and deliver business growth at the core of its business.

Intelligent Operations is Hitachi's name for its service and product solutions that seek to use information technology (IT) to accelerate social innovation. This article provides an overview of Intelligent Operations, describes its future global deployment, and presents case studies of its use.

USE OF INFORMATION TECHNOLOGY TO ACCELERATE SOCIAL INNOVATION

Modern society is underpinned by a large number of devices that are used in daily life or business activity. People carry smartphones and other portable devices, cars are controlled by 150 or more sensors, and the healthcare sector uses numerous devices to monitor patient health. In the business sector, it is anticipated that the use of information will be encouraged in a diverse range of situations in the future. Examples include the monitoring of aging social infrastructure such as bridges and tunnels, improvements to machinery utilization at production facilities, modeling and sharing of the knowledge and skills of the people who work there, and the efficient production and distribution of energy and other resources.

If social innovation is to be achieved through the use of detailed information from the field, it will require a fusion of IT with operation technology for the collection and control of information from devices. It will also require the use of formalized real-world knowledge and analysis techniques to discover the value contained within this information, and the provision of mechanisms that can use it as feedback in tasks such as decision making and device control. To support innovation by society, corporations, and customers, Hitachi has brought together its solutions that use IT to accelerate social innovation under the Intelligent Operations framework (see Fig. 1).

Intelligent Operations draws on technologies for the utilization of big data, highly reliable clouds, and security to provide consulting services, vertical

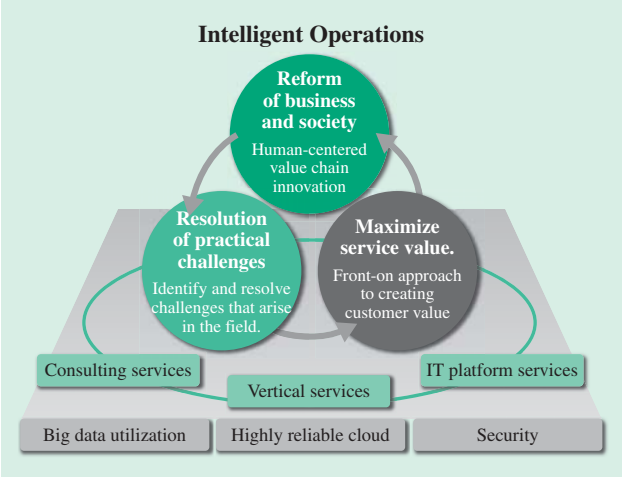

Fig. 1—Overview of Intelligent Operations.
Reform of business and society is achieved through human-centered value chain innovation.

services for specific industries, and IT platform services based on these technologies. Based on these services, Hitachi is creating people-centered businesses and reforming society by identifying the challenges that arise in the field and maximizing service value.

The Intelligent Operations solutions framework consists of three layers. These are the IT platform service that supplies standard platforms (Intelligent Operations Suite), the vertical services that provide system implementation and operation to specific industries, and the consulting services that identify issues, formulate solutions, and provide operational support (see Fig. 2).

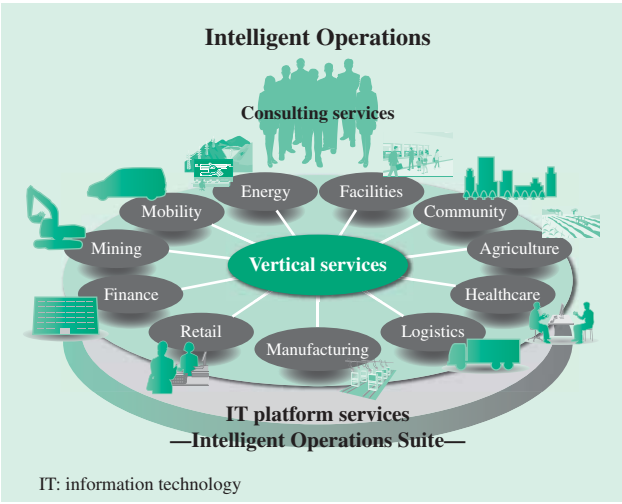

Fig. 2—Intelligent Operations Solution Framework.
The Intelligent Operations framework consists of three layers: consulting services, vertical services, and IT platform services.

TABLE 1. Descriptions of Vertical Services of Intelligent Operations
Hitachi is expediting the provision of solutions to 11 different industry sectors.

	Vertical service	Description
(1)	Intelligent Operations for Energy	Promotion of energy efficiency, adoption of renewable energy, implementation of smart grids that balance supply and demand for electric power
(2)	Intelligent Operations for Mobility	Provision of services for citywide optimization of transportation, including railways and automobiles
(3)	Intelligent Operations for Mining	Productivity improvement through more sophisticated operational management of mining equipment and more efficient maintenance
(4)	Intelligent Operations for Finance	Provision of finance in ways that are tailored to each stage in the customer's business or life, more efficient funds distribution including corporate currencies (redeemable points or similar)
(5)	Intelligent Operations for Retail	Demand prediction and support for product strategy and development, taking account of the greater diversity and shorter lifecycles of products
(6)	Intelligent Operations for Manufacturing	Total support encompassing product installation, operation, and maintenance with a direct link between customers, sites where the product is used, production lines, and developers
(7)	Intelligent Operations for Logistics	Provision of IT services that support management strategies while boosting supply chain efficiency, taking account of factors such as growing demand in emerging economies and the offshoring of production facilities
(8)	Intelligent Operations for Healthcare	Highly secure collection of data held by healthcare providers and its use for analysis to provide services to insurers or pharmaceutical companies
(9)	Intelligent Operations for Agriculture	Amid concerns about crop failure and food shortages caused by population increase or abnormal weather, this service seeks to stabilize prices and improve distribution efficiency by making agricultural production more reliable and transforming agriculture into a "senary industry" (a term used in Japan to refer to the added-value production and distribution of agricultural goods).
(10)	Intelligent Operations for Community	Provision of programs that contribute to health promotion for the elderly to help create living environments that are suitable for an aging population
(11)	Intelligent Operations for Facilities	The use of advanced sensing technology and big data to improve the safety of aging social infrastructure, and to minimize its maintenance and refurbishment costs

Vertical services utilize information on people's activities, equipment operation, and the environment in each industry sector to make improvements in areas such as efficiency and service level. Table 1 lists the 11 industry-specific services that Hitachi offers. These are, (1) energy services, including use of renewable energy and optimization of electric power networks, (2) mobility services for optimizing transportation across an entire city, (3) mining industry services

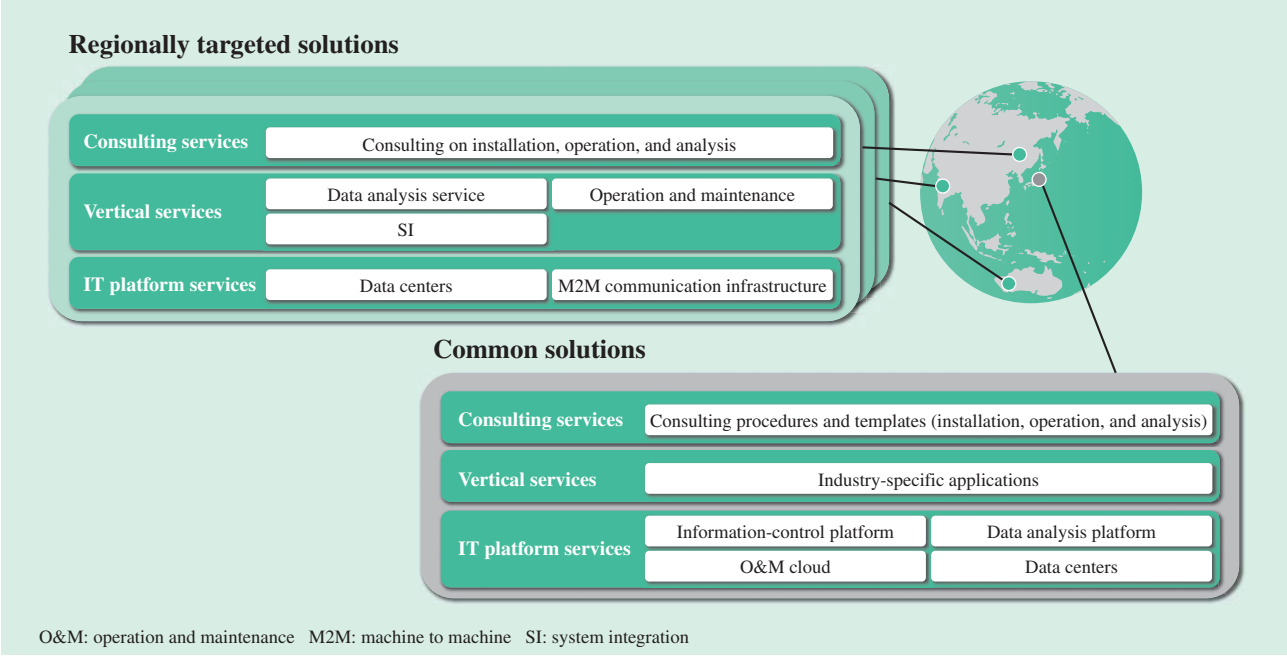

Fig. 3—Global Deployment of Intelligent Operations.
The Intelligent Operations suite offers both regionally targeted and common solutions that are deployed globally.

for improving the efficiency of equipment operation and maintenance, (4) finance industry services for providing finance in ways that suit customer needs and using IT to make the distribution of funds more efficient, (5) retail services for product development and distribution based on demand forecasts, (6) manufacturing services that support products throughout their lifecycle, (7) logistics services that help operate supply chains globally, (8) healthcare services that utilize medical information for purposes such as insurance or drug development, (9) agriculture services for more reliable production and for adding value to crops, (10) community services that promote healthy living for the elderly and others, and (11) services for facilities that improve safety and reduce maintenance costs for social infrastructure equipment.

GLOBAL DEPLOYMENT OF INTELLIGENT OPERATIONS

This section describes the global deployment of Intelligent Operations. Hitachi's aim with Intelligent Operations is the efficient delivery of services that have been tailored to the characteristics of each region. To achieve this, Hitachi is working to establish both regionally targeted solutions that support the creation of services that match the needs of that particular region, and common solutions that raise overall service levels by combining standard products and services of the sort that are required everywhere (see Fig. 3).

Both the regionally targeted solutions and common solutions are made up of three service layers, namely IT platform services, vertical services, and consulting services.

The common IT platforms provided by the common solutions include an information-control platform, data analysis platform, operation and maintenance (O&M) cloud, and data centers. These platforms collect and collate information from equipment used in social infrastructure, and consolidate the information for use in analysis and control[(1)]. The data analysis platform provides standard analysis functions for the searching, analysis, visualization, and optimization of big data archives. The O&M cloud service provides operation and maintenance functions via the cloud[(2)]. The vertical services included in the common solutions provide various industry-specific applications that run on the IT platforms. Hitachi also offers consulting services that include procedures and templates for the installation, operation, and analysis of these applications, IT platforms, and other services.

The regionally targeted solutions are based on the common solutions and localized for particular markets. Data centers, machine to machine (M2M) communication infrastructure, and other IT platforms are provided in a form that suits the particular circumstances of the region. The vertical services

provide system integration (SI), data analysis, and operation and maintenance for specific industries. The consulting services, meanwhile, encompass system installation and operation as well as data analysis, utilizing those services that are also offered as common solutions.

This global deployment of Intelligent Operations will require improvements in the quality of both the regionally targeted solutions and common solutions. Rather than dealing with each solution individually, this will require working through a loop in which the common solutions are revised based on feedback from the different regions and industries, with these changes then being incorporated into the regionally targeted solutions.

To work towards getting Intelligent Operations established globally, Hitachi intends to expedite this loop process by undertaking measures such as proof of concept (PoC) projects in specific industries throughout the world.

CASE STUDIES

This section describes initiatives in the mining, healthcare, and logistics sectors that provide specific examples of the global deployment of Intelligent Operations.

The first example is from the mining industry. With demand for minerals and other natural resources rising throughout the world in response to factors such as rapid growth in emerging economies, there is a need to boost productivity in mining by improving equipment utilization. As mines are often located at remote sites, Hitachi is working on IT systems that will use the cloud to combine equipment information from the mine site with information collected from each step at the factory, and to consolidate this for use as feedback in decision making or control[(3)].

The next example is from the healthcare sector. The rapid rise in the cost of healthcare has become a problem in recent years as a result of the aging populations in developed economies and the growing prevalence of lifestyle diseases due to rising living standards in emerging economies. Like other developed economies, the UK faces the challenge of caring for the continually rising number of people suffering from chronic illness, and also the need to improve quality and reduce costs throughout the healthcare sector. Against this background, Hitachi is building a medical data sharing system specifically for the Greater Manchester region in the UK that is used to share clinical information, including basic patient information, between different healthcare providers, and is demonstrating a system for repurposing this information[(3)].

In the logistics sector, meanwhile, supply chains are becoming increasingly global in response to factors such as the growing demand in emerging economies and the offshoring of production facilities in recent years. China in particular is plagued with inefficiencies despite its large market and rapid growth, with the cost of logistics reaching 17 to 18% of gross domestic product (GDP). In response, Hitachi is working on efficiency and other improvements in transportation equipment and the logistics of parts manufacturers in China. It is also seeking to create IT services with high added-value that support corporate operations by facilitating the collection and collation of data from each link in the supply chain, including procurement, production, transportations, retail, recycling, and disposal[(4)].

CONCLUSIONS

This article has described the global deployment of Hitachi's Intelligent Operations that use IT to accelerate social innovation.

If a better environment is to be provided throughout the world for people to live and conduct business, it is important to be able to deliver both uniform services that are globally standardized and meticulously localized services that take account of regional characteristics and cultural considerations. By providing the consulting services, vertical services, and IT platform services of its regionally targeted solutions and common solutions under the Intelligent Operations framework, Hitachi believes it can contribute to quality improvements in industry-specific systems and greater convenience in all areas of society.

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Featured Articles

The Role of Geospatial Technologies in Social Innovation

Bahadir Gultekin, PhD.
Michihiro Tsuda

OVERVIEW: Location matters to our quality of life, and geospatial technologies such as GIS, and satellite imagery provide us with a valuable capability to analyze and understand the relationship between location and our environment, which the authors see as the essence of Hitachi's social innovation concept. Utilization of geospatial technologies leads to better planning and more efficient implementation of energy distribution; more reliable and environmentally conscious agriculture; and faster and smoother traffic. This article summarizes Hitachi Solutions, Ltd.'s geospatial technologies and various implementations especially in the urban infrastructure sector. These implementations cover asset and facility management in the power and gas distribution sector. Also, agricultural information systems such as field and soil management, fertilizer design, and remote sensing are explained. Finally, the article summarizes efforts towards globalizing Hitachi's geospatial technologies.

INTRODUCTION

HITACHI describes its Social Innovation Business as providing total solutions for sustainable urban development worldwide, with the role of addressing critical global issues such as the need for creating and improving the transportation infrastructure in urban areas, improving access to clean water, developing technologies that promote a smooth and efficient transition to the smart grid while keeping a sharp eye on sustainability objectives and the conservation of our world's supply of precious natural resources[(1)]. Providing total solutions in the urban infrastructure sector is at the heart of this concept because the quality of urban infrastructure is the defining indicator for the quality of life of the citizens in that urban environment. Utilization of geospatial technologies based on geographical information systems (GIS) provides a unique key to the overall scheme of social innovation. They provide a location-based common platform where all social innovation technologies can be gathered, analyzed, and displayed in a visual and easy-to-comprehend manner on maps, or on satellite images. This article summarizes Hitachi's geospatial technologies and implementations, especially in the urban infrastructure sector. These implementations cover asset and facility management in the power, gas, and water distribution sector. The usage of geospatial technologies in these sectors are explained, together with how they help clients to regulate their business processes for higher efficiency and cost effectiveness. Moreover, agricultural information systems such as field and soil management, fertilizer design, remote sensing, and traceability are explained.

The final section summarizes efforts being made to globalize our geospatial technologies.

GEOSPATIAL TECHNOLOGIES

There are various descriptions and definitions of geospatial technologies in the literature and Internet. Geospatial technologies have three components, the first of which is GIS. The Geospatial Information Authority of Japan (Ministry of Land, Infrastructure, Transport and Tourism) has a very comprehensive definition for this technology: "GIS is a technology that supports the integrated management and processing, visual display, sophisticated analysis, and rapid evaluation of data containing location-dependent information (spatial data) based on geographic position."[(2)] The second component is the tools to provide the data for this technology, such as satellite images, maps, and global positioning systems (GPS). The third and final component is the applications that are developed on these two components, and which show interrelations between data in the location dimension that would not be evident if the data were managed in traditional formats, such as

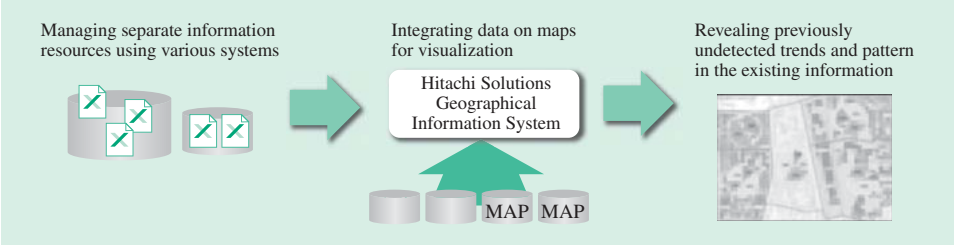

Fig. 1—Visualization of Interrelation between Data. Geospatial technologies allow users to detect trends and patterns in the data, which are difficult to detect when using traditional management methods.

alphabetically, in arbitrary groups, or in ledger format (see Fig. 1). Some examples of these applications are facility/asset management systems, energy and/or water distribution network models, and agriculture information management systems. It is possible to increase the number of these applications, but this article will focus on these ones, only.

UTILIZATION OF GEOSPATIAL TECHNOLOGIES IN URBAN INFRASTRUCTURE SECTOR

Facility/Asset Management in Power Distribution

The biggest investment of power distribution companies is in their assets. The biggest challenge faced by power distribution companies is to increase the stability and quality of electric power while decreasing operational costs. They need to accomplish this task despite the ongoing depreciation of their assets because of asset aging. This is only possible if they can establish an efficient equipment repair cycle and furthermore an effective maintenance cycle that will prevent accidents and failures before they occur. This is only possible if they can capture real field information related to asset condition (see Fig. 2).

The following is made possible by utilizing the geospatial technologies for facility management.

- As the locations of the assets are known, it is possible to create a hierarchical data model. For example, a power pole can be the origin asset, and the insulators or other equipment on the pole can be related to this pole (parent-child relationship).
- It is possible to create a network structure as the locations and hierarchy of assets in the grid are already known. In this way it is possible to estimate the area affected by a failure or accident by tracing it along the distribution network (upstream for the source of trouble or downstream for the affected area).
- It is also possible to use various spatial analyses, such as area analysis and failure/cause and effect analysis, to define and estimate the possible risk areas and to identify areas and assets that have high priority for maintenance.

