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HITACHI
Inspire the Next

Digital-driven Financial Innovation
–FinTech & Beyond–

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From the Editor

Along with the key topic of financial technology (FinTech), the information technology (IT) and business models used for financial services have become topics of unprecedented interest. Although people are familiar with financial IT in terms of bank automated teller machines (ATMs) and making payments at branches and over the Internet, news articles about system consolidations taking place as a result of bank mergers are not something that particularly excite the interest of ordinary consumers.

Recently, however, the emergence of highly convenient financial services provided by FinTech startups over smartphones and tablets has driven a major shift in consumer awareness of financial services, while existing financial institutions are also drawing in interested players, giving rise to a never-before-experienced level of activity in the field of service innovation. Underpinning all this, progress is also being made on environmental improvements like deregulation and standardization by governments and agencies.

Advances in digital technology, meanwhile, are driving what is called Industrie 4.0, prompting innovation and competition on a global scale in a variety of fields. It is anticipated that this will develop into a major transformation that will encompass all areas of society, a phenomenon that has been dubbed “Society 5.0.”

Hitachi has a track record of developing high-quality platform products and mission-critical information systems for its financial institution customers inside and outside Japan, and supplying them with a wide variety of solutions and other IT services. Recognizing the trends represented by FinTech and digitalization, Hitachi has also launched new initiatives in “digital financial innovation.”

This issue of *Hitachi Review* describes, (1) what forms financial innovations driven by advanced digital technology will take, (2) measures for using digital technology to boost financial business efficiency and collaborative creation with customers in order to produce these innovations, and (3) the type of platforms that will underpin digital financial innovation. The focus in these articles is not so much on presenting case studies or describing already established technologies, but rather on presenting possibilities for what sorts of things Hitachi should create by leveraging its technology and know-how, and its extensive links with customers, in the form of digital financial innovations.

I look forward to receiving the opinions from readers of this issue of *Hitachi Review*, and I hope that we can all work together toward achieving “digital financial innovation.”

Editorial Coordinator,
“Digital-driven Financial Innovation —FinTech & Beyond—” Issue

Toshiaki Tokunaga

Vice President of Financial Information Systems Division, Financial Information Systems Division, Financial Institutions Business Unit, Hitachi, Ltd.

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Digital-driven Financial Innovation

—FinTech & Beyond—

FinTech, a term coined in America from the combination of the words finance and technology, has become a key topic in the world of finance. FinTech is giving rise to a stream of convenient financial services that utilize smartphones and other digital tools, or new digital technologies such as big data analytics, fostering digital financial innovations that are transforming business and other aspects of our daily lives.

Hitachi, which works with numerous customers to overcome challenges in its Social Innovation Business, is also seeking to use collaborative creation with customers for innovation in the world of finance. With an eye to the future of FinTech, Hitachi is taking on the challenge of working with its customers to bring innovation to the finance business through the development and provision of services and solutions that combine finance with the latest IT.

Expert Insights

Blockchain is Here for the Enterprise: The Hyperledger Project

Brian Behlendorf

Executive Director, Hyperledger Project

Brian Behlendorf is the Executive Director of Hyperledger Project. He was a primary developer of the Apache Web server, the most popular web server software on the Internet, and a founding member of the Apache Software Foundation. He has also served on the board of the Mozilla Foundation since 2003 and the Electronic Frontier Foundation since 2013. He was the founding CTO of CollabNet and CTO of the World Economic Forum. Most recently, Behlendorf was a managing director at Mithril Capital Management LLC, a global technology investment firm.

We are about to see a complete transformation in the way we exchange and track data and assets across industries. Creating standards for a cross-industry distributed ledger has the opportunity to revolutionize the way we do business, increasing trust, accountability and transparency while simultaneously streamlining business processes. With distributed ledgers, virtually anything of value can be tracked and traded and in a permanent, secure way that makes it easier to create cost-efficient business networks without requiring a centralized point of control.