As can be seen from the system image in Fig. 2, it is also possible to use mobile technologies with GPS capabilities. The system can be used for customer support, accident support, and task checking by exchanging information between staff managers and field workers. This leads to better customer service through the quick and accurate response to customer complaints or accidents using mobile technology. Also, it improves efficiency in the field by viewing

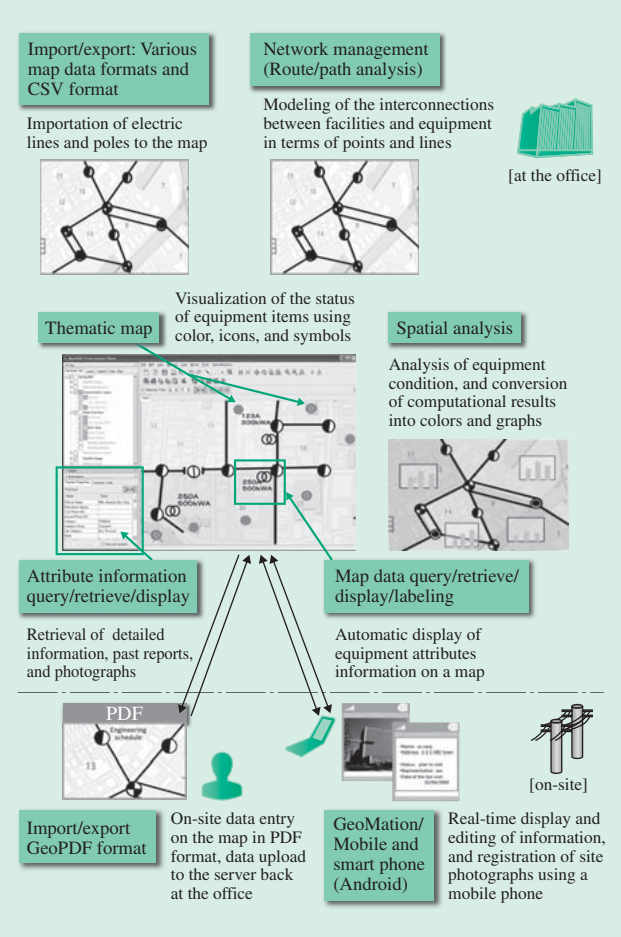

Fig. 2—Image of Facility/Asset Management System for Power Distribution Sector.
Geospatial technologies allow the user to manage their assets at the enterprise level.

detail information on the current staff and status of utilities from mobile phones or tablets.

The facility/asset management system can also be used for gas utility companies, and our dedicated software application is currently running in more than 12 gas utility companies.

Agricultural Information Management System

Hitachi Solutions has been developing and enhancing its agricultural solutions since 2004, and these have been adopted by approximately 50 agricultural cooperatives and other organizations, mainly in Japan.

The same principle applies in the agriculture sector as in other sectors. Farmers have to increase their efficiency while decreasing their operating costs. However, there is another dimension in agriculture which is the environmental burden that fertilizers impose on farming fields. This agricultural information management system provides various tools not only to estimate the best harvest time, operate the agricultural machinery efficiently, and optimize the farming work, but also to generate solutions and/or advice for farmers on how to use fertilizers or agricultural chemicals. This leads to more efficient farm practice as well as less burden on the environment (see Fig. 3)[3].

Also, when it comes to agricultural practices, another very important aspect is the safety and security of the food. Registering and recording all fertilizers and chemicals used in the field makes it possible for third parties to audit these records for the safety and reliability of the crop and the food.

Although this system provides a wide range of GIS tools for more efficient and environmentally conscious agricultural practices, there is another aspect that the authors would like to emphasize in this chapter: the utilization of satellite imagery.

Hitachi Solutions has been providing DigitalGlobe* satellite imagery, which provides the world's highest resolution commercial satellite images, to Japanese and Asian customers since 2001. For this reason, Hitachi has accumulated a depth of know-how relating to satellite imagery and its use in different fields and sectors. Applying this know-how to the agriculture sector yielded an important application: planning the harvesting sequence of wheat. The harvest time for wheat depends on its dryness. Traditionally, the dryness level is decided manually at the time of harvest by the farmers. However, there can be differences in wheat dryness even within the same field, and this usually leads to harvesting some of the wheat before it is dry enough, which means a lower quality crop. By using the satellite image analysis function of the agricultural information system to analyze wheat

* DigitalGlobe is a registered trademark of DigitalGlobe.

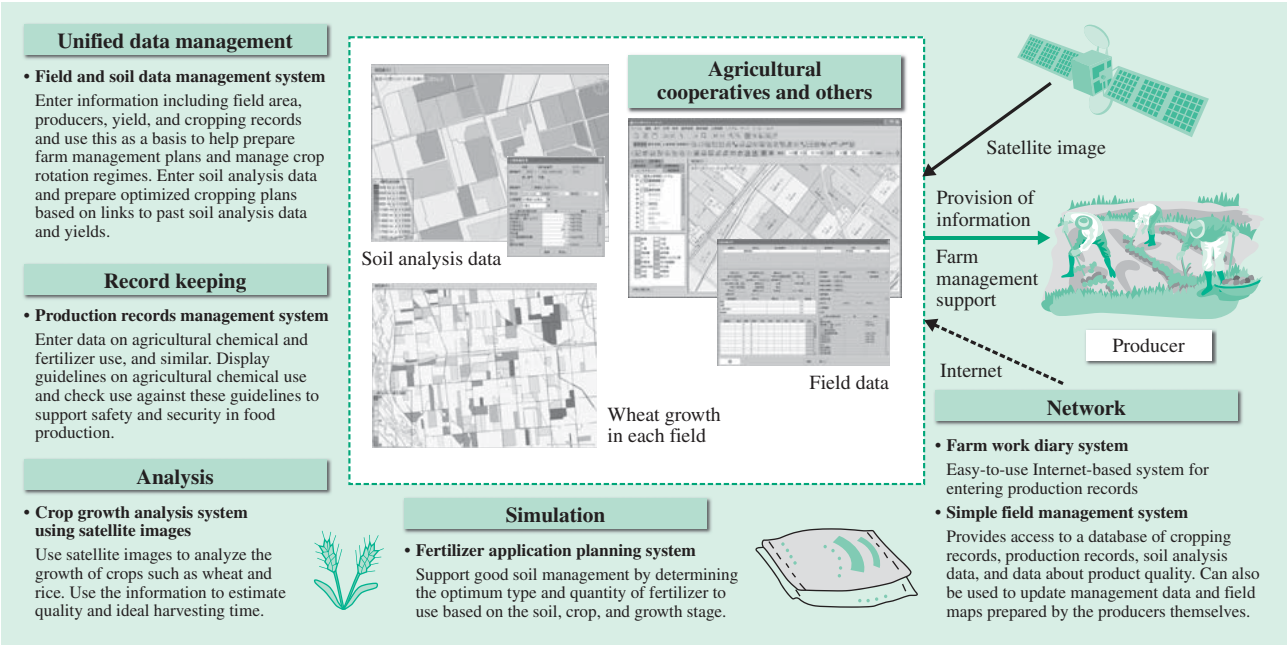

Fig. 3—Overview of Agricultural Information Management System.
Hitachi Solutions, Ltd.'s agricultural information management system was developed on geospatial technology (GIS and satellite imagery). It has been developed according to user needs to overlay a wide range of different information and provide various analysis tools to create a more efficient and environmentally conscious agriculture business.

fields and ascertain the growth in each field so that harvesting can be performed in the order in which each field dries out, great reductions were made in fuel oil use for drying. This also cut CO_2 emissions dramatically and helped to avoid quality loss as less chemicals were used to dry the wheat[3].

This application provides a very good example of social innovation utilizing geospatial technologies in the farming and agriculture sector.

GLOBALIZATION OF GEOSPATIAL TECHNOLOGIES

The geospatial technologies and their applications in the urban infrastructure and agriculture sectors are suitable for expansion in the global market, especially in emerging countries such as Brazil, Russia, India, and China (BRICs), Turkey, Vietnam, etc. In these countries the necessary infrastructure investments have already been made. However, there is a need for efficient and cost effective management systems for these existing investments. For this reason, Hitachi Solutions has been trying to promote its geospatial solutions in those countries for the last three to four years in collaboration with other Hitachi group companies, and has been getting some promising results. As mentioned in the previous chapters, geospatial technologies provide a common platform for social innovation. There is another article in this issue about probe data and its use in solving traffic problems in Hanoi, Vietnam and Istanbul, Turkey in which our geospatial technologies were used. Hitachi Solutions is also working on projects related to the power transmission and distribution sector in countries like India, Turkey, and Russia through local partners; agricultural information solutions in the BRICs, and disaster management systems in South East Asian countries like Vietnam in collaboration with Hitachi group companies. Hitachi Solutions is dedicated to promoting its know-how and expertise in geospatial technologies more and more, and will contribute to Hitachi's social innovation concept.

CONCLUSIONS

In an article back in 2009, one of the authors, Bahadir Gultekin, mentioned that there are two hurdles for Hitachi group companies in the global market that result from its being a traditional and large company. The first is adaption to different cultures and business habits, the second is flexibility and speed of reaction to changes in the global context. Now, in 2014, he believes that Hitachi has recognized these hurdles and is making great efforts towards solving these problems by introducing its social innovation concept whereby Hitachi becomes a total solution provider and can realize its true power[4].

Hitachi Solutions will continue to develop and adapt its geospatial technologies to the needs of the global market as it has been doing for the last 25 years. Its target is to become a leading solution provider in geospatial technologies in the global market in collaboration with other Hitachi group companies.

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Featured Articles

Expanding Global Big Data Solutions with Innovative Analytics

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OVERVIEW: Through the proliferation of sensors, smart machines, and instrumentation, industrial operations are generating ever increasing volumes of data of many different types. At the same time, advances in computing, storage, communications, and big data technologies are making it possible to store, process, and analyze enormous volumes of data at scale and at speed. The convergence of OT and IT, powered by innovative analytics, holds the promise of creating new social innovation businesses. Hitachi's R&D Group has established the Global Big Data Innovation Lab (GBDIL) to coordinate world-wide analytics research activities in support of the global expansion of the social innovation solution businesses by providing innovative analytics to the recently launched Hitachi Global Center for Innovative Analytics (HGC-IA). This article introduces GBDIL and HGC-IA, and describes a common reference architecture for developing, deploying, and operating big data solutions that leverage Hitachi's innovative analytics technologies. Through the use of example use cases, the article explains the strategy to expand the global big data solution business.

MARKET AND TECHNOLOGY TRENDS

TODAY, we are at the dawn of transformative changes across industries, from agriculture to manufacturing, from mining to energy production, from healthcare to transportation. These transformations hold the promise of making our economic production more efficient, cost effective, and, most importantly, sustainable. These transformations are being driven by the convergence of the global industrial system [operations technology (OT)] with the power of integrating advanced computing, analytics, low-cost sensing, and new levels of connectivity [information technology (IT)].

Through the increasing use of interconnected sensors and smart machines and the proliferation of social media and other open data, industrial operations and physical systems produce a continuous stream of sensor data, event data, and contextual data. This unprecedented amount of rich data needs to be stored, managed, analyzed, and acted upon for sustainable operations of these systems. Big data technologies, driven by innovative analytics, are the key to creating novel solutions for these systems that achieve better outcomes at lower cost, substantial savings in fuel and energy, and better performing and longer-lived physical assets.

Opportunities to create big data solutions abound in many industries (power distribution, oil and gas exploration and production, transportation, telecommunications, healthcare, agriculture, and mining, to name a few) and in the public sector (homeland security, smart cities, population health management, etc.). To realize operational efficiencies and to create new revenue-generating lines of business from the deluge of data requires the convergence of IT × OT by leveraging an analytics framework to translate data-driven insights from a multitude of sources into actionable insights delivered at the speed of the business. To achieve this, innovations in analytics will be required: first, to deal with the vast volumes, variety, and velocity of data; and second, to create increasing value by moving from descriptive or historical analytics (what has happened and why?) to predictive analytics (what is likely to happen and when?), and finally to prescriptive analytics (what is best course of action to take next?) (see Fig. 1).

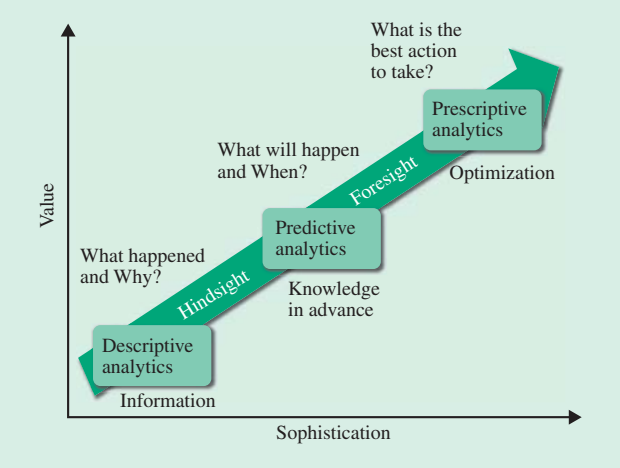


Fig. 1—Evolution of Analytics Sophistication. Analytics is evolving in both sophistication and value from "descriptive analytics" to "predictive analytics" to "prescriptive analytics." Descriptive analytics helps describe the current state, predictive analytics attempts to predict what might happen next, and finally, prescriptive analytics aims to automatically suggest the best action to take.

HITACHI'S RESPONSE TO MARKET AND TECHNOLOGY TRENDS

Through its strengths in IT and OT, Hitachi is uniquely positioned to lead this transformation by developing Social Innovation Business in the global market.

Hitachi has taken a lead in addressing these opportunities by establishing the Hitachi Global Center for Innovative Analytics (HGC-IA). The HGC-IA was launched in June 2013 to provide customers globally with innovative solutions that leverage the power of big data by linking Hitachi operating units with researchers and engineers located in the U.S., Europe, Japan, and other regions around the globe. "The HGC-IA will provide opportunities for Hitachi to co-innovate with customers and partners to create value through advanced data analytics, developing solutions to meet customers' challenges in areas such as sales, productivity, and cost. Vertical solutions are being developed across several industries, including: Health Care, Communications & Media, Energy, Transport, Mining, as well as enterprise fields such as logistics, manufacturing, and business intelligence for opportunities to deploy Hitachi technologies." [(1)] The Global Big Data Innovation Lab, which serves as the R&D arm of the HGC-IA, harnesses the expertise and inventive power of over 300 researchers worldwide to deliver cutting-edge analytics technologies to the customer solutions being developed by the HGC-IA. Uniquely, in a single global structure, Hitachi has solution stacks, data scientists, architects, and consultants who build the right big data analytics solutions to reinvent the way global business operates.

Aided by these new organizations, a key element of Hitachi's strategy is to create repeatable, high-value, industry-specific solutions that are developed over a common solution framework, and are delivered as appliances, packaged applications, or cloud services. By building on a common framework, Hitachi can develop repeatable industry solutions quickly and efficiently. This strategy leverages Hitachi's assets and deep expertise in social infrastructure, IT, and solutions.

COMMON SOLUTION FRAMEWORK

Early adopters of industrial automated control systems deployed custom-built analytics applications implemented over a siloed architecture. However, this approach has several drawbacks: it is expensive and resource intensive; it is inefficient since every application needs to be built from scratch; it makes it challenging to scale and to deal with new functionality, new data types, and new quality-of-service requirements; and finally it is incomplete – most good application designers are not domain experts and are unfamiliar with the analytics needed over sensor and event data, and not that many domain analysts are familiar with application design.

Instead, the market demands a solution framework for repeatable, scalable solutions that cater particularly to the needs of analytics over operational data obtained from physical systems and other data sources such as social media. This framework must also abstract the underlying complexities of provisioning such a system for application architects while supporting different deployment models: centralized, core-edge, and in the cloud. Such a framework will make it easier to build prototypes for customers by reusing components, make it more efficient for system integrators to deploy the solutions in the customer environment, and enable the efficient development of "analytics-in-a-box" solutions for various verticals.

Our solution framework is based on years of experience building IT × OT solutions for a variety of vertical industries. In designing the framework, Hitachi has identified the following requirements: (i) ability to ingest, process, manage, and analyze both streaming data and large volumes of stored data; (ii) ability to process both time series and event data; (iii) ability to process both structured and unstructured data; (iv) ability to process data within the enterprise

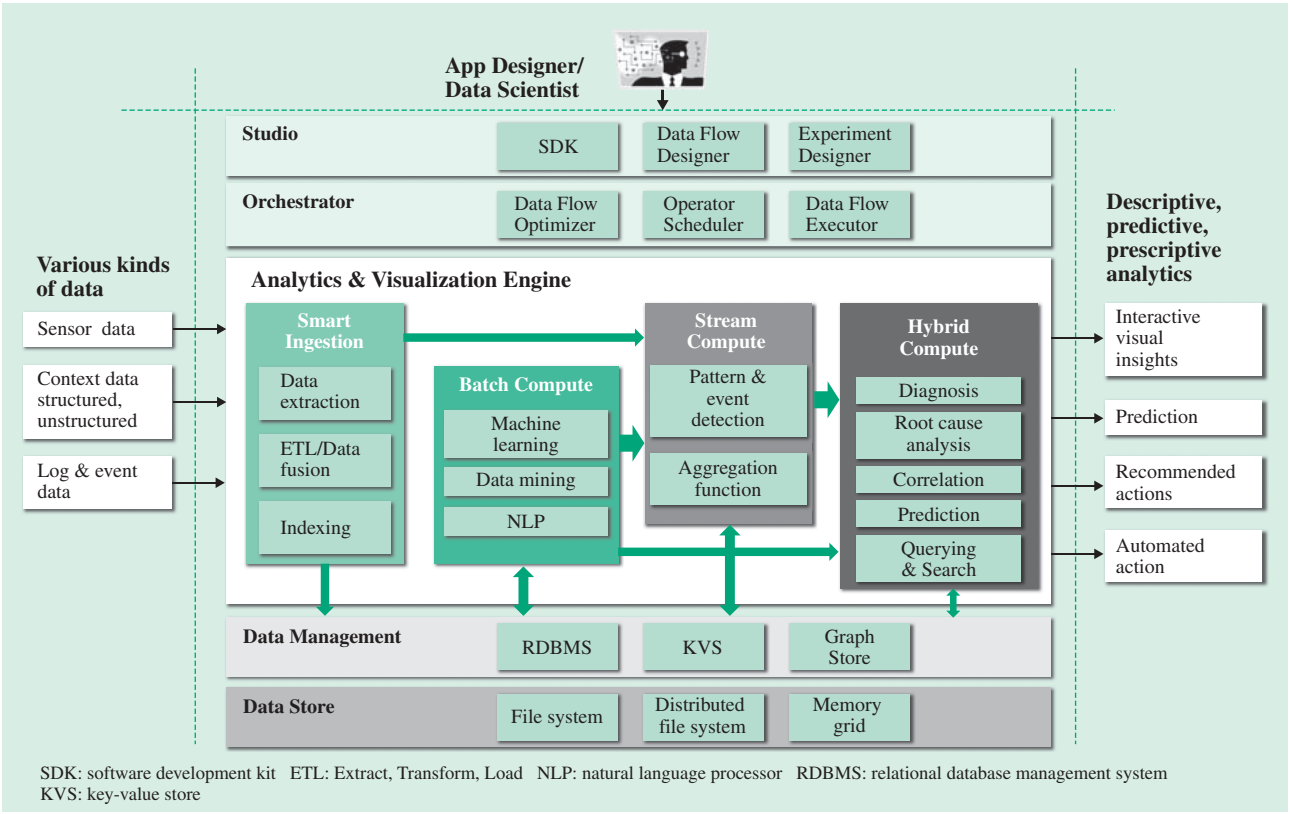
and outside the enterprise; and (v) ability to be deployed in the cloud and on-premise.

Because the framework needs to satisfy a variety of data processing and analytic needs, it will require a small number of data processing engines with different capabilities; plug-and-play capability to interchange engines; and the ability to create, optimize, and execute tasks that run over a combination of the engines. Appropriately defining the components and interfaces of this framework ensures that it can be used to develop and deploy solutions for a variety of industries.

The outputs of our data management and analytics framework over these various kinds of data should be interactive visual insights, predictions, and recommended manual or automated actions.

Fig. 2 shows the reference architecture of such a framework. The architecture consists of:

- Connectors to various data sources.
- An ingestion layer to prepare data for analytics processing and for storing the data.
- A data store layer, which provides different engines for storing data to be used for historical analysis.
- A data management layer, which provides different engines for managing and processing data of different types.
- A stream processing core for streaming analytics such as pattern and event detection and streaming on-line analytics processing.
- A batch processing layer for analytics over historical data, including machine learning, data mining, and natural language processing methods.
- A hybrid computation layer for analytics over combinations of streaming and stored data.
- A visualization, presentation, and automation layer for output in terms of interactive insights and automated actions.
- A development studio, which includes an Analytics Workbench for designing complex analytic data flows and experiments, and a repository of common analytics operations that can be reused in many applications.
- An orchestration layer, which includes an optimizer for analytics data flows, a scheduler, and an execution manager for managing the execution of analytics data flows on multiple execution engines. The framework allows for solutions that can run on a single node and on a large cluster.



SDK: software development kit ETL: Extract, Transform, Load NLP: natural language processor RDBMS: relational database management system
KVS: key-value store

Fig. 2—Common Reference Architecture.
Hitachi's common reference architecture aims to support the development and deployment of big data solutions across verticals. It consists of components for ingesting, storing, managing, analyzing, and visualizing big data over a single node or a cluster.

CURRENT ACTIVITIES

Besides architecting the common framework, HGC-IA and the Global Big Data Innovation Lab are involved in several proof of concept (PoC) activities. This includes being actively engaged in creating customer solutions for the communications, mining, shale oil and gas, healthcare, and other industries, with the goal of improving the efficiency and reliability of operations in these industries. The following sections describe two representative examples.

Oil & Gas Industry Solution

Industry experts recognize that technological advances in the development of energy sources such as shale gas, oil sands, and deep water resources have the potential to transform global energy markets. In particular, shale gas has a critical role to play in supplying future energy needs. Advances in horizontal directional drilling and hydraulic fracturing technologies have unlocked the potential for recovering enough natural gas from shale to power the US economy for a century. However, the problem of maximizing output from a shale gas reservoir is not well understood. This makes production decisions and sizing top-side facilities difficult. Furthermore, operators often struggle with realtime performance of support for down-hole gauges, semi-submersible pumps, and other equipment. Non-productive time may constitute over 30% of the cost of drilling operations. Descriptive, predictive, and prescriptive analytics applied to addressing these problems could have a profound impact on the production cost, efficiency, and environmental impact.

In keeping with an objective of making repeatable solutions, Hitachi is aiming to build a solution for this industry. Fig. 3 presents a schematic of this solution.

To strengthen the vision and execution of Hitachi's interests in the oil and gas technology domain, the US Big Data Lab has established collaboration with the Energy & Environmental Research Center (EERC) at the University of North Dakota. The EERC is a contract research organization that focuses on energy and related environmental issues. Hitachi and EERC have prioritized the research focus to solve the hard problems operators face today in developing the Bakken Field for sustained operations across the processes.

The Bakken Production Optimization program has two primary goals:

(1) Optimizing well productivity by better understanding the underlying Bakken field geology and its response to different wellbore trajectories and completion techniques.

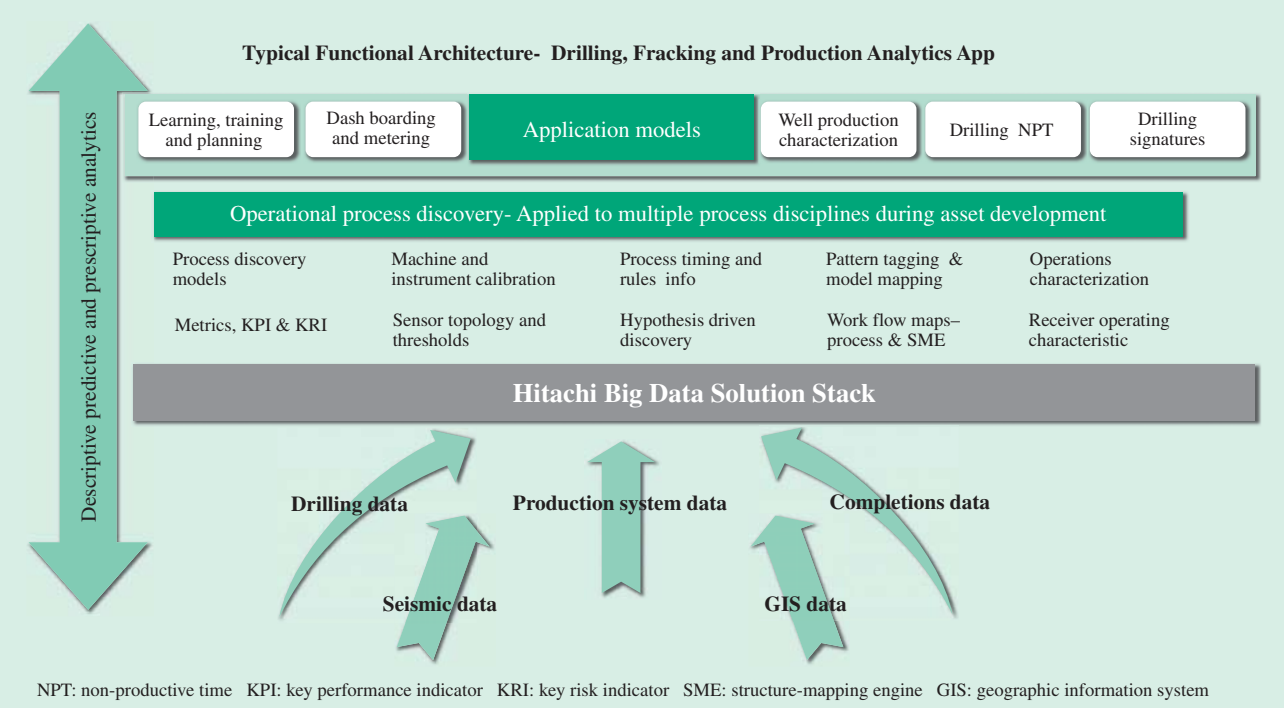


Fig. 3—Schematic of an Oil & Gas Solution.
The upstream oil and gas industry solution processes several kinds of data, including geology, drilling, production, and operations data. The data is managed and analyzed through Hitachi's big data solution stack and is combined with domain specific knowledge to build several oil and gas industry specific applications such as well production characterization and reduction of non-productive time.

(2) Improving drilling efficiency and reducing the surface impact of drilling by potentially using water and gas generated at the well site, as well as other techniques.

To meet the above goals, our solution will derive insights from a vast amount of data collected and stored as a "system of record" today. These insights will help transform the orthodox approach of deploying systems of record to deploying "systems of engagement" to reduce the cost of operations, and to improve the productivity, reliability, and sustainability of operations (see Fig. 4).

Fig. 4—Production Characterization Application.
The dashboard for the production characterization application displays the complex, non-intuitive interrelationships between geology, completions, production, and operations data.

Healthcare Industry Solution

Companies operating in the healthcare industry today are dealing with the significant challenge of providing services and systems that improve the quality of medical care for populations in the face of rising medical care costs, often associated with the additional dimension of an aging society. To tackle this problem, Hitachi established the European Big Data Laboratory (EBDL) within the University of Manchester Innovation Centre (UMIC) to develop and deliver Proof of Concept (PoC) projects for the conurbation of Greater Manchester, UK, working closely with the National Health Service (NHS) England partners in Salford, Central and South Manchester.

The PoC projects are being undertaken by EBDL together with NHS in Greater Manchester (NHS England in GM), North West e-Health (NWeH) and the Manchester Academic Health Science Centre (MAHSC), with the aim of achieving an increased quality of life while containing medical costs by making full use of IT and big data. Specifically, the projects involve the development and verification of a secure healthcare data integrated (federated) platform and a life-style improvement program for pre-diabetics.

Fig. 5 shows the overview of the secure healthcare data integrated platform and key technologies. This platform would enable a variety of healthcare services to securely and appropriately share patient

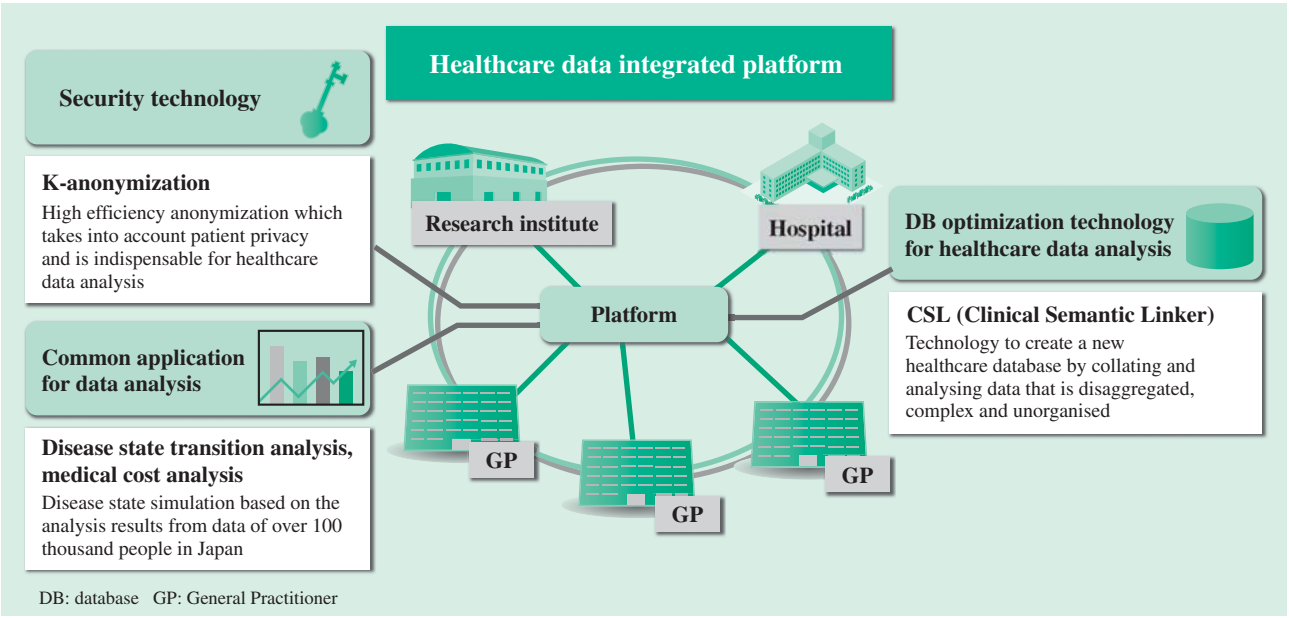


Fig. 5—UK Healthcare Integrated Platform.
Federated data platform to facilitate the sharing of medical information in order to enable secure analytics technologies to deliver new high quality healthcare services across primary, secondary and social care.

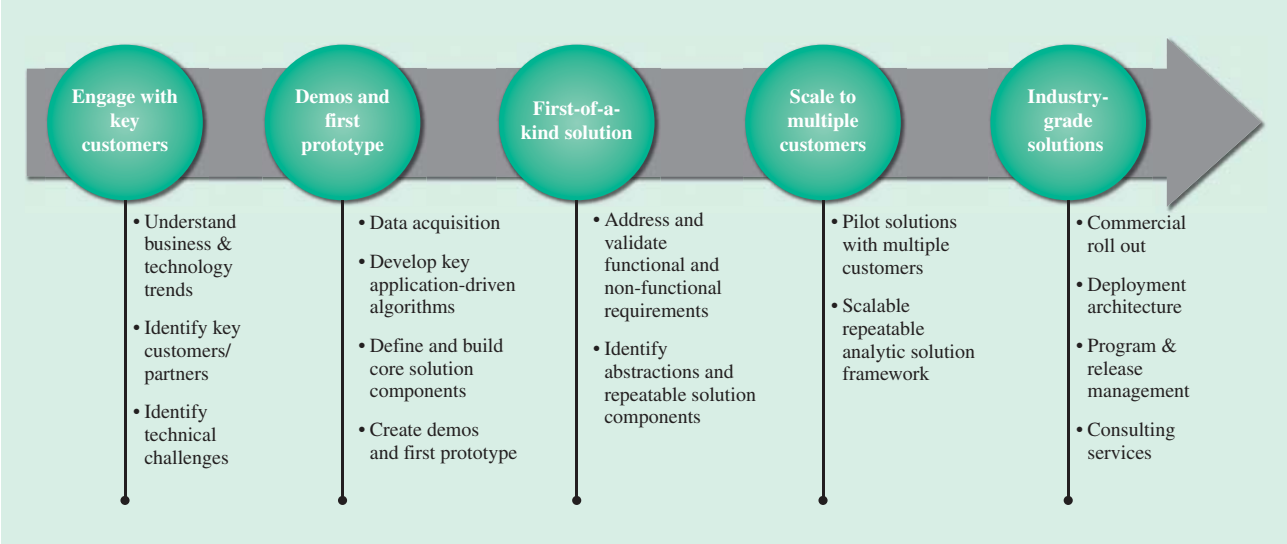


Fig. 6—Solution Methodology.
The stages of our solution methodology consist of engaging key customers in a specific vertical, building a first demo/prototype, testing and validating the first prototype, scaling to multiple customers, and finally commercially rolling out as an industry grade solution.

data to better inform the delivery and development of services. The platform has three primary goals:
(1) Expanding the coverage of secure data-sharing from 0.25 million people in Salford to 2.87 million people across Greater Manchester.
(2) Developing innovative IT systems to tackle the new challenges of increasing complexity in security and, information governance whilst promoting the data analysis that will support service development and assurance, while keeping patient data privacy paramount.
(3) Creating new services that improve patient outcomes reduce variation in treatment, making high quality services available to larger populations and allowing the secure sharing of information between all of the organizations and institutions involved in health and wellness, helping to keep patients healthy for longer.

Based on the results from these initial PoC projects, there are plans for taking the knowledge learned and products and services developed to expand Hitachi's healthcare business to other regions within the U.K., followed by markets in other commonwealth states, North America, Japan and Europe.

CONCLUSIONS AND FUTURE ACTIVITIES

Hitachi will continue to work with its partners to build out big data platforms, analytics services, and solutions with the objective of establishing its position as a top-tier player in the IT × OT convergence space.

Fig. 6 shows the process Hitachi is using for moving beyond the PoC stage to select customer deployments, and then to full roll out of industry solutions.

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Yoshikazu Tsuda
Takashi Hayashi

OVERVIEW: As the operations of Japanese multinational companies become increasingly global, Hitachi is seeking to assist their activities by strengthening its total IT support structure, which encompasses not only system implementation but also the fulfillment of maintenance or operation needs. Hitachi is also developing service solutions that utilize a variety of advanced technologies to bring social innovation to different parts of the world.

INTRODUCTION

WITH economic activity extending internationally, Japanese multinational companies need to operate at a global level.

Against this background, Hitachi is strengthening its total information technology (IT) support structure at a global level to keep pace with the expansion of global business by Japanese multinational companies in particular.

This article describes what Hitachi is doing at a global level with regard to its IT support structure, and its enterprise solution for enterprise resource planning (ERP) and the automotive industry.

EXPANSION OF GLOBAL IT SUPPORT STRUCTURE

Hitachi has been working with its overseas group companies and locally based vendor partners to support Japanese companies of manufacturing/distribution industry, which have been going through an accelerating process of globalization. Factors such as the expansion of support to cover more regions and the increasing diversity of regional requirements have created a need for more comprehensive local support.

A global support structure has been established utilizing the offices, staff, and other resources of Hitachi Consulting Corporation, which supplies consulting, implementation, and managed services globally. For example, Hitachi has experience with companies of precision manufacturing industry and with global ERP projects that utilize products such as Oracle[*1] or SAP[*2], and is actively involved in supplying these services to the increasingly global pharmaceutical industry.

Hitachi supplies total IT support at a global level that includes not only system implementation but also subsequent support and other maintenance or operation needs.

In particular, Hitachi has established a global delivery structure that utilizes resources such as its Global Delivery Center in India and China Delivery Center in China for reasons that include cost and the availability of high-quality IT staff. This allows the provision of total services that extend from consulting to design, implementation, and maintenance, with services to customers being handled through area support points close to where they are located, and activities such as operational level manufacturing and maintenance being handled by the delivery centers in India and China. Also, each area support point is appropriately staffed with people able to speak Japanese.

In the future, Hitachi intends to meet the diverse globalization needs of Japanese multinational companies by strengthening and expanding its IT support structure at a global level (see Fig. 1).

USE OF ADVANCED ERP TECHNOLOGY TO SUPPORT JAPANESE MULTINATIONAL COMPANIES

Japanese multinational companies have a growing need for system integration aimed at things like pursuing

*1 Oracle is a registered trademark of Oracle and/or its affiliates.
*2 SAP and SAP HANA are the trademarks or registered trademarks of SAP AG in Germany and in several other countries.

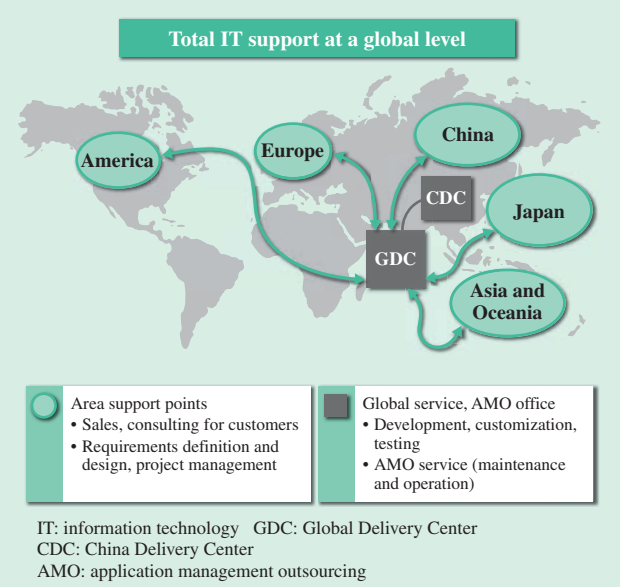

Fig. 1—Overview of Total IT Support at Global Level. Hitachi supplies total IT support at a global level by utilizing the global resources of its group companies.

global business, strengthening their governance, and improving the efficiency of IT resources. Facing the same challenges, Hitachi has been deploying its global financial accounting system throughout the world to its group companies with systems based on SAP solutions since 2006, including system maintenance and operations (as of January 2014, the system had been installed at 382 companies in 33 different countries).