While blockchain technologies were initially created to support the anonymity and secure the exchange of cryptocurrencies in the 2000's, perhaps most famously in the Bitcoin[*1] system released in 2009, the technology has business applications far beyond cryptocurrency. Companies across industries have already begun to apply blockchains to financial assets, manufacturing, intellectual property or real estate. In many cases, these systems have nothing to do with cryptocurrencies, but are simply common ledgers and smart contract platforms.

This is where the Hyperledger[*2] Project (HLP) comes into play. The HLP was founded in December 2015 as a collaborative effort created to advance blockchain technology by identifying and addressing important features for a cross-industry open standard for distributed ledgers that can transform the way business transactions are conducted globally. As we have seen with many early-stage and complex technologies that fall under the collaborative project umbrella at the Linux Foundation[*3], the beauty of cross-company and industry open source projects is that organizations can share the unprofitable and unsexy work of building the libraries and standards that underlie systems. A shared code base also serves as an excellent way of concurrently building a standard for coexisting on a blockchain.

The HLP envisions a world of many chains, some public like Bitcoin, some private, some "unpermissioned" like Bitcoin, some "permissioned" like you will likely see in healthcare settings, at least initially. Hyperledger aims to provide tools for communities to build their own chains, rather than driving everyone to one chain. Much like the Apache web server project drove people to build their own websites, rather than encouraging everyone to just use one big site.

The joint goal is to develop a common distributed ledger technology that is shared, transparent and decentralized, which makes it ideal for enterprise applications in finance and a myriad of other areas including retail, banking, manufacturing and the Internet of Things. Designed for collaboration and with a strong focus on privacy, confidentiality and auditability, Hyperledger allows anyone to create their own blockchain shared ledger for their own company, industry or personal use case.

The Project's mission is four-fold:

1. To create an enterprise-grade, open source distributed ledger framework and code base, upon which users can build and run robust, industry-specific applications, platforms and hardware systems to support business transactions.
2. To create an open source technical community to benefit the ecosystem of the HLP solution providers and users focused on blockchain and shared ledger use cases that will work across a variety of industry solutions.
3. To promote participation of leading members of the ecosystem including developers, service and solution providers and end users.
4. To host the infrastructure for the HLP, establishing a neutral home for community infrastructure, meetings, events and collaborative discussions and providing structure around the business and technical governance of HLP.

With more than 80 members (as of August 30, 2016), the HLP is among the fastest-growing projects at The Linux Foundation with an impressive membership base. As a premier member, Hitachi will likely play an important role in the project. It is still early days, but as we advance in establishing open source standards across blockchain technology, we will see a significant evolution in how we conduct transactions across industries.

*1 Bitcoin is a registered trademark of bitFlyer, Inc.
*2 Hyperledger is a trademark of The Linux Foundation.
*3 Linux Foundation is a registered trademark of The Linux Foundation. Linux is a registered trademark of Linus Torvalds.

Technotalk

Understanding the Essence of FinTech and Leveraging It for Innovation in Finance

Yuri Okina, Ph.D. Vice Chairman, The Japan Research Institute, Limited
Shuhei Aoki Corporate Officer and Executive Strategist, Hitachi, Ltd.
Toshiya Cho Senior Vice President, Financial Innovation Center, Business Planning Unit, Financial Information Systems Sales Management Division, Financial Institutions Business Unit, Hitachi, Ltd.

As use of smartphones spreads throughout society and rapid progress is made in technologies such as big data and AI, there is rising interest in FinTech, which creates new services that combine these information technologies with financial services. Hitachi is focusing on the financial sector as one of the core areas of its Social Innovation Business. Hitachi intends to support innovation in banking and finance through collaborative creation with customers by accelerating its efforts on FinTech, including participation in an international joint development project for blockchain technology and the establishment of a FinTech-related research and development organization in Silicon Valley in the USA.

What is FinTech?

Cho: There is growing expectation and trepidation that the emergence of new financial services, collectively called FinTech, and the rise of the companies who provide them will bring about a revolution in the world of finance. As you know, the term "FinTech" comes from the combination of the words finance and technology. While the linking of finance and technology, and especially information technology (IT), is nothing new, what implications can we expect for the financial business from this new trend represented by FinTech? We are here today to discuss this subject with two people who are closely involved with the finance industry and financial services.