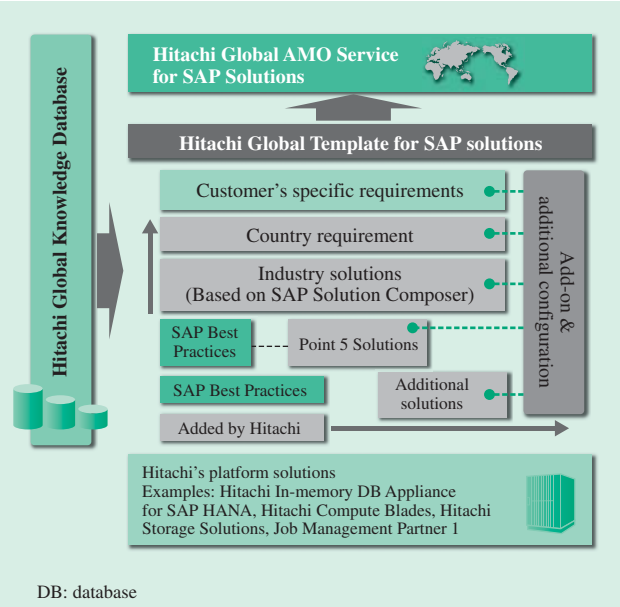

Fig. 2—Hitachi's One-stop Global Solution for SAP. Hitachi supplies a one-stop global solution for SAP.

The following section describes an enterprise solution for Japanese multinational companies based around ERP that is based on the knowledge of global system deployment that Hitachi has gained from this work.

Hitachi Global Solution for SAP

Hitachi offers its Hitachi Global Solution for SAP as a solution that combines the functions needed for global system deployment. The solution is built around three core elements. These are the Hitachi Global Template for SAP solutions, which is based on SAP Best Practices and includes enhancements by Hitachi to the functions required for the global operations of Japanese multinational companies; the Hitachi Global Knowledge Database, which systematically collects and collates know-how from implementations in different countries drawn from sources such as experience of projects at numerous customers or core system deployment at Hitachi; and the Hitachi Global AMO[*3] Service for SAP Solutions, which deals with global operation and maintenance (see Fig. 2).

Keeping Pace with Latest SAP Technology

Hitachi also provides powerful support for the globalization of its customers on the hardware front by supplying the Hitachi In-memory Database (DB) Appliance for SAP HANA[*2] throughout the world through Hitachi Data Systems Corporation. This product is an appliance machine that supports SAP HANA, the latest technology for SAP systems. Having led its competitors by utilizing SAP HANA as the database for Hitachi Global Template for SAP solutions, Hitachi is contributing to new innovation by its customers by making it possible for them to process ever increasing of data in realtime.

Realizing Global Operations

For the globalization of increasingly complex business operations, the Hitachi Global AMO Service for SAP Solutions delivers operation and maintenance services to customers based on know-how obtained by Hitachi through the operation and maintenance of systems at its group companies (at 102 sites across 31 countries, as of 2013).

Through its global-level partnership with SAP AG, Hitachi intends to deploy solutions that combine its own technologies with those of SAP, globally and across a wide range of industries.

*3 Application management outsourcing: Outsourcing of business system management to a specialist vendor.

GLOBAL SERVICES FOR AUTOMOTIVE INDUSTRY

A global response is seen as being essential in the automotive industry where competition takes place on a worldwide scale. The following sections describe new global services being planned by Hitachi that are based on its past experience and knowledge.

Existing Global Business Model

Hitachi has already been supporting the globalization of the automotive industry through its past activities, which include the supply of (1) car parts, (2) on-board devices, and (3) information and telecommunication services for vehicles. These activities include solution services for enterprises, as described in the following section.

(a) Global telematics service (Japan, USA, Europe, Australia)

Services that add value to information services for drivers by connecting IT centers to on-board devices such as car navigation systems and telematics control units (TCUs) that transmit vehicle control data.

(b) Map update service for car navigation (Japan, North America, Europe, Australia, Gulf states, South Africa, China)

This service produces maps for car navigation. Hitachi developed an incremental map update technology in 2008 and provides map updating through a center-based service.

(c) Car navigation application for Android[*4] (Japan, North America, Europe[*5])

(d) Fleet management service (Japan)

Vehicle tracking, safe driving support, and vehicle dispatch and management are provided through an Android car navigation application linked to a center-based service.

Future Global Business Model

In the future, Hitachi intends to develop businesses that provide enterprise solutions to the automotive industry by utilizing advanced technologies in which Hitachi has particular expertise, namely technologies for car navigation map authoring and compilation, analysis and processing of location information (probe data), and analysis and processing of vehicle control data.

Specifically, Hitachi is proceeding with the global deployment of the following two businesses that utilize these technologies.

*4 Android is a trademark of Google Inc.
*5 Scheduled to be fully available in North America and Europe in December 2014.

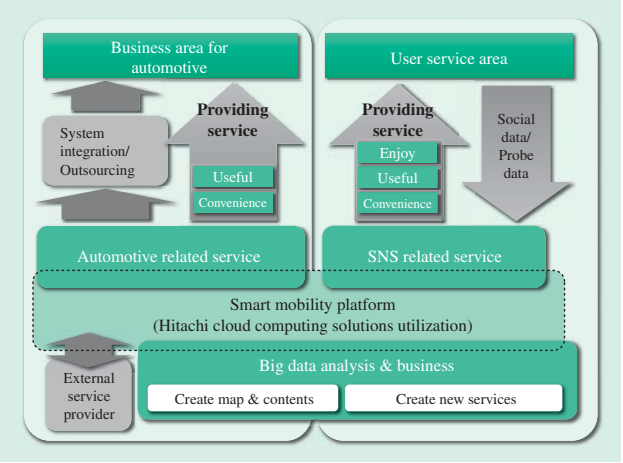

Fig. 3—Overview of Smart Mobility Service.
Hitachi is constructing and supplying a new service system that combines and builds on existing technologies in the form of a smart mobility service.

The first is the supply of a smart mobility service that acts as a platform for assisting the analysis and processing of location information, not only by the automotive industry, but also by many other corporations. This will involve the construction and supply of a new service system that combines and builds on existing technologies.

The second is a center-based service business that provides technologies and services required by automated driving systems.

Smart Mobility Service

Fig. 3 shows an overview of the smart mobility service. It will initially be rolled out in Japan, North America, and Europe. This center-based service utilizes social networking services (SNSs) to learn about the different traffic regulations and road characteristics in each country, and uses this to collect, analyze, and disseminate content based on realtime location information. Various application services will be provided through social map and "driving characteristics/vehicle condition" businesses described below.

(1) Social map

This utilizes information such as changes in location data collected in realtime, context data provided to an SNS, and image data collected from vehicle-mounted cameras to generate map data and map content for distribution to vehicles.

(2) Driving characteristics/vehicle condition

This uses information such as vehicle control data, sensor data, and image data from vehicles to analyze vehicle behavior and direction, and then uses this as

the basis for evaluating the driving characteristics of the driver and the vehicle condition.

Fig. 4 shows the technology roadmap for the smart mobility service. As this is a service that can obtain added value from global support, Hitachi has planned from the beginning to deploy the service globally.

Automated Driving Support

2013 was the year in which the automotive industry set out on the road toward practical automated driving. In response, Hitachi has been working on research and development aimed at producing local dynamic maps (LDMs). In expectation of future integration with center-based LDM services, Hitachi will utilize its social map technology to support automated driving vehicles from the standpoint of maps and map content.

Hitachi is also supporting activities relating to automated driving in Europe, starting with the demonstrating and standardization of a telematics service that supports the optimal driving of electric vehicles (EVs) through its participation in the European Efficient Cooperative Infrastructure for Fully Electric Vehicles (eCo-FEV) project.

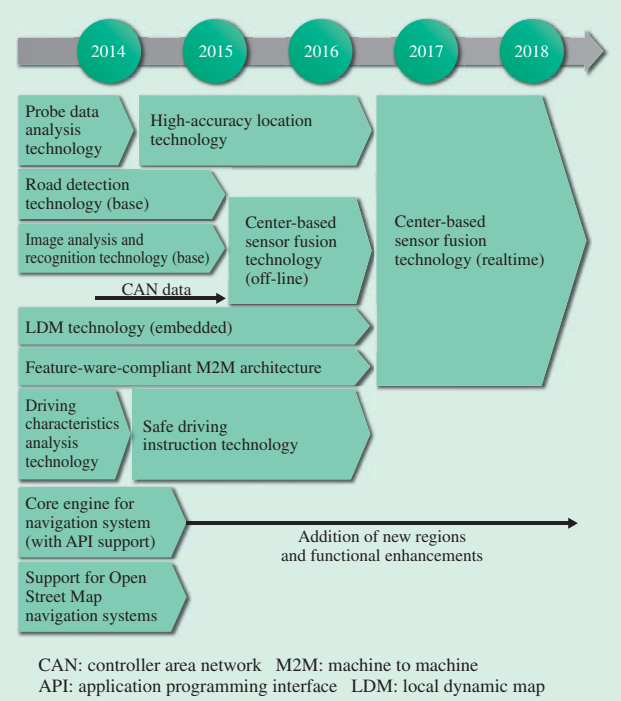

Fig. 4—Technology Roadmap.
The figure shows the technology roadmap for the smart mobility service.

CONCLUSIONS

This article has described what Hitachi is doing at a global level with regard to its IT support structure, ERP, and advanced technology for the automotive industry.

The job title, chief digital officer (CDO), has become more prominent in recent years, particularly in the USA. The role of a CDO is to utilize digital technology to keep a business ahead of its competitors. The utilization of big data is one such activity. The utilization of big data is the leading concern of many companies, and it is made possible by the sort of work on advanced technologies and their applications described here.

Based on the advanced technology base described in this article, Hitachi believes it will be able to deploy services that support the rapidly accelerating globalization of Japanese multinational companies in particular.

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Featured Articles

One-stop Services for IT Lifecycle in China and Southeast Asia

Masato Saito
Keigo Iechika
Kenji Yamamoto
Yoshiyuki Sakurai

OVERVIEW: In response to the IT system requirements that flow from the increasing globalization of corporate activity, Hitachi Systems, Ltd. is engaged in strengthening global business operations through (1) support for overseas expansion by Japanese multinational corporations and the use of global IT system reorganization as an opportunity for business expansion, (2) acquisition of technology and facilities through business development (M&A, JVs), and (3) the establishment of new overseas markets utilizing know-how in applications and other fields acquired in Japan. In particular, Hitachi is planning to offer one-stop IT lifecycle services in Southeast Asia through Hitachi Sunway Information Systems, which it established in April 2013.

INTRODUCTION

THE market environment for information technology (IT) is developing rapidly along with the increasing globalization of corporate activity, with user requirements also subject to ongoing changes. Japanese multinational corporations, which are continuing to expand their global businesses by targeting emerging economies and regions experiencing rapid growth, have a growing need for IT systems that can deliver the same levels of functionality and quality they are accustomed to receiving in Japan, and that are price-competitive in the markets where they will be used. In China and Southeast Asia, meanwhile, which are experiencing rapid economic growth, the expansion of business in various different industry sectors is being accompanied by a sharp increase in the use of mobile devices and other IT. Along with this increasing globalization among users, Hitachi is seeking to deploy its existing IT services and solutions throughout the world.

This article describes, with examples, the acquisition of technology and facilities by Japanese multinational corporations through initiatives such as mergers and acquisitions (M&A) or joint ventures (JVs), and deployment using applications developed in Japan.

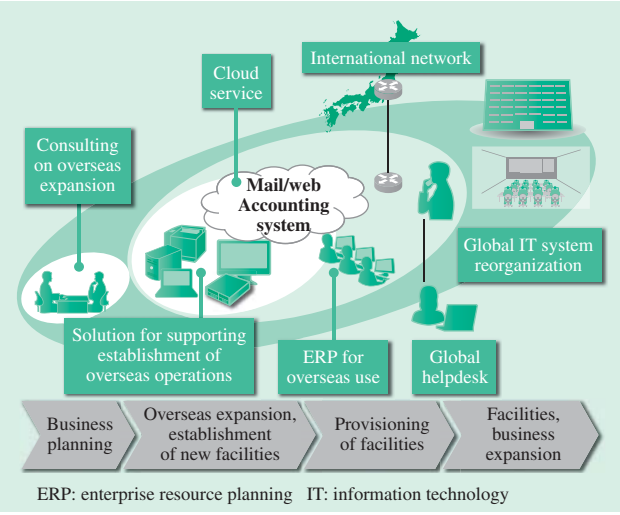

Fig. 1—Overview of Services that Support Overseas Expansion. Hitachi supplies one-stop services that extend from consulting on overseas business planning to solutions for establishing overseas operations and global IT system reorganization.

SUPPORT FOR OVERSEAS EXPANSION BY JAPANESE MULTINATIONAL CORPORATIONS AND GLOBAL IT SYSTEMS

Trends in Overseas Expansion by Japanese Multinational Corporations

Going beyond the overseas expansion of manufacturing, particularly in China, recent years have seen a rise in the establishment of service and logistics businesses that supply internal demand in the rapidly growing emerging economies of Asia. Along with this development, Japanese multinational corporations have also begun to look at their IT systems more as strategic tools, rather than limiting their use to only what is needed within the region where each operation

is based, as in the past. Furthermore, an increasing number of companies are attempting to reorganize their IT into global systems that include Japan. Supporting this global IT system reorganization requires not only the ability to deploy advanced IT throughout the world, but also detailed measures that are tailored to the circumstances at specific overseas locations.

Support Service for Overseas Expansion

A Japanese multinational corporation planning to set up overseas offices or production facilities has many issues to consider. These include the choice of country or region, preparation of business plans, confirmation of legal and taxation measures in the destination country, company formation procedures, recruitment and training, inculcating staff with the parent company's business strategies and vision, and quality management. It is also common for IT infrastructure at the new site to cause confusion among staff due to differences from Japan (network links, quality of workmanship and respect for deadlines of IT vendors).

In response, Hitachi Systems, Ltd. offers a one-stop service for assisting overseas expansion, including working as a consortium with specialist suppliers able to support market research and business planning, and handle activities such as company formation and legal and taxation matters. Specifically, it has established a "support service for establishment of overseas operations" that supports the procurement of the IT equipment and fittings and the installation of networks and other IT infrastructure, including telephone lines, and Internet connections, needed when setting up an overseas office (see Fig. 1).

Hitachi has built up experience in satisfying customer needs, with examples of work conducted as part of global IT system reorganizations including, (1) kitting out and distribution of several thousand personal computers (PCs) to sites spread across China, (2) implementation and operation of an international network spanning multiple countries and utilizing multiple carriers, together with local area networks (LANs), (3) remote monitoring and on-site maintenance service for IT equipment at overseas sites, and a multi-lingual help desk service, and (4) the multi-country installation of enterprise resource planning (ERP) solutions (SAP[*1], Microsoft Dynamics[*2] AX, and Infor SyteLine[*3]) optimized to suit the customer's business and other requirements.

BUSINESS DEVELOPMENT INITIATIVES FOR STRENGTHENING TECHNOLOGY AND LOCAL ORGANIZATIONAL STRUCTURE

The challenges of establishing a business infrastructure to satisfy local customer needs and deliver services at a locally competitive cost, while also deploying distinctive IT services and solutions, include having competitive services and other solutions that can be deployed in the same way throughout the world. In response to these two challenges, Hitachi is pushing forward with establishing the foundations of its business through measures that include M&A or other forms of investment in companies that already have operations in the market concerned. The following sections describe examples of business development initiatives aimed at establishing the foundations of a business with a sales capability and local customer base, and for expanding services and other solutions that are able to be deployed globally.

Strengthening IT Service Centers in Southeast Asia

Hitachi Systems, Ltd. formed Hitachi Sunway Information Systems Sdn. Bhd. in April 2013 to establish business operations in rapidly growing Southeast Asia. The new company is a joint venture with Sunway Technology, an unlisted IT subsidiary of Sunway Group, a Malaysian conglomerate (see Fig. 2).

Fig. 2—Formation of Hitachi Sunway (April 2013).
Hitachi established Hitachi Sunway Information Systems Sdn. Bhd. to strengthen its IT service business in Southeast Asia.

*1 SAP is a registered trademark of SAP AG in Germany and in several other countries.
*2 Microsoft Dynamics, Windows, and Hyper-V are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
*3 Infor SyteLine is a trademark and/or registered trademark of Infor Global Solutions or one of its affiliates.

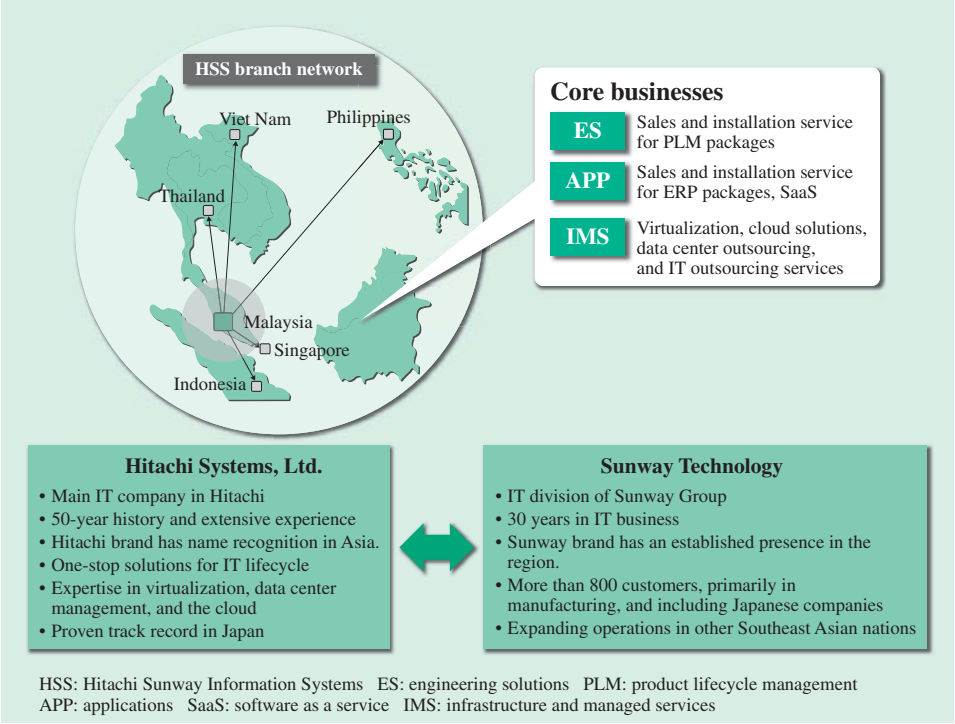

Fig. 3—Business Expansion by Hitachi Sunway in Southeast Asia.
Hitachi Sunway is expanding its three core businesses in Malaysia (where it is headquartered) and five other Southeast Asian nations.

Headquartered in the outskirts of Kuala Lumpur, Hitachi Sunway supplies IT services to the nations of Southeast Asia (Malaysia, Republic of Singapore, Kingdom of Thailand, Republic of Indonesia, and Socialist Republic of Viet Nam). This comprises an engineering solutions business that focuses on sales of product lifecycle management (PLM) software from Siemens[*4], an applications business that focuses on sales of Oracle[*5] ERP packages, and an infrastructure and managed services business based around IT outsourcing and the provision of IT infrastructure (including virtualization, security, and data center operations) (see Fig. 3).

Hitachi Systems, Ltd. is seeking to raise the level of local technical capabilities and upgrade the structure of its business for supplying solutions with high added value so that it can supply Japan's excellent IT services to local customers while also supporting the IT systems of Japanese multinational corporations with operations in Southeast Asia at a level similar to what they are accustomed to receiving in Japan. The company is utilizing its extensive experience and know-how in IT services built up over more than 50 years to offer more advanced IT and a wider range of products. Its plans for the future primarily involve the provision of IT infrastructure and its fee-based business based on IT outsourcing.

Globally Competitive Cloud and Virtualization Solutions

Hitachi purchased US software company Cumulus Systems Inc. (CEO: Arun Ramachandran, Headquarters: Mountain View, California, USA) to strengthen its platform business that serves data centers or cloud service providers, and also its virtualization solution and global businesses. Cumulus develops and markets tools for analyzing the performance of platforms, including operating systems (OSs) such as Microsoft Windows[*2], UNIX[*6], and Linux[*7]; virtualization environments such as VMware[*8] and Microsoft Hyper-V[*2]; and storage. It also has a development center in India with a high level of technical capabilities. The company draws on these strengths to supply performance analysis tools to hardware vendors, system integrators, and other companies with global operations.

Utilizing Cumulus's products, Hitachi Systems, Ltd. uses performance analysis tools suitable for use throughout the world in its platform business serving companies that operate data centers or cloud service platforms and in its corporate-focused virtualization solutions business, both of which operate in the global market.

*4 Siemens and the Siemens logo are registered trademarks of Siemens AG.
*5 Oracle is a registered trademark of Oracle and/or its affiliates.
*6 UNIX is a registered trademark of The Open Group.
*7 Linux is a registered trademark of Linus Torvalds.
*8 VMware is a registered trademark or trademark of VMware, Inc. in the United States and other jurisdictions.

GLOBAL DEPLOYMENT OF APPLICATION PACKAGES

Hitachi supplies a number of application packages that deliver effective solutions to Japanese customers in a variety of industries. Hitachi has selected a number of these high-added-value applications that can also provide this added value to overseas customers and is deploying them accordingly. The following sections describe two solutions that are being marketed primarily in China.

Business Management System for Elderly and Nursing Care

China is the world's most populous country and has an elderly population of approximately 178 million (according to the sixth census of the National Bureau of Statistics of China), with this number growing by about 10 million each year. To deal with this rapidly aging population, the Chinese government intends to increase the number of care facilities and improve welfare services, having included an active program of investment in care for the elderly in its 12th Five-Year Plan. Along with this, the size of the elderly care market is forecast to grow to 500 billion Yuan (approximately 8 trillion yen) by 2020.

Given this situation, Hitachi is adapting its Fukushi no Mori series of services to the Chinese market. The series has already been used to provide tailored services to welfare providers in Japan, which is at the forefront of the trend toward aging populations (see Fig. 4). Hitachi Systems, Ltd. is working in conjunction with Shanghai Vansys Computer Technology Co., Ltd., a Chinese IT company with a strong presence in the healthcare sector, to assess where the system functionality is under or over specified, using the Shanghai Baoshanqu Jinsewannian Jinglaoyuan, which operates a facility with approximately 500 beds, as a model user. The system is already fully operational at the Xiangyiyuan Senior Citizen Center, with a trial installation operating at the Shenyang City Pension Service Center and plans to deploy the system throughout China in the future.

Fig. 4—Overview of Business Management System for Elderly and Nursing Care.
The system is based on a package developed for Japan, with functions revised to suit nursing care providers in China.

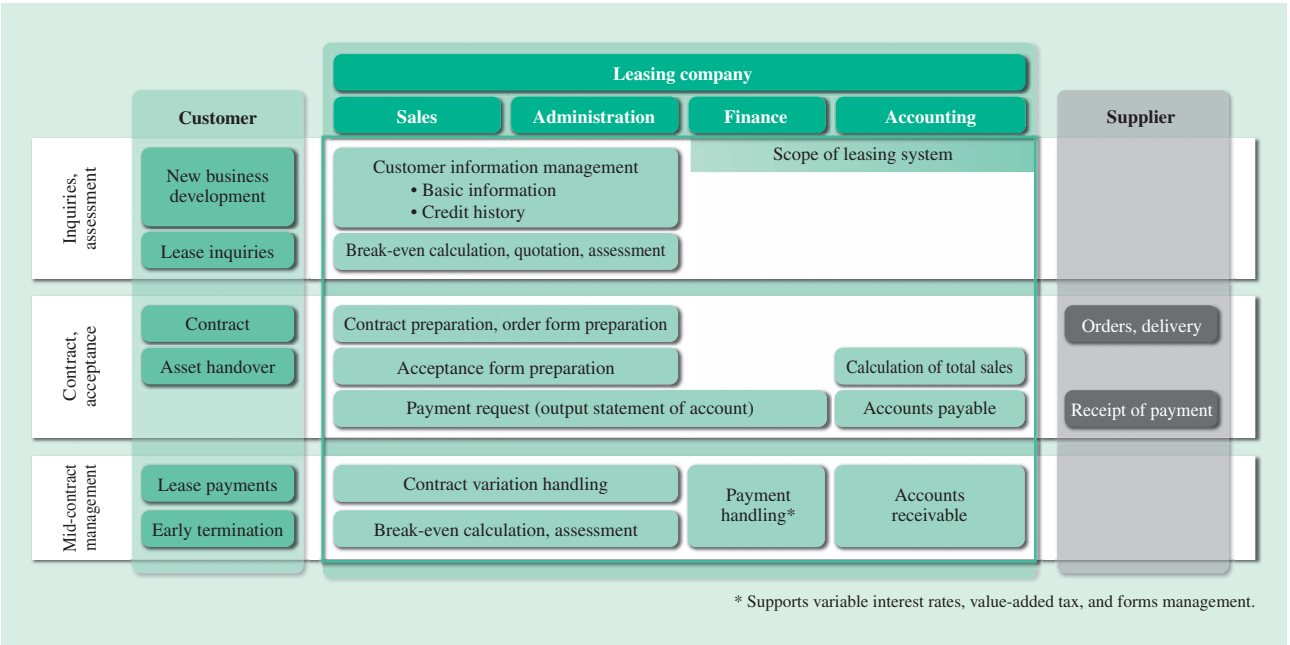

Fig. 5—Overview of Leasing System for China.
The system combines specialist functions for each phase of the leasing business, including contract preparation and lease accounting.

Business Management System for Leasing Companies

The leasing market in China has been growing in recent years, with a rapid increase in the number of such companies to 761 at the end of 2012, 3.6 times the number at the end of 2010. By turnover, the market is already the world's second largest after the USA, and is expected to expand further. However, the rapidly growing leasing market in China is characterized by a lack of good business management practices and slow progress on the adoption of systems specifically designed for the industry, with gathering momentum behind the installation of management systems that suit its business processes.

Drawing on its approximately 40 years of experience in implementing business systems for leasing companies in Japan, Hitachi Systems, Ltd. has developed a leasing system specifically for the Chinese market that is based on a system that is already in operation at Hitachi's own leasing business in China. The system specifications are tailored to the Chinese market, including, (1) integrated management of all steps from customer management to contract termination, (2) comprehensive debt recovery management and payments processing, and (3) support for variable interest rates and value-added tax (see Fig. 5). The Hitachi Lease Management System for China business management system for Chinese leasing companies was released in December 2013, and it has already entered partial use.

By providing high-quality leasing business management practices, Hitachi believes that this system will contribute to the development of the Chinese leasing industry, greater choice of financing options for Chinese companies, capital investment, and the development of the Chinese economy. Hitachi is also looking at supplying the system elsewhere, including in the Association of Southeast Asian Nations (ASEAN) nations, where the leasing business is expected to experience rapid expansion.

CONCLUSIONS

This article has described, with examples, what Hitachi is doing in relation to business growth and to support the overseas expansion of Japanese multinational corporations, the acquisition of technology and facilities through initiatives such as M&A or JVs, and the overseas deployment of applications developed in Japan.

Having had experience satisfying the demanding requirements for IT systems in Japan, Hitachi Systems, Ltd. is now accelerating the expansion of its business to deal with the globalization of markets and customers, and to supply the rapidly expanding IT markets in China and other Asian nations that are undergoing particularly strong growth. It is seeking to quickly establish a place for itself inside the local markets of different counties and to grow its global business by working actively on business development, including investing in local companies.

In the future, Hitachi plans to provide one-stop services for the IT lifecycle in the global market by pursuing more intensively its three strategies of, (1) providing one-stop support for the global operations of Japanese multinational corporations, (2) establishing business infrastructure in each country through business development measures and expanding its global solutions and services, and (3) deploying globally solutions and services that draw on experience from Japan.

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Featured Articles

Case for Regional Solution for Transaction Banking Leveraging on Hitachi eBworx Digital Transaction Banker

Andrew Goh Kian Sin

OVERVIEW: The need for a global or regional cash management solution has in recent years been a key consideration prompting several large regional banks to upgrade and change their systems to cater to the needs of their corporate customers. Banks are actively looking to tap into this large market potential and have begun to exploring various models of implementation. Here, Hitachi eBworx shares their view on implementing a global solution, including an analysis of some of the guiding principles and critical success factors in such an implementation. Hitachi eBworx Digital Transaction Banker has been successfully deployed in some of the largest regional banks in Southeast Asia and is quickly gaining interest among banks in Japan, China, and Europe.

INTRODUCTION

TRANSACTION banking as a whole in Asia has seen a rise in the need to provide regional or global solutions as local corporations and conglomerates grow away from their local markets into regional markets as well as large multinational corporations moving into Asia making this one of their key focus markets. Banks in the region that were focused within their domestic market have mostly followed suit and adapted their strategy to include expansionary strategies.

Specifically in the areas of transaction banking, banks have begun to expand their strategy especially with the opening of markets and proliferation of foreign direct investments, areas in which corporate customers have begun to demand more sophisticated cash management requirements. In many cases, this has to do with the expansion of these corporations out of their local operations. Banks are aggressively expanding in the market both organically and via acquisitions including establishing overseas branches and offices to tap the potential revenue from loyal customers.

As corporations begin to grow internationally, they seek a banking partner that can help support their expansion and provide them with global services.

TRANSACTION BANKING OUTLOOK IN SOUTHEAST ASIA

Banks today have started to offer more complex cash management services and the level of sophistication of these services has increased over the years. Although the more established banks have begun to provide more comprehensive transactional and liquidity services, these have been largely domestic-oriented.

Banks in Southeast Asia in particular have started to explore and embark on providing single-platform, global cash management solutions, and this is an area that is garnering interest as corporate demands increase. The super-regional banks of Southeast Asia [DBS Bank Ltd., Oversea-Chinese Banking Corporation, Ltd. (OCBC), and United Overseas Bank Ltd. (UOB) of Singapore and Maybank and CIMB Bank Berhad (CIMB) of Malaysia] and large tier-one banks have aggressively expanded into the region, and have all mostly looked into changing and implementing a global solution for their transaction banking needs[1] [2] [3].

Research by gtnews[4] found that corporations expanding overseas seek centralized control of cash but are likely to require a hybrid solution where regional autonomy is provided (due to the nature of their business, inter-corporate relationships, local expertise, and regulatory requirements). In the study, over 30% of these corporations required global oversight, 30% required global cash management, and only 5% local autonomy, while the rest had no considerations or had not thought about this.

Local corporations have begun to flex their capabilities overseas through both organic expansion and mergers and acquisitions. The need for a global cash management system to assist these corporations

to manage their liquidity and cash positions is very important. For these corporations that are growing overseas (as well as incoming foreign multinationals), the need for a global cash management solution is rising.

However, provision of a global cash management system is not merely about providing more functions or about providing multiple local cash management solutions in isolation from each other. Banks need to understand the expectations of today's globalized corporations, the competitive market landscape and what technologies are available that can be leveraged to provide such a global transactional platform.

The key questions arising are:

- What are the key issues and challenges faced by banks when they consider implementing a truly global solution?
- What constitutes a good solution to serve their international banking customers? What kind of services, features and functionalities?
- How can banks differentiate themselves and grab market share in servicing these large corporations?
- How can banks compete in their market as well as against foreign banks?

Implementing a single cash management platform (web-based, multi-language, multi-currency, multi-country, multi-function, multi-bank, and multi-time zone with a global architecture meeting local requirements) has many benefits for the bank besides meeting customer requirements. In a single-platform environment, banks can manage the system and its requirements centrally, yielding considerable cost savings. The system, of course, will need to come with configuration and parameter settings that befit a global system, where products can quickly be rolled out across a regional network.

Faced with so many questions and potential challenges, it is not easy for banks to consider all their options. Hence, it is important for banks to look for a partner that combines experience in consulting for banks with similar visions with implementation experience and proven solutions that can help the bank carry through the implementation of a strategic

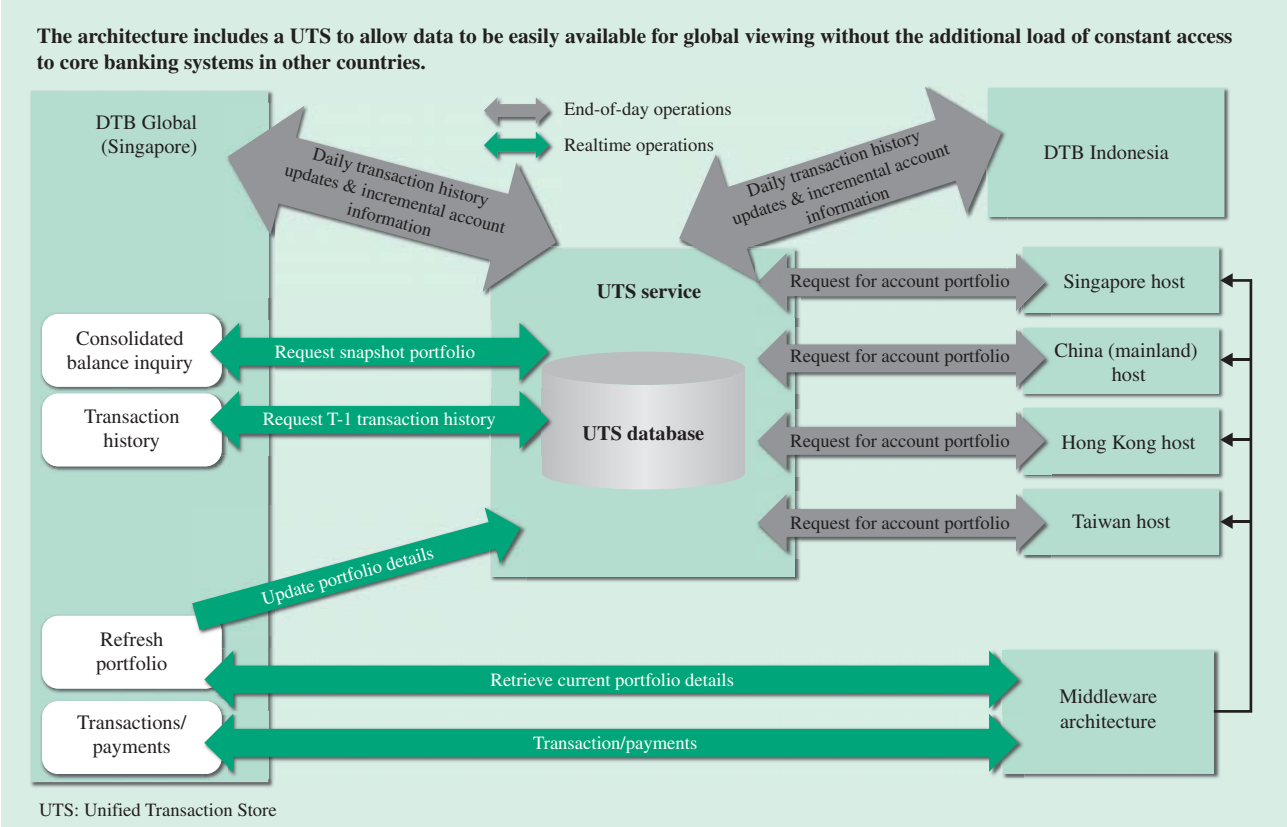

Fig. 1—UTS Architecture.
This figure shows how the UTS architecture facilitates global portfolio view especially in consideration to manage volume of requests to the various core banking systems in multiple locations. Customer portfolio information are downloaded via an end-of-day operation to the UTS database (this can be periodic intraday as well) after which customers will be able to enquire their global positions. Realtime requests are then fired on-demand basis rather than having to pull the entire portfolio from the various core banking which may result in heavy 'data traffic'.

and well-thought-out plan, thereby ensuring that the bank obtains the targeted benefits of implementing a global transaction banking system.

DIGITAL TRANSACTION BANKER (DTB) —GLOBAL CASH MANAGEMENT PLATFORM

There are various approaches to and interpretations of what defines a global cash management platform. The investment for such a solution will be considerable, and hence it is important that the bank is armed with the necessary information to make the decision. Based on our initial analysis and understanding, the deployment of a global cash management platform should be based on four key criteria. Our Digital Transaction Banker (DTB) solution is designed based on these key criteria:

1. Single global platform
2. Ability to segmentize customers
3. User-centric solution
4. Mobile-ready

Single Global Platform

a. Global Platform

Customers do not want to login to different systems in different countries to perform simple transactions, or even to carry a 'keychain' of tokens in order to login to the various systems. DTB provides a single global platform based on a global, single-source architecture, with multi-language, multi-currency, and even multi-bank capabilities (ability to create multiple entities even within the same country), supporting customers with business footprints that span a number of countries and time zones.

b. Global Portfolio Management

The ability for a corporation to view its cash position (portfolio of balances) and transaction history across different subsidiaries as well as across borders is a key feature in a global cash management system.

DTB's Unified Transaction Store (UTS) brings data from various core banking and legacy systems over a wide-area network without congesting the network with frequent requests (multiple account requests)(see Fig. 1). It integrates with various systems across borders and ensures that optimal performance is still achieved. This allows customer to have a single consolidated view of their account portfolio across regions, giving them the ability to make informed decisions based on their total holdings. For corporations seeking global oversight, this information helps them assess the position of all their subsidiaries.

This also facilitates controlled disbursement, where corporations with knowledge of their global and local positions are able to make snap decisions on whether to allow large disbursements of funds on a daily basis.

c. Cross-border Transactions

Cross-border transactions are important. These are achieved through remittance services such as outward telegraphic transfers. DTB is equipped with robust features to support international payments such as:

• Flexible Product Configurator

When deploying in a new country, or when changes are needed to payment attributes, such as the cut-off time, limits, or other product attributes, DTB's Product Configurator makes it easy to make the required configuration changes by bank (see Fig. 2). Also important is the ability to use global standards such as SWIFT (Society for Worldwide Interbank Financial Telecommunication) messages.

• Global Signature Matrix

Today's transactions might be created from a shared service center in the Philippines, verified in Hong Kong, and approved in Singapore, for example. This is only possible if the implemented solution has a global architecture in place, such that transactions can easily move between different entities and countries to facilitate a truly global community of users. To address these geographical challenges, DTB's Signatory Matrix is built on top of a single global platform which makes regional approval possible.

• Intelligent Transaction Processing

Global companies will not necessarily know the correct settings for each country when submitting a transaction. For example, a corporate submitting payroll from one country to various subsidiaries in other countries may not have details of the local payment systems and hence may not differentiate between the various payments mode [automated clearing house (ACH), real time gross settlement (RTGS), and various other in-country formats or standards]. Hence, the system should have the intelligence to 'decide' on the payment mode based on certain rules specified in the configuration so that it can send the transaction for processing in a way that is transparent to the initiating corporation.