To begin with, the term "FinTech" has a variety of meanings. How do you think it should be defined?

Aoki: There is a certain degree of ambiguity in terms of the meaning and scope of how the word is used. What I personally found most interesting was the categorization adopted by José Antonio Gallego[*1], a former executive at a bank in Spain. He divided up FinTech services into five types.

The first type is Sioux, which refers to the native American tribe. Gallego used the highly independent-minded people to represent the targeting of new customers that were previously ignored by banks. This type of FinTech service covers social lending, for example. The second type is Guerrilla. This involves services that target expensive bank services, including a foreign exchange service vis-a-vis individual customers, that charge lower fees than a bank by using the Web to match people who want to swap, for example, yen for dollars with people who want to swap dollars for yen. The third type is Samurai, referring to defeating a formidable enemy with a simple implement like a sword. One example is a service that recommends the most suitable mutual funds for a customer when the customer responds to a simple questionnaire on a smartphone. The fourth type is Double Agent, referring to business models that are based on using the infrastructure of banks to supply their services. This type includes services that provide customers with funds transfer services using the credit card infrastructure. The fifth type is Invaders from Outer Space that, if they should exist, could ruin mankind. In other words, these are services that do not look profitable but, if successful, could mean the end of the banking industry. Virtual currencies and the blockchain platforms they run on are covered under this type.

Okina: Is it the emergence of innovative technologies that has made these FinTech services possible?

Cho: Rather than technological breakthroughs, I believe it is more about creating new services through the skillful combination of existing technologies. Blockchain technology, for example, seems like a new development, but it was originally devised as the basis

*1 José Antonio Gallego, Banco Bilbao Vizcaya Argentaria, S.A. (BBVA). URL: http://banknxt.com/53695/fear-fintech-startups/, http://banknxt.com/author/joseantoniogallego/

for the Bitcoin[*2] virtual currency. That is, you can take the view that all this attention suddenly being directed toward blockchains is because they can be used, not only as a virtual currency, but also for a wider range of businesses and applications.

In that sense, there are other factors behind the rapid growth in FinTech over recent years.

Aoki: According to bankers in the USA, there are two major factors at play. The first is that a portion of the bankers who lost their jobs during and after the Lehman crisis in 2008, set up finance-based IT ventures and moved to the West Coast. The second factor is that the worldwide spread of smartphones has led to a rising number of people who want everything to be handled cheaply and efficiently with a personal touch, including banking transactions.

Okina: In addition to those factors, another development that is believed to be driving the growth of FinTech with a strong personal touch is that progress in technologies such as big data analytics and artificial intelligence (AI) has, for example, made it easier to offer custom-made services that use transaction or event records.

The aftermath of the 2008 financial crisis saw, not only a reduction in the capital base of American financial institutions, but also a tightening of banking regulations. Moreover, another consequence was that the loss of equity due to the large drop in real estate prices dramatically increased the number of people who cannot borrow from banks. It was that gap, you could say, that led to IT companies offering financial services like crowdfunding and social lending.

Link between Finance and IT in FinTech

Cho: As noted earlier, there has long been a connection between finance and IT. In what way is the connection in the case of FinTech different than in the past?

Aoki: Major progress was made on the adoption of IT in the financial sector during the 70's and 80's when the rapid increase in the number of financial transactions (and increased amount of paperwork) due to the liberalization and internationalization of banking services coincided with the popularization of computers. What was demanded of IT in this period was "processing"—information system technologies were used to process existing operations, which were skyrocketing.

Subsequently, financial crises that took place in a number of countries during the 90's and 2000's highlighted the need for enhancing the safety of payment and settlement systems, as well as of financial transactions, without compromising efficiency. As a result, the link between finance and IT was strengthened to achieve "sophistication" of operational safety and efficiency.