Ability to Segmentise Customers

DTB has a complete onboarding module that allows the bank to onboard customers in a timely manner and to tailor services and other content for different customer segments.

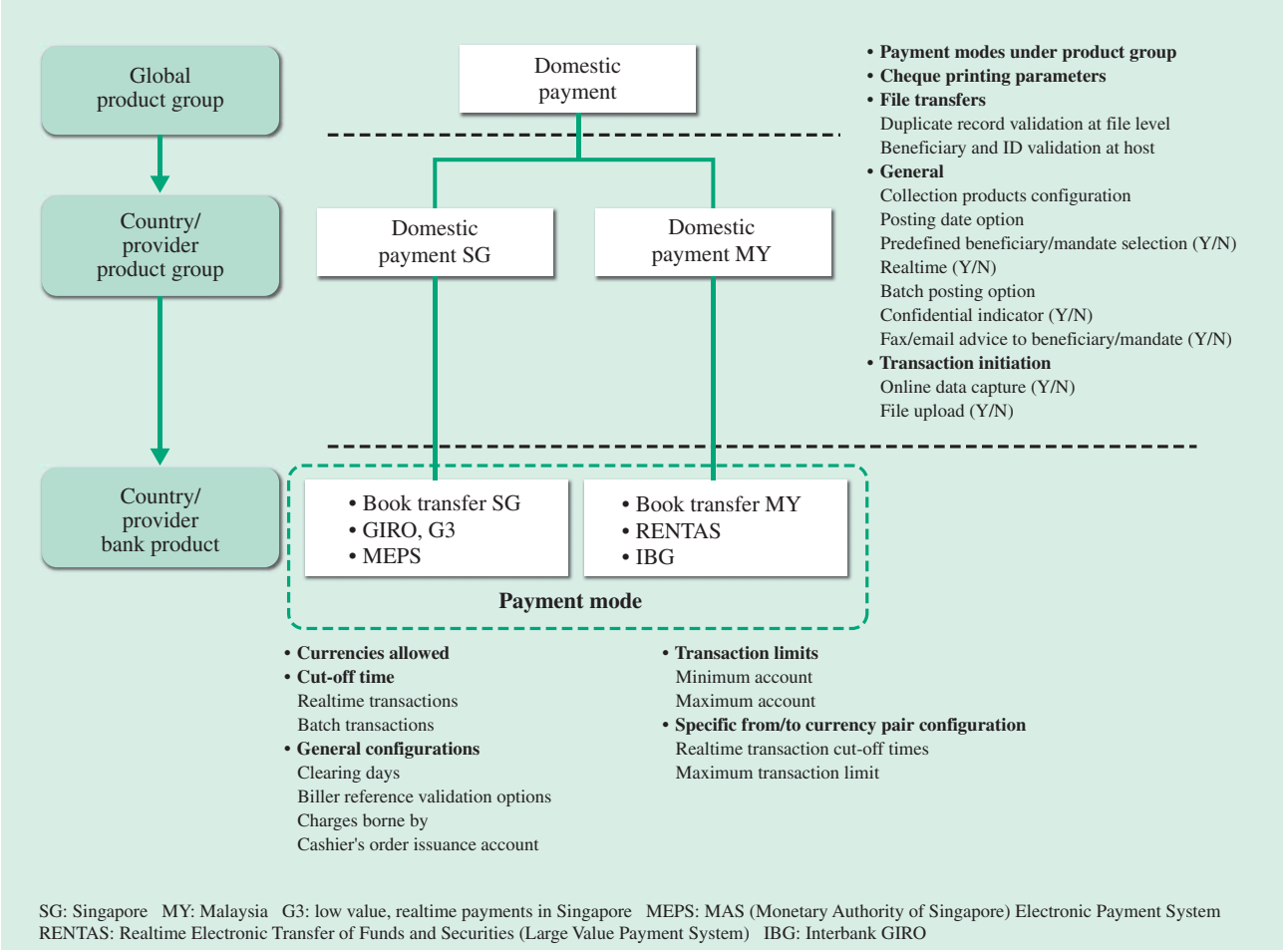

Fig. 2—Product Configurator.
The Product Configurator allows creation and maintenance of groups of common payment types across different countries facilitating easy deployment in a multi-country scenario. Another example will be to group International Payment (Global Product Group) followed by Outward Telegraphic Transfer (OTT) and Demand Draft (DD) for the various countries (Country Product Group and Country Bank Product). The term Provider is used because some banks may wish to deploy the system in a country where the bank has more than one entity thus the Provider concept allows another level of granularity.

a. Targeted Platform, Segmented Customers

A global platform should have the capabilities to allow the bank to target different services and content at different customer groups. The ability to differentiate customer segments by industry and role, and to define and configure targeted content and functions accordingly, has many advantages when the platform is used by corporations globally. This is made possible by our Digital Portal Manager (DPM) whereby the bank can tailor content based on various customer segments and even user roles (see Fig. 3).

For example, (in addition to inquiry and transactional capabilities) the platform should present Singapore-specific news and information to manufacturing industry decision makers in Singapore, while showing their Chinese counterparts content that is more specific to China. There should also be the ability to configure and personalize content to fully maximize productivity when using the system. The days of static systems with fixed content are disappearing.

b. Rapid and Flexible Onboarding

One key issue that becomes particularly relevant when the offering goes global is the speed of onboarding a customer. Currently, banks are taking longer than before to onboard customers due to various issues such as comprehension of and compliance with the corporation's board resolutions on setting up their cash management service, the requirement for corporate-specific features such as custom products, pricing, a complex signatory matrix, and configuration of the corporation's file formats (sometimes including development and coding).

Onboarding a customer in an orderly yet timely manner is important to achieving high customer

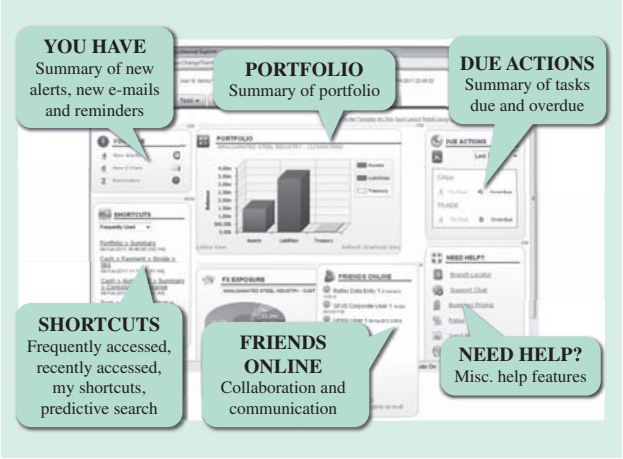

Fig. 3—Digital Portal Manager (DPM).
Today's transaction banking system is expected to come with strong collaboration and personalization features to facilitate easy information management for the corporate users. The use of Web 2.0 (or more aptly Enterprise 2.0) is an integral component in the presentation of information and to promote greater usability of the system. DPM allows targeted content presentation to different segments of customers.

satisfaction, and to expediting the generation of revenue from the use of the system. In order to onboard efficiently, the DTB Onboarding module is designed based on the following key considerations:

• Rich parameters for onboarding

This provides the flexibility to configure the corporation's account tagging and attributes, account accessibility, signature type, user groups, and users. Also important is the flexibility to cater for scenarios that include "verifiers" and "releasers" (as well as "makers" and "authorizers"), and different account and function accessibility for different roles and user groups.

• Customizable service packages

Product attributes can be customized (if required) to allow global corporations to comply with their own internal processes. The ability to provide things like better cut-off times or alternate transactional limits is important for very large corporations. This goes hand-in-hand with our flexible Product Configurator.

• Universal file format configuration

As corporations have their own file formats, banks need an easy method to configure corporation file formats quickly and map them to the bank's file schema. The ability to do this is particularly important in a global cash management situation as file formats will come from different subsidiaries, including from different countries. DTB's Universal File Exchange (UFX) provides this flexibility along with "ownership" so that the bank, or even the customer, can configure the various file formats.

• Flexible pricing engine

Pricing translates to revenue for the bank. It requires the flexibility to have default charges as well as pricing by selected packages, corporations, or even pricing at the level of the account used (in which the pricing depends on which account is used for a transaction). DTB's Pricing Engine is able to support different pricing for single and bulk transactions, tiered pricing (whether tier or slab pricing), and cross-currency support.

• Global signature matrix

As discussed above, the signature matrix is another important configuration.

User-centric Solution

a. Customer Experience

As solutions become richer, and with it more sophisticated and complex, customer experience becomes increasingly important. Customers do not want to spend too much time wondering how to navigate and use the system.

Decision makers are getting younger, and this generation of users is demanding that their experience using the system be of a certain standard. They are not afraid to voice their dissatisfaction and shift their business to another bank that will listen to their needs.

DTB has been designed with consideration for customer experience and user friendliness. It is built hand-in-hand with the DPM framework, which provides easy navigation and targeted content.

Hence, customer experience management is very important, especially when customers can tarnish the bank's brand by posting their dissatisfaction (quite immediately) on social media networks.

b. Delegated Administration

Large corporations require control of how the system is used. The solution must have the capability to satisfy configuration requirements that are sometimes complex. Some of the key corporate administration items in DTB include:

a. Account accessibility
b. User groups and users
c. Signature types and signature matrix
d. Self-service report design and generation
e. Self-configuration of file format for file uploads/transfers
f. Define and manage files (outgoing and incoming/return files, generated reports, MT SWIFT files)

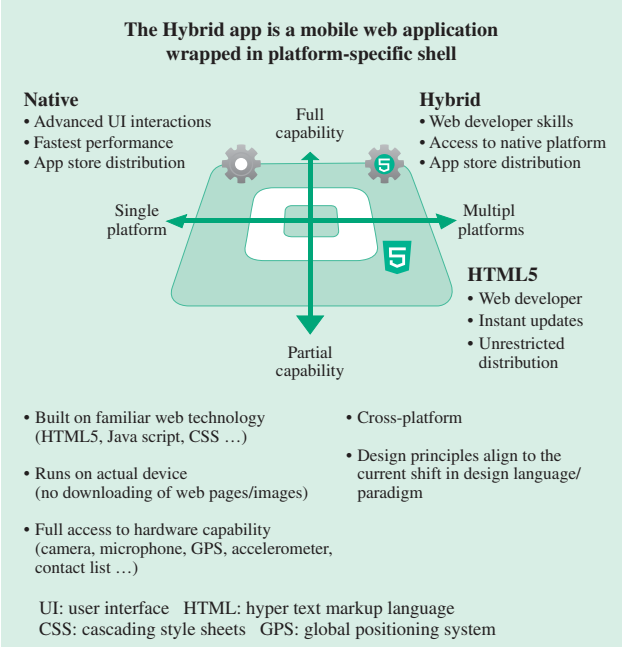

Fig. 4—Mobile on Hybrid Technology.
Today's transaction banking system is expected to come with strong collaboration and personalization features to facilitate easy information management for the corporate users. The use of Web 2.0 (or more aptly Enterprise 2.0) is an integral component in the presentation of information and to promote greater usability of the system. DPM allows targeted content presentation to different segments of customers.

Mobile-ready

With today's younger generation of leaders fully embracing the use of mobile technology, it is essential that banks provide their banking services on smartphones and tablets, and support platforms such as iOS[*1], Android[*2], Windows[*3] Mobile 8, Blackberry[*4] 10, as well as upcoming platforms.

Banks need to examine their approach to cross-device support.

The bank needs to have a mobile strategy and have a clear understanding of the services to be made available on mobile. In the case of cash management, because decision makers are the target market for mobile services, these services should not follow the path of retail mobile banking targeted at the general public.

Our signature Mobile hybrid has taken the above into consideration and made the implementation of mobile platforms easier and faster (see Fig. 4).

*1 IOS is a trademark or registered trademark of Cisco in the U.S. and other countries and is used under license.
*2 Android is a trademark of Google Inc.
*3 Windows is a registered trademark of Microsoft Corporation in the United States and other countries.
*4 BlackBerry and related trademarks, names and logos are the property of BlackBerry Limited and are registered and/or used in the U.S. and countries around the world.

CONCLUSIONS

These are but some of the key considerations for banks in deploying a global cash management solution. In order to further research and explore this matter, it would be advisable for a bank to look for an experienced partner to advise on some of these topics and to help the bank to identify, define and derive an implementation roadmap.

It is important to find a solution provider with the right experience and track record to help advise the bank on architectural and implementation requirements, accommodating regulatory and bank compliance with regards to data and systems residing inside and outside the country. Hitachi eBworx has the right experience and has partnered with various banks in successfully implementing DTB across regions.

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Featured Articles

Addressing the Energy Challenge

—How Hitachi Consulting Bends the Energy Curve Better—

Joel Hurley
Robert Heath
Rob Farris
Jowilla Rabor

OVERVIEW: Businesses across the international landscape are faced with rising energy rates, climbing consumption, and increased local government regulations. Coupled with the climate change agenda, these factors are driving corporations to take a harder look at their corporate energy strategy. Companies are investing in energy reduction initiatives to keep energy costs flat and consumption low, but are often faced with several challenges. First, finding these energy reduction opportunities can be difficult. Many times, it takes the combination of hundreds of energy projects to bend the energy curve. Secondly, many companies have capital constraints, aggressive 'rates of return' for project funding, and lack sufficient internal expertise, experience and resources to manage projects of this size and scope. To address these challenges, Hitachi Consulting Energy Solutions sets out to help companies by providing an innovative and results-oriented approach which allows companies to reduce energy expenses with no upfront capital investments. We do this by bringing together the breadth of Hitachi, Ltd. capabilities and solutions, which pair cutting edge technologies with an end-to-end service model that allows companies to successfully bend the energy curve.

INTRODUCTION

INCREASING energy rates are decreasing corporate profits; The International Energy Outlook 2013* predicts that global energy consumption will grow by 56% between now and 2040. This immense increase and constrained supply will impact energy reliability and price rate volatility.

In response to these challenges, C-level executives are treating energy as an important aspect of business which impacts bottom line results.

Addressing the Energy Challenge

The energy challenge is not limited to organizations of a particular industry or region. Many businesses must manage rising energy costs with an increasing need for energy in order to continue delivering their products and services to an expanding global marketplace. Corporations who see their bottom line most susceptible include those with a large facility footprint, intensive energy consumption, and in regions with high energy rates.

Companies investing in energy reduction initiatives aim to keep energy costs flat and consumption low. Despite the work of responsive energy managers and executives, major barriers remain in the way of improved energy performance. First, finding the right type and scale of energy reduction opportunities can be difficult. Many times it takes the combination of hundreds of energy projects to reduce consumption and cost in order to bend the energy curve effectively.

Secondly, many companies have capital constraints and aggressive 'rates of return' for project funding. Each business has only so much to invest each year, and energy projects, typically compete for funding against other projects that will help to expand the reach of the business or play a key role in market positioning. Thirdly, even with available funding, companies often do not have the deep subject matter expertise nor scale to manage large-scale retrofit projects that are required to make a substantial impact on the energy expense.

To help to address these energy challenges, Hitachi Consulting Energy Solutions sets out to provide companies with an innovative and results-oriented approach that allows reductions in energy expense with no upfront capital investment. We do

* Source: U.S. Energy Information Administration, www.eia.gov

this by bringing together the breadth of Hitachi, Ltd. capabilities and solutions which pairs cutting edge technologies with an end-to-end service model.

HITACHI CONSULTING ENERGY SOLUTIONS

Our approach allows companies to both optimize their energy consumption and keep costs down.

Hitachi Consulting Energy Solutions is offered by the types of power purchase agreements (PPAs) that many companies typically use to buy electricity. In this model, the client does not have to pay the full capital cost of an energy efficiency technology project upfront, but instead pays for it over time as savings are realized.

By combining the PPA service model with advanced energy saving technology, companies can protect themselves against fluctuating rates. This comes as part of a full-suite of energy management services from opportunity identification and business case development to implementation with project management, financing and support services.

How Hitachi Can Make It Happen Better?

When embarking on an energy assignment, project begins with the identification of energy performance measures (see Fig. 1). Consultants work with clients to evaluate the existing energy performance of their portfolios, identifying opportunities and conducting financial analysis. Armed with a comprehensive understanding of their actual energy performance portfolios, we identify specific energy opportunities where investments can yield considerable results.

Team then identifies technologies that can be retrofitted across the company's entire real estate portfolio, and designs projects around each initiative. These may include Hitachi products and solutions as well as energy savings in areas such as:

- Facility lighting optimization including retrofits, smart controls sensors, and exterior solutions
- Variable frequency drives (VFDs) for heating, ventilation, and air condition (HVAC)
- Variable refrigerant flow (VRF) cooling and heating systems
- Absorption chillers
- Motors for air handler fans and pumps for chilled and non-chilled water
- Data center optimization
- Smart building management system
- Steam generation and distribution
- Compressed air
- Rectifiers [alternating current (AC) to direct current (DC) converters]

Team provides a value based service model through which service fees are based on savings achieved. Through careful monitoring and metering, both our clients and team will be able to track avoided kilowatt hours, giving a real-time understanding of the actual energy saved. Clients can then achieve cost savings by paying for these avoided kilowatt hours out of their existing utility budgets. In order to provide the necessary financing for this program, Hitachi Capital America Corp. (HCA) will work with clients as part of team. HCA's financing solutions help to save clients from the complexities of capital or financing leases, rental or direct purchases; payments are due when the actual energy savings are realized.

Project team brings together the diverse skill sets needed to complement on-site energy teams, giving clients the resources they need to achieve savings on a portfolio-wide scale. The roles needed to facilitate these types of energy saving initiatives may include:

- Energy engineers
- Energy managers
- Project managers
- Finance experts
- Analysts
- IT specialists
- Industry specialists
- Installers
- Technical support staff
- Organizational change management specialists

For ongoing management of the energy savings solution, we provide outsourcing services including full service help desk support as well as proactive

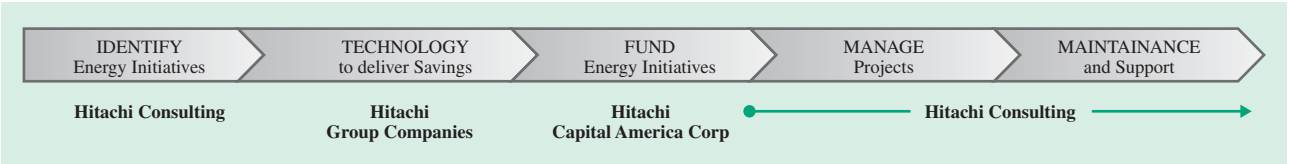

Fig. 1—Hitachi Consulting Energy Solutions Process.
This overview shows Hitachi's services and capabilities that support an end-to-end energy solution.

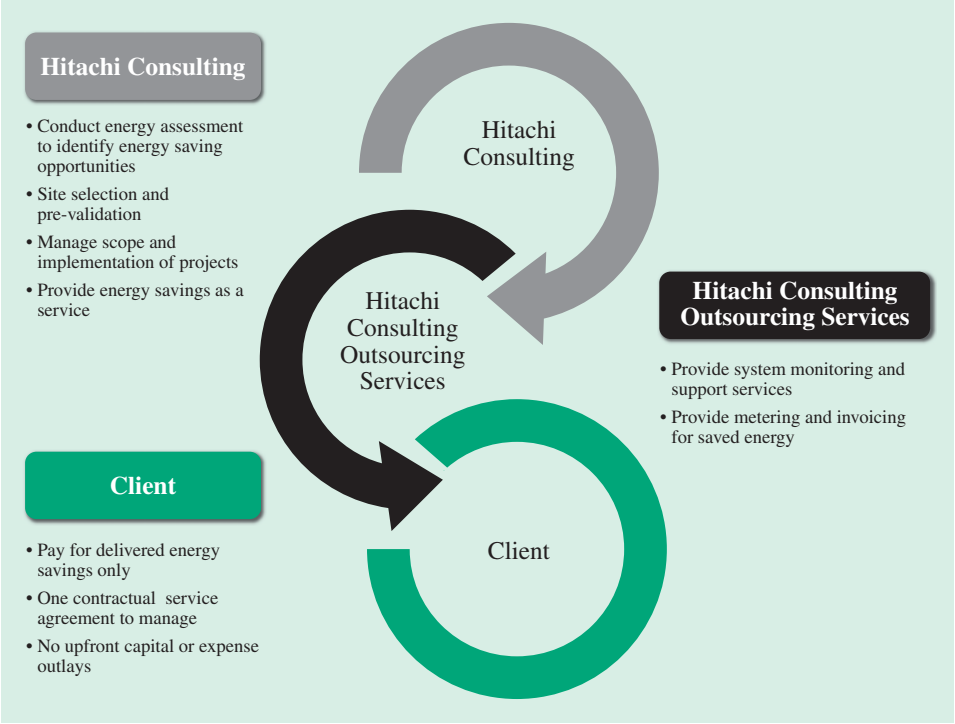

Fig. 2—Roles of Hitachi and its Clients.
This high level overview shows how Hitachi Consulting works with its clients and outsourcing service capabilities to provide energy solutions.

monitoring and integration with existing service desk software. This service can be provided on a global scale, ranging from remotely delivered shared services to a dedicated on-site team. Ongoing monitoring of energy consumption allows for sustained energy savings and real-time assessments of how best to leverage and continuously improve the energy profile based on emerging technologies (see Fig. 2).

Tangible Benefits

This program solves a number of actual challenges faced by corporations today. First, it provides energy teams with a partner that can scale to meet any energy management challenge bringing project managers, engineers, installers and analysts to bear on energy performance opportunities. Secondly, our approach to metering energy usage results in less complicated savings calculations. Detailed reporting on actual, delivered energy savings is provided throughout the engagement.

Our Energy Solutions via HCA provides a fixed rate for the actual energy savings. This gives customers more predictability and a greater ability to forecast and plan.

CLIENT CASE STORY

Like many global companies with a significant facilities footprint, our case study organization forecasted a significant and exponential increase in energy expense which impacted their bottom line profitability. In addition to honoring commitments that the company was making towards environmental sustainability, energy rate volatility and anticipated increases in energy consumption were forcing this global organization to focus on controlling the energy expense line item.

Though the organization had implemented a number of energy initiatives and had succeeded in holding energy expenses flat over several years, it had become more and more difficult to identify new projects of the appropriate scale and with an attractive internal ‘rate of return’ that could be addressed. Energy expense growth was beginning to outpace the organization’s ability to address it. Without near term action, the organization would see upwards of 20% increase in a billion dollar energy expense line item.

Hitachi Consulting Energy Solutions was instrumental to the success of this client’s energy program. Our team collaborated with the organization and HCA to identify, fund, and deliver on energy initiatives that would have been unachievable with conventional funding models. Our experienced professionals were able to supplement the organization’s existing resources and fill gaps in expertise and scale in order to allow for central management of these initiatives. Initiatives implemented over a four year period are yielding hundreds of millions of dollars

in annual energy savings and today this company is ranked as the one of the top corporate citizens for environmental sustainability. With a value based model, the organization is about to manage its investment expenditure according to the savings accrued.

The reception at the client has been phenomenal and the creative methods of achieving cost reductions have generated much interest within and external to the client. The organization has achieved results beyond its original goals, plus generated improvements to environmental sustainability without upfront investment.

ENERGY SOLUTION AND SOCIAL INNOVATION

Hitachi Consulting Energy Solutions supports Hitachi, Ltd.'s commitment to Social Innovation, integrating cutting edge IT, products, and services that have been developed over many years to improve safety and security throughout the global society. With this innovative energy service approach, companies are able to optimize their energy usage, reduce their carbon footprint, and take action on energy initiatives that may not otherwise be achievable.

Our approach cuts through the complexity and offers measurable and sustainable energy savings. Designed in partnership with our clients, the strategy and services are geared entirely toward eliminating barriers to performance improvement. Our approach is not about selling equipment or making bets on energy futures; it is focused on turning energy savings into a commodity that our clients can buy through their existing utility budgets.

CONCLUSIONS

Hitachi Consulting leverages decades of deep industry experience to provide practical business strategies and technology solutions. Our collaborative, pragmatic approach enables superior operational performance, positive business change, and consistent measurable results. With Hitachi Consulting Energy Solutions, we continue to find ways to help our clients to eliminate barriers to their success.

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Featured Articles

Realizing Smart Mobility Using Probe Data

Tatsuya Okubo
Koichiro Yoshioka
Akiyuki Nakamura
Naoyuki Taniguchi

OVERVIEW: The rapid increase in cars, motorbikes, and other road traffic, particularly in the parts of Asia experiencing strong economic growth, is resulting in chronic traffic congestion due to the inability of infrastructure construction to keep up with demand. Because the side effects of this congestion include harm to the environment and economic costs, national governments around the world have recognized it as a major problem. Unfortunately, funding the large investment required to build road infrastructure of a similar standard to developed economies is difficult. Hitachi markets ITSs to emerging economies that are based on the use of probe data and able to be adopted at low cost. Hitachi is also looking to utilize these systems not just in traffic applications but also for a wide variety of social innovations in areas such as logistics or urban planning by using probe technology, so that it can help provide safer and more comfortable lives and contribute to the progress of a society that is conscious of the environment.

INTRODUCTION

THE major cities of Asia are experiencing ongoing rapid growth. Issues such as damage to the environment and economic costs are becoming societal problems in these cities as increasing vehicle use results in chronic traffic congestion. To minimize these problems, it is important to proceed with urban planning and road planning measures that include the construction of the road network and the provision of public transportation, and to do so with reference to congestion and other traffic information.

Over time, devices such as roadside sensors and closed-circuit television (CCTV) have been installed to provide a way of collecting traffic information, particularly in developed economies. However, installing these roadside sensors and other devices along roads over a wide area is expensive, and impractical for emerging economies that struggle to obtain adequate investment for road infrastructure.

In response, Hitachi is working on the implementation of intelligent transport systems (ITSs) that use probe technology and that can typically be installed more quickly and less costly than these older methods. Hitachi has been working on research and development of a variety of ITSs since the 1990s[(1), (2)], and has implemented demonstration systems that use probe technology, in countries like the Socialist Republic of Viet Nam and the Republic of Turkey as well as in Japan, with the aim of building up know-how and to verifying their effectiveness.

Also, by using this probe technology, there is scope for deploying these systems not just for traffic applications but also in a wide variety of other areas such as logistics or urban planning to help make society safer and more secure.

This article gives an overview of an ITS that uses probe technology, and describes an overseas demonstration project and the deployment of the system in social innovation businesses that utilize probe technology.

USE OF PROBE TECHNOLOGY FOR TRAFFIC MANAGEMENT

This section gives an overview of an ITS that uses probe technology and describes how traffic information is generated, which is the core technology of the system.

Overview of System that Uses Probe Technology and its Application

The ITS that uses probe technology collects global positioning system (GPS) data (position, speed, time, and other data) from on-board units (OBUs) installed in probe cars. The collected data is sent to a data center

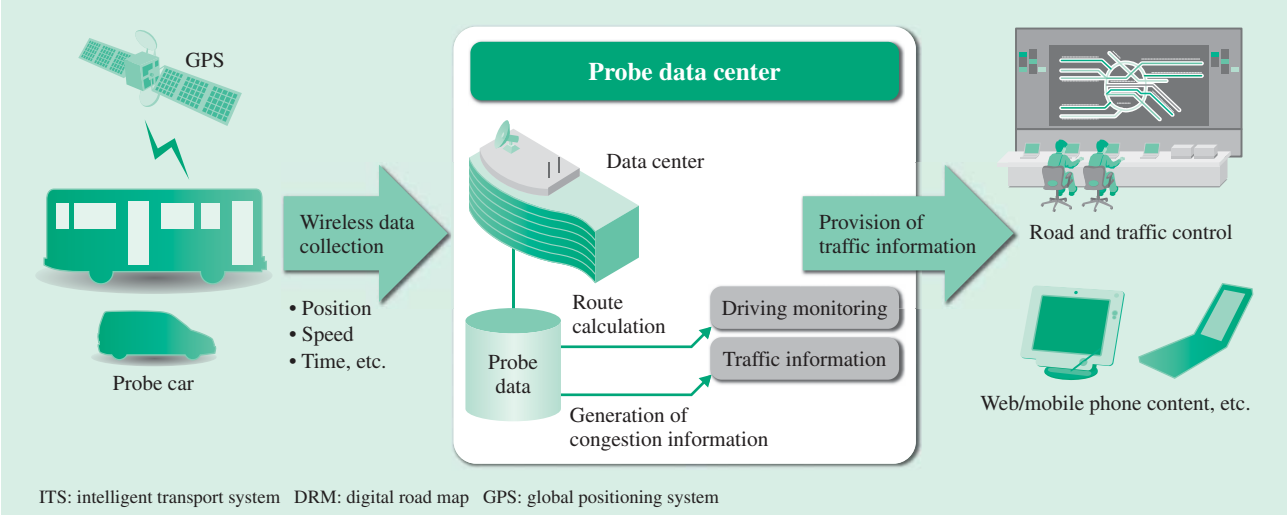

Fig. 1—Overview of ITS Based on Probe Data.
The data center collects driving records, including position information, from probe cars fitted with on-board GPS units and matches this to a DRM. The traffic information obtained by collating this data is then used in applications such as traffic control or the distribution of traffic congestion updates.

via communication methods such as mobile phones or dedicated short-range communication (DSRC) (see Fig. 1). This is stored in a database in such forms as driving records or behavior information. The GPS position data is matched to a digital road map (DRM) (map matching); a calculation is performed to estimate the vehicle's route; and the travel time, speed, and other parameters are also calculated. The system then collates data from a number of vehicles to generate congestion data for each section of road.

The generated traffic information is used for a variety of traffic management tasks, including traffic control, distribution of congestion updates, electronic road pricing (ERP), vehicle behavior management, and road planning.

Technique for Generating Traffic Information from Low-density Position Data

In emerging economies, it is sometimes the case when using probe technology to generate traffic information that the volume of data and density of coverage is inadequate. Reasons for this might include the number of OBUs collecting GPS data being low or the frequency of collection being limited due to the cost cap of communications. When the probe data coverage density is low, it can be difficult to determine the route followed because there may be more than one possibility for traveling between consecutive GPS positioning points.

In response, Hitachi's map matching technique can generate traffic information more accurately and for a wider area from a small quantity of data by using GPS data from a number of locations to estimate the route traveled[3] (see Fig. 2).

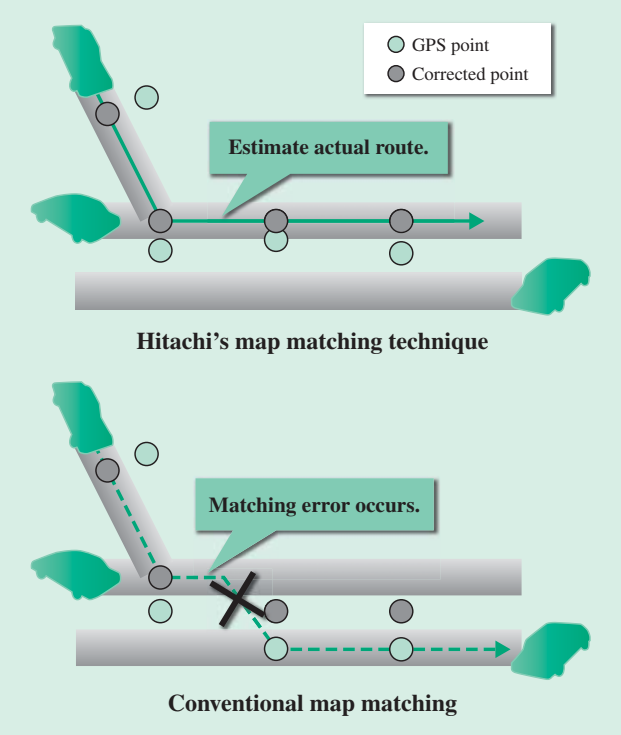

Fig. 2—Hitachi Map Matching Technique.
Rather than matching each GPS position to the map independently, the technique performs highly accurate map matching even when working with a small quantity of probe data by using a number of GPS positions to estimate the route traveled and matching this to the roads along the route.

OVERSEAS PROJECTS

This section describes demonstration projects in Viet Nam and Turkey.

Probe Data System in Viet Nam

Hanoi, Viet Nam, currently uses surveillance cameras to assess road traffic conditions. There is also a prospect of their implementing an ITS using probe technology to collect more accurate information less costly.

For two years from 2011 to 2012, Hitachi participated in the FY2011 and FY2012 projects for the facilitation of trade and investment (demonstration projects and general projects) of the Ministry of Economy, Trade and Industry. This involved a demonstration project that collected and processed probe data from taxis to assess traffic congestion in Hanoi and obtain useful information for road and transportation planning.

By matching taxi probe data (300 vehicles in the first year, 800 vehicles in the second) to a DRM and calculating and displaying the traffic information for each section of road and time period, the demonstration project produced data, graphics, and other forms of information that could be used to assess the overall traffic situation in Hanoi (see Fig. 3).

The demonstration project achieved an accuracy of congestion identification (a traffic information indicator) of approximately 70% and confirmed that traffic information obtained from taxi probe data could be used for tasks such as traffic control.

Probe Data System in Turkey

Although Istanbul, Turkey, has a traffic control system that uses roadside sensors and CCTV cameras, chronic traffic congestion is a serious problem in the city.

Because use of roadside sensors to assess traffic conditions is only available along certain main roads in the current system, solving the city's congestion problem will require the collection of detailed traffic information that includes minor roads.

Also, because parts of Istanbul are designated as world heritage sites, it is difficult to undertake major work such as road building or widening. As a result, the city of Istanbul has set out to solve its congestion problems by adopting ITS technology rather than by embarking on major road works.

Hitachi has been using probe technology to operate a model business since August 2013 through a demonstration project (FY2013 project of the Ministry of Land, Infrastructure, Transport and Tourism for using model businesses to study the viability of overseas deployment of ITS technology).

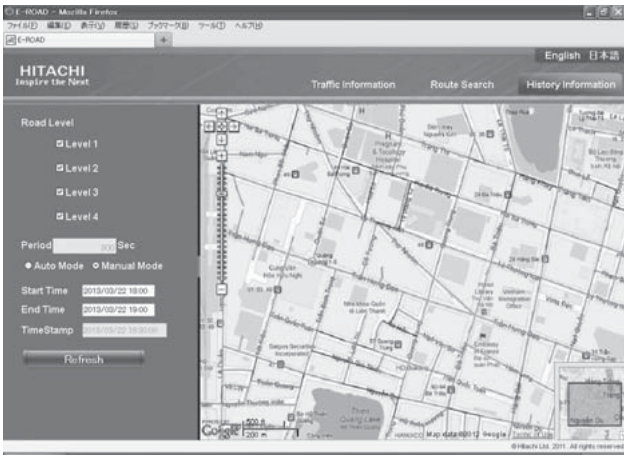

Fig. 3—Traffic Information Display Tool Used in Hanoi Demonstration Project.
The tool can display the traffic information for each section of road for any time period.

This project involves use of a demonstration system that generates traffic information using probe data from 2,000 buses, and that includes a function for determining the fastest route between any two points. Planned work includes conducting road tests and other measures to verify the system's accuracy, and demonstrating that Hitachi's model business has the technology to help resolve Istanbul's traffic issues (to be completed by March 2014).

It is hoped that the spread of congestion can be minimized in the future by giving the public access to the traffic information provided by the model business. It is also hoped that the system will improve public convenience by, for example, shortening the time taken by emergency and other vehicles to reach their destination by providing them with fastest-route information.

DEPLOYMENT OF SOCIAL INNOVATION BUSINESS BASED AROUND PROBE DATA

In addition to OBUs, probe data can also be collected from GPS-equipped smartphones or smartcards. This data can then be processed to enable the measurement and management of the movement of people and vehicles of various types, such as cars, buses, and trains. There is also the potential to extend the use of this technology beyond traffic applications to include a wide variety of social innovation businesses in areas such as logistics or urban planning.

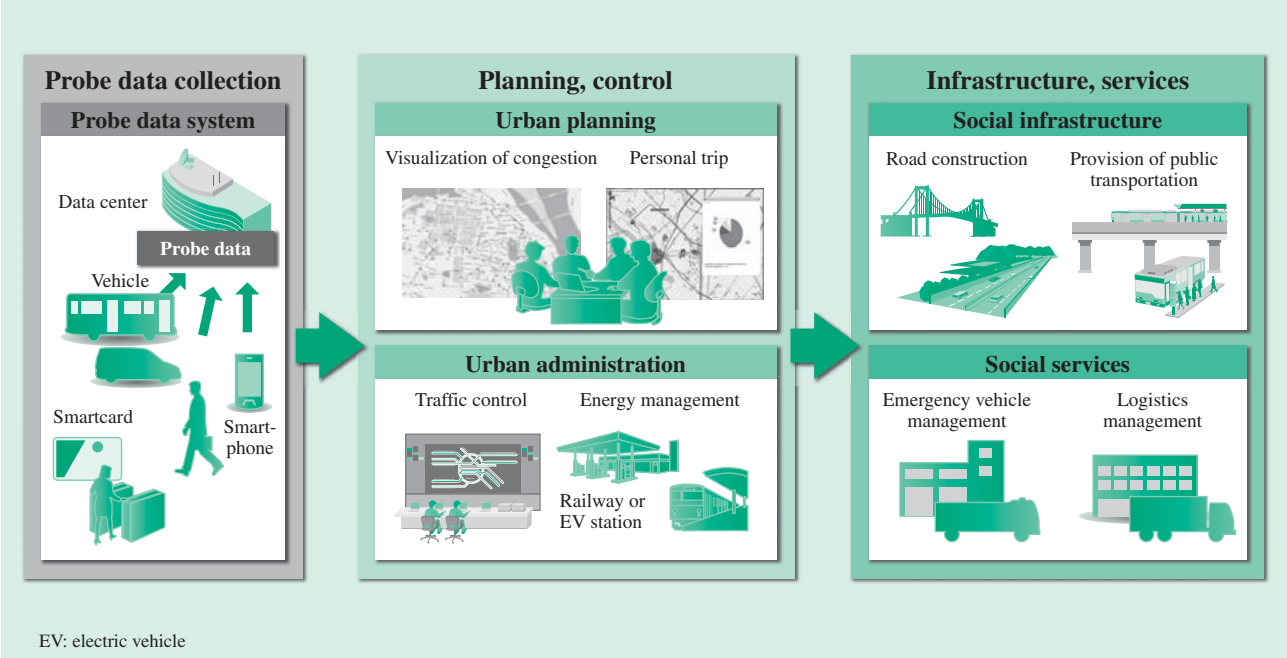

Fig. 4—Use of Probe Data System in Smart Mobility Solutions.
It is possible to determine and manage the flow of traffic and people based on probe data collected from a variety of devices, including smartphones and smartcards as well as OBUs. This can be further developed to make a contribution to society that influences people's lives directly by optimizing activities such as logistics or urban planning.