In contrast, what we are now seeing, I believe, is a move toward "usurpation," whereby finance and IT are being brought together by new players in the financial market to take over existing operations that had been handled by traditional financial institutions or payment and settlement infrastructure.

Okina: Clearly, the Internet has played a major role in usurpation. In that sense, we can say that FinTech is part of the Internet of Things (IoT), can't we?

The robust systems used for payment processing in the banking industry, in which the payment system is operated by a restricted group of finance industry participants using large centralized computers, were largely put in place back in the 80's before the spread of the Internet. However, the subsequent development of the Internet has led to the decentralization of networks, opening them up to many participants, and spreading them to the edges of the banks' payment networks. These other participants have taken the initiative, and have come to provide a wide variety of services from a user's perspective.

Due to high cost-performance, a consequence of not requiring hardware and instead relying on bank deposits for final settlement, FinTech has seen the emergence of a steady stream of new business models. Companies with extensive customer bases made up of Internet users are entering the market also. These factors can be seen as bringing major changes to the competitive environment in ways that usurp the role of existing financial institutions.

Cho: Defining FinTech according to the five types mentioned earlier, how do you see this going?

Okina: It seems likely that non-banks will continue to make active use of FinTech as a tool for providing an alternative interface with banks' individual customers, or an alternative infrastructure for the transfer of capital and securities provided by a trusted third party. The former corresponds to the first four types, and the latter corresponds to blockchains used as an infrastructure for transferring goods and money.

Vision and Strategy are Crucial

Cho: While I assume that banks will bear the brunt of the impact of FinTech, what impact do you foresee on the existing banking industry from the changes you

*2 Bitcoin is a registered trademark of bitFlyer, Inc.

have spoken of, particularly the change involving non-banks taking over the interface with customers?

Okina: Looked at from a macro perspective, the core functions of banks have been to act as intermediaries for finance and to settle payments. In terms of acting as financial intermediaries, there has been a progressive breakdown (unbundling) of this function since the 80's due to financial innovations such as securitization and derivatives, with a variety of players entering this field. The settling of payments, meanwhile, has been an area in which banks have traditionally had a monopoly, and while it is still the case that final settlement is made by cash or bank deposit, this is another area where unbundling has progressed in recent times, and a variety of players have become involved in the portion of payment services that precede final settlement. By providing added value and better convenience than banks, I believe they will continue to encroach on that function.

Yuri Okina, Ph.D.

Vice Chairman, The Japan Research Institute, Limited

Graduated from the master's program at the Graduate School of Business Administration, Keio University in 1984. Commenced work at The Japan Research Institute, Limited in 1992 after working at the Bank of Japan. Other subsequent appointments include non-executive director and member of the industrial revitalization committee at the Industrial Revitalization Corporation of Japan (2003 to 2007), Council Member of the Science Council of Japan (SCJ) (2005 to 2014), and Guest Professor at Keio University (2014 – Present). Appointed to her current position in 2014. She has a doctorate (economics) from Kyoto University, is a Member of the SCJ, and a member of the Japan Society of Monetary Economics (JSME).

Aoki: It would be fair to say that FinTech has dramatically improved the efficiency of the pre-settlement stage where we make transactions and deliver payment instructions. It also improves efficiency in the post-settlement stage, such as in managing household account books. Thus traditional banks may lose customer interface, or customer bases more broadly, because new players providing efficient services come between banks and their customers, just like a wall that makes the customers invisible to banks. The impact of this is not likely to be small, particularly in the case of small- and medium-sized financial institutions that have similar customer segments to the FinTech companies. In the extreme, banks may be reduced merely to handling batches of customer funds transfers brought to them at the end of each day by the FinTech companies.

Cho: Is the situation different for large banks?

Aoki: Of course this is nothing but a stylized model of the real world, and there are big differences between banks. That said, large banks have extensive transactions with the wealthy segment (in the case of individuals) and large companies (in the case of companies), so their customers are different from those of FinTech companies which mainly target the mass market. Accordingly, large banks are not in much competition with FinTech companies. Moreover, those banks could also choose to adopt FinTech themselves in order to acquire customer segments that are new to them. However, large banks still do have customers among the mass market, and it goes without saying that they are at risk of having FinTech companies encroach on that customer base. In that case, there is an emerging trend toward infrastructure-heavy banks collaborating with FinTech companies using minimal assets of their own.