Hitachi uses the term "smart mobility solutions" to refer to solutions like these that apply its processing techniques to a wide variety of information and deliver a wide variety of services (see Fig. 4).

This section describes examples of smart mobility solutions for a variety of fields.

Traffic Applications

Traffic restrictions, weather information, and CCTV camera footage collected at a center along with traffic information based on probe data collected from vehicle OBUs can be used for traffic control tasks such as monitoring congestion or accidents in realtime. Also, congestion can be mitigated and traffic flow encouraged to follow normal patterns by the realtime distribution of collected traffic information to variable message signs (VMSs), the web, or smartphones and other user devices.

Logistics Applications

Efficient logistics requires control to take account of current traffic conditions.

In addition to its use for providing realtime congestion updates, probe technology can also contribute to efficient logistics through its ability to indicate the fastest route based on congestion information.

In another example, there are restrictions on the routes available to special-purpose vehicles (SPVs) that exceed the standard rules on size or gross weight due to the load they place on roads and bridges. In emerging economies in particular, where there is a strong need to reduce road maintenance costs, the probe data from SPVs can be used to determine which routes they take and to monitor whether they are operating in accordance with the law.

Urban and Road Planning Applications

In the case of urban planning, personal trip information obtained from GPS-equipped smartphones or smartcards can be analyzed to determine such things as population densities, travel routes, and means of travel in a city[(4)]. This can help achieve objectives such as optimizing the provision of public transportation such as trains or buses, improving accessibility to important sites, or controlling the flow of people to revitalize commerce.

In the case of road planning, travel times for each section of road calculated from probe data can be used as the basis for presenting a visual representation of the areas able to be reached from a central location within particular times (the "accessible area"). Through the use of this information to identify where to undertake work, this can lead to effective road improvements that relieve urban congestion.

CONCLUSIONS

This article has described the features of a Hitachi system for using probe data to generate traffic information, the steps being taken toward its commercialization, and its application in Hitachi's Social Innovation Business.

Vehicle use is growing rapidly in the major cities of Asia as their economies grow, creating an urgent need for ways of generating traffic information efficiently. Hitachi believes that the use of smart mobility solutions based around probe data can provide a safer and more comfortable way of life and achieve urban development that is conscious of the environment.

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Featured Articles

Global Deployment of Cash Management Solution with Core Role for Banknote-recycling ATMs

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OVERVIEW: With the considerable expansion in the circulation of cash in emerging economies as they undergo strong economic growth, the adoption of automated machines to reduce queuing at banks and improve over-the-counter services has been proceeding rapidly over recent years. Because of technical issues relating to the quality of banknotes and the presence of counterfeit bills, most of these automated machines are dedicated cash dispensers or deposit accepting machines rather than the banknote-recycling ATMs widely used in Japan that are able to reuse deposited cash for withdrawals. As a result, banks face tasks associated with these automated machines that are onerous to perform, such as the frequent need to replenish, collect, handle, and sort cash. Also, the number of automated machines per capita is seen to be inadequate. The core technologies that have been developed for banknote-recycling ATMs in Japan are called "sensing and handling," and these technologies have the potential to solve major issues with cash handling in emerging economies. Hitachi aims to supply its banknote-recycling ATMs globally, and is seeking to supply solutions and services that will form part of the infrastructure of society.

INTRODUCTION

SINCE the cash dispenser (CD) was first introduced to Japan in 1969, the technology has kept pace with changing needs by evolving into the automated teller machine (ATM), incorporating numerous functions. These machines now offer a variety of services including online inter-bank transactions. They have become an important part of the infrastructure, essential to our daily lives, with approximately 190,000 machines operating around Japan.

Rapid economic growth in emerging economies over recent years has resulted in an expansion in the circulation of cash together with a surge in the number and size of cash transactions, either over-the-counter or through automated machines. The chronic congestion this has caused has become a problem at a societal level in some countries. Against this background, banks in these countries are making rapid progress on the provision of social infrastructure that will facilitate objectives such as expanding services and the use of automated machines that allow for flexible deployment, and also efficiency improvements and increasing the number of outlets and counters.

In many countries, large numbers of counterfeit or worn banknotes that are unsuitable for mechanical handling are circulating in urban areas. Most of the automated machines installed in such countries are dedicated CDs or automated deposit machines (ADMs). The number of such devices per capita is also seen as insufficient.

This article describes initiatives by Hitachi that are based on technology and experience built up in Japan and that seek to create a safe, secure, and trouble-free society through the global supply of banknote-recycling ATMs that are capable of both accepting and dispensing cash.

PROVISION OF SOLUTIONS BASED AROUND RECYCLING ATMS

The original motivation for financial institutions to introduce ATMs was to save labor by automating over-the-counter cash handling. Hitachi's aim goes beyond the supply of the required equipment and extends to supplying solutions that have the potential to provide important social infrastructure and innovation in the use of ATMs for cash handling.

Improvement in Cash Handling and Capital Efficiency

Most overseas banks return the banknotes they receive at the counter or ADM to the back office or a cash handling center. The cash is then tallied by counting the banknotes to confirm their total matches the receipt. Next, in accordance with legal requirements, the banknotes are checked manually or using a special-purpose scanner to sort counterfeit or worn banknotes from those able to remain in circulation. The former are returned to the currency issuing agency (such as the central bank). Of the remaining banknotes, those suitable for mechanical handling are selected so they can be used to stock CDs.

In addition to this back office work, another necessary task is the continual monitoring of CDs and ADMs so that they can be frequently restocked or emptied of cash to ensure they do not shut down due to lack of funds or becoming full. In the case of machines installed away from bank branches, this also requires the transportation of cash, a task made expensive by the attendant need for security.

CDs and ADMs also pose a problem of capital efficiency. Whereas CDs need to be stocked with banknotes, ADMs require their collection. Compared to the case when deposited banknotes are reused for withdrawals, this will in principle require roughly double the amount of cash and associated handling. Because this cash is not available for other investment, the loss of capital efficiency imposes a non-trivial cost, particularly in countries with high interest rates.

In contrast, a recycling ATM performs counterfeit checking, sorting, and counting of deposited banknotes automatically, identifying those suitable for reuse and storing them in its internal repository. The banknotes from the repository can then be used for withdrawals. For these reasons, Hitachi believes the recycling ATM is an effective solution because not only can it perform the back office work itself, it also reduces the amount of cash needed for cash services.

Provision of Safe, Secure, and Convenient Cash Transactions

In countries where there is a high risk of banknotes being forged or deliberately altered, not only are such banknotes frequently deposited over the counter or into ADMs, it is also not unusual for such counterfeit notes to be present in cash withdrawn from a CD. Similarly, the presence of worn banknotes in circulation is an operational problem for CDs and ADMs because it makes them more likely to jam. The tasks of identifying and separating worn banknotes, detecting and eliminating counterfeit notes, and investigating how they entered the system imposes a major workload on cash handling centers and other facilities that perform back office work.

The advanced banknote recognition functions in recycling ATMs can detect and separate banknotes unsuitable for circulation and automatically deal with them in accordance with the applicable rules. Furthermore, the next-generation banknote-recycling mechanism described below can track each banknote that passes through an ATM, including counterfeit notes, by using a function for reading the banknote serial numbers.

In this way, the recycling ATM can act as part of the social infrastructure, reducing security risks that threaten our safety and providing an environment in which users can be confident about making transactions.

TECHNICAL INNOVATION UNDERPINNING GLOBAL DEPLOYMENT

Challenges for Global Deployment of Recycling ATM

Hitachi has been working relentlessly to develop its ATMs ever since it leads the world with the release of its HT-2806 recycling ATM in the 1980s. In order to market these machines globally, however, there is a need for further development to adapt them to the banknotes and other requirements of different countries and regions.

Fig. 1 shows the technical elements that make up the cash module at the core of an ATM. Banknotes inserted by users into the bill slot on an ATM are separated and passed one at a time through

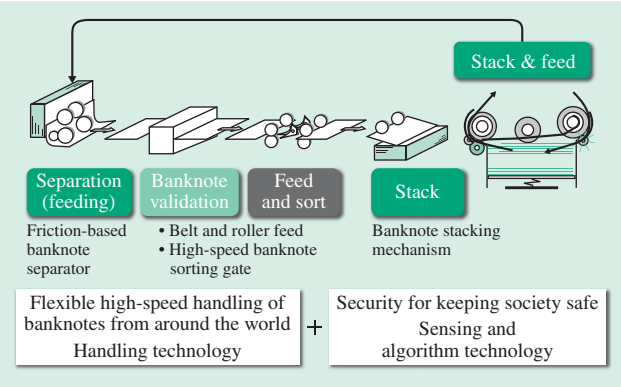

Fig. 1—Technologies Used in Note Transport Mechanism. After being individually separated and passed through the note validator, the banknotes are sorted and then stacked.

TABLE 1. Relevant Factors for Overcoming Challenges
The table lists the factors relevant to the challenges that needed to be overcome before the cash module could be marketed globally.

Category	Relevant factors
Physical properties of banknotes	Variety of dimensions, built-in security features, paper types, and materials (polymer banknotes)
Banknote circulation	Degradation of banknotes in circulation, risk of counterfeit notes, differences in number of banknote denominations to be handled, skewing in number of notes in each denomination needing to be held due to country's choice of banknote denominations
ATM installation site	Harsh conditions due to temperature, humidity, weather, dust, and other environmental factors when ATMs installed on building exteriors, prevalence of criminal acts such as vandalism or illegal withdrawals from ATMs

ATM: automated teller machine

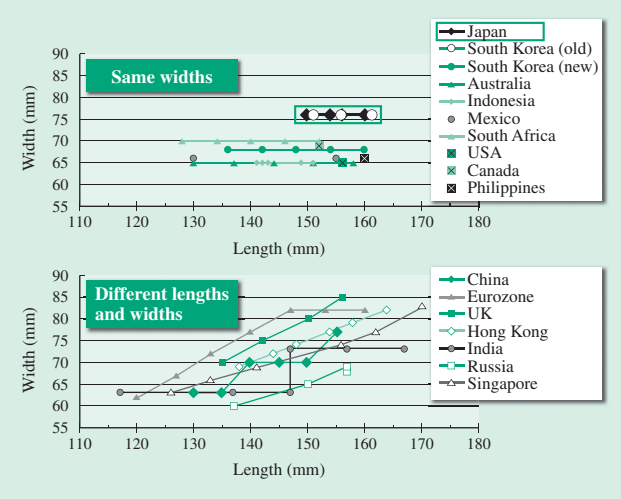

Fig. 2—Dimensions of Banknotes Used in Different Countries and Regions.
Banknotes are very diverse, with different denominations having the same widths in some countries and different lengths and widths in other countries or regions.

the banknote validator that rapidly reads their denomination and checks for counterfeit notes and whether they are torn or folded, and then on to the feeding and sorting unit that stacks them in accordance with the result of validation.

When seeking to supply ATMs developed in Japan to overseas markets, the initial challenges for the cash module related to the sensing technology, which must reliably read the characteristics of even worn banknotes in poor condition, and the handling technology, which needs to be able to feed different types of banknotes reliably without their jamming. Technical innovations were required in both cases. As obtaining the specifications for banknotes circulating in different countries was difficult, the challenges lay in studying and analyzing the banknotes from these different countries and regions to work out how to handle them and to expand the range of options able to be offered. Table 1 lists the factors relevant to overcoming these challenges.

Fig. 2 shows the differences in the dimensions of banknotes from different countries and regions, one example of a physical banknote characteristic.

Commercialization of Banknote-recycling Mechanism

Hitachi overcame the three challenges described above to release the Hitachi Cash Module worldwide banknote-recycling mechanism in 2000. With ongoing enhancements having been made since then, the unit continues to be supplied as a core module. ATMs fitted with the Hitachi Cash Module are now operating in more than 50 countries around the world, including China and India. The Hitachi Cash Module is an entry-level model for banknote-recycling that can work with banknotes in a variety of sizes from around the world by using multiple cash cassettes, a cash handling technique common in overseas CDs.

In 2009, Hitachi released the Universal Recycler (UR) series next-generation banknote-recycling mechanism and the Smart Recycler (SR) series of ATMs fitted with the UR mechanism (see Fig. 3). Hitachi has continued to develop the technology of the UR series based on the needs of different stakeholders and the problems they face, namely the operational considerations of banks, the staff who handle cash, and the ATM users. In addition to increasing cassette capacity to lengthen the time between visits to

Fig. 3—Next-generation Banknote-recycling Mechanism and ATMs in which it is Used.
The series was developed with consideration for a variety of needs and issues, including staff and the operational considerations of banks as well as users.

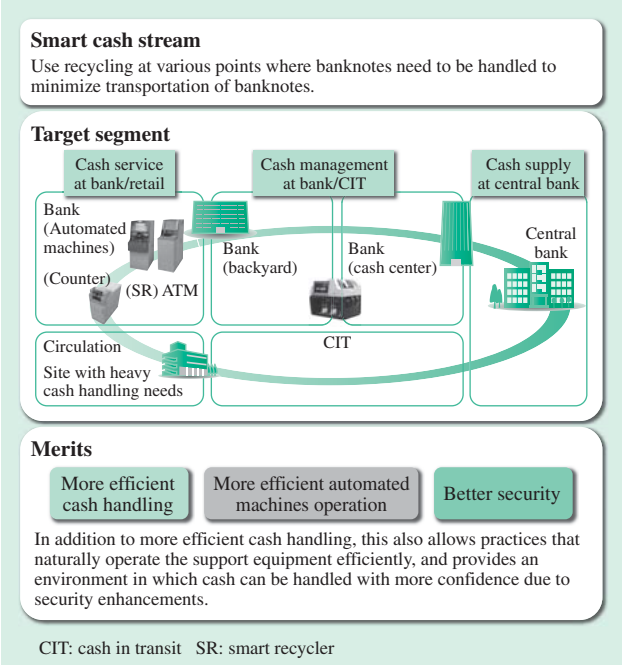

Fig. 4—Minimizing Quantity of Banknotes to be Transported for Cash Circulation.
Efficient cash handling and better security can be achieved by minimizing the quantity of banknotes that need to be transported.

replenish or collect cash, the machines are equipped with an internal mechanism for verifying the number of notes with a view to offering a wider range of solutions in the future. They also support tracking of banknotes by serial number.

In the future, Hitachi intends to develop solutions that improve the efficiency of cash handling and equipment operation, enhance security, and allow cash to be handled with confidence by using the banknote-recycling mechanism to implement banknote-recycling at different points and minimize the quantity of notes that need to be moved (see Fig. 4).

The next section describes the technologies that underpin the banknote-recycling mechanisms and solutions already in commercial use.

Sensing Technologies for Banknote-recycling Mechanisms

While automated machines need to recycle as many deposited banknotes as possible to achieve a high level of cash handling efficiency, they also need to avoid accepting counterfeit or deliberately altered notes and dispensing worn notes. On the other hand, being too strict about banknote validation will detract from user satisfaction and operational efficiency by rejecting notes that could have been accepted or withholding notes that could have been used for withdrawals. Furthermore, banknote validation needs to take place in the very short period of time between the note's passing through the validator and its sorting in the stacker.

In response, Hitachi has applied optical, chemical, and electromagnetic techniques to the study of banknotes from around the world to develop validation technologies that combine sensors and algorithms. The banknote validator performs high-speed processing that integrates data collected from sensors. In addition to identifying the denomination, it also reads the security information and features built into each banknote and uses a recognition algorithm to perform a counterfeit check in realtime.

The UR series is also equipped with technology for reading banknote serial numbers. Because it can identify individual banknotes, this function can be used for more extensive banknote tracing, in the ATM and elsewhere and including counterfeit or altered notes. It can also detect and separate banknotes that are unsuitable for circulation because they carry advertising messages or other printing, which happens in some countries.

Handling Technologies for Banknote-recycling Mechanisms

For banknote-recycling to work in practice, it must be capable of reliably feeding different types of banknotes from various countries. Banknotes come in a variety of denominations, sizes, and materials (different types of paper, polymer notes), with a lack of uniformity in the size of notes of the same denomination being not uncommon. Other problems include banknotes that have become wrinkled, folded over, creased, or torn in use, or that contain staples. Also, as ATMs can be installed on exterior walls, measures are needed to deal with extremes of temperature and humidity, or with dust in the case of sites near deserts.

In response, the cash module is able to feed banknotes reliably, even when notes of different sizes, materials, and conditions are present, thanks to the provision of an advanced note separation mechanism and stacking and transport mechanism. The cash module also reduces faults by optimizing the path that banknotes travel to shorten its length while also preventing jamming, even if notes overlap or foreign material is present. As an environmental measure, the cash module features high-speed note transport without jamming by adopting a mechanism that stabilizes the feeding force even if large changes occur in temperature or humidity. Other functions automatically remove dirt from sensors and

automatically adjust sensor sensitivity to maintain sensing accuracy and reduce the incidents of faults due to dust.

SOCIAL CHANGE BROUGHT ABOUT BY RECYCLING ATMS

Hitachi began supplying recycling ATMs to Chinese financial institutions in 2000. As in Japan, the machines were initially marketed as a solution for reducing teller workload and improving cash handling efficiency, and this remains the main reason for their installation. The increase in the number of recycling ATMs operating in China is forecast to exceed 50,000 per year in 2015, making up about 60% of all automated machines installed. Similarly, it is forecast that about 5,000 machines/year will be installed in the Association of Southeast Asian Nations (ASEAN) and about 2,500 machines/year in India (Hitachi estimate based on Global ATM Market and Forecasts published by Retail Banking Research).

The operational efficiency of recycling ATMs is at its best (the work of replenishing or collecting notes from the machines is reduced) when the numbers of banknotes deposited and dispensed are in balance. The benefits are also greater when the daily transaction volume is high. However, because past experience indicates that recycling ATMs tend to dispense more money than they take in, one challenge in further improving operational efficiency is to increase the number of banknotes deposited.

In one example, ATMs were set up to handle monthly customer payments on credit cards issued by a retail bank. This resulted in a considerable number of deposit transactions, and succeeded in improving the ATM operational efficiency by bringing the number of banknotes deposited and dispensed into closer alignment. As a consequence, to improve customer service, credit cards and the provision of ATMs contributed to each other's wider adoption in China where paying by cash has been the norm. Users are able to enjoy better transaction services thanks to the spread of credit cards. The bank benefited through higher card transaction fee income, more efficient ATM operation, and a reduction in queuing at branches thanks to more ATMs being available, leading to a virtuous circle of further customer service improvements.

By using ATMs, which have become part of the social infrastructure, customers can now feel confident about withdrawing or depositing money regardless of time or place.

CONCLUSIONS

This article has described solutions for overseas financial institutions based around recycling ATMs, and the banknote handling and sensing technologies that underpin them.

Hitachi believes that these technologies can extend the role of the automated machines that act as intermediaries between banks and customers beyond their use as a substitute for over-the-counter services, spreading a culture of recycling banknotes in ATMs and other automated machines throughout the world and delivering solutions and services that make the way people live in society safe, secure, and comfortable.

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