Cho: Whether they are small- and medium-sized or large-sized, banks are showing strong interest in FinTech. Does this mean that they will adopt FinTech for themselves in order to avoid losing customer interfaces to start-up companies, or will they make an effort to acquire new customer segments?

Okina: The reasons why individual banks are interested in FinTech are many and varied. These reasons might include using FinTech to go into direct competition with start-up companies in order to maintain their customer base, researching trends in FinTech without actually using it themselves in order to determine what response is needed, or working with FinTech companies with the aim of acquiring new customer segments. Whatever approach banks adopt, FinTech is one of the trends that exists at present. In a situation like this, it may be only natural that they

first seek to build knowledge and then try some new initiatives of their own.

Cho: If traditional banks take steps that involve the use of FinTech, what sort of things should they be watching out for do you think?

Aoki: Obviously, FinTech is just a tool. It seems to me that an approach like, "let's give FinTech a try," is getting one's priorities backwards in the sense of choosing what to do based on the tools available. What is important is to start from "what" by identifying what kind of services they should provide that will enable them to differentiate themselves and maintain and enhance their competitive position in relation to FinTech companies and other financial institutions. Having made that decision, there are a variety of "hows," in other words tools, available. The key is to choose the optimal tool that can be what you call FinTech, or can be a traditional one. Starting with the tool first may carry a heavy risk of wasted effort.

Okina: I agree. In the future, banks will need to compete or to collaborate with the new FinTech companies entering their markets. Whichever option banks choose, open innovation will be vital if they are to overcome the limitations of their principles of self-sufficiency. However, without a vision and strategy for how they intend to use IT, such initiatives will end in failure. Particularly crucial is the idea of continuing to change their business models by using IT on the basis of a clear strategy.

Cho: What is needed to change their business models?

Okina: The banking industry in the developed countries, particularly in Japan, is experiencing an era of low growth and surplus funds, with fewer financing opportunities. In addition, the impact of a declining population will become more pronounced, with difficult times ahead during which the deposits that make up the banks' customer bases are forecasted to decrease. I believe the banking industry needs to work out strategies for the future from a rigorous user perspective. Also crucial, I believe, is to consider what makes banks different from IT companies, and what capabilities they have that come with being a financial institution.

Potential of Blockchain and Virtual Currencies

Cho: Dr. Okina noted earlier that another consequence of FinTech, in addition to its serving as an alternative interface, is the potential use of blockchains to create new infrastructure. Will this result in Bitcoin superseding existing currencies? If it does so, I think this would usher in a major new epoch with respect to the social infrastructure we know as money.

Aoki: While there are cases where blockchains can be used as infrastructure for enabling the transfer of money and assets between an unspecified number of participants, there are also cases where they are used for transfers between specific participants. Although the mechanism for verifying the validity of a transfer differs depending on which of these is involved, in either case, the same basic concept applies of progressively building up a chain of records of transfers of money and assets between people. It is an electronic endorsement, so to speak. While blockchain technology is often treated as if it were a subset of FinTech, the mechanism itself is actually not directly related to finance, and it can be used much more widely for non-financial transactions, such as vehicles, real estate, and diamonds.

Cho: Do you mean that virtual currencies will not enter widespread use?

Shuhei Aoki

Corporate Officer and Executive Strategist, Hitachi, Ltd.

Joined the Bank of Japan in 1981 and served as the General Manager for the Americas, Director-General of the Financial Markets Department, Director-General of the Payment and Settlement Systems Department, and other positions prior to joining Hitachi, Ltd. in 2014.

Aoki: As with existing electronic monies, I expect they will gain a certain degree of popularity. However, for a virtual currency to be used like bank notes or bank accounts, it would require the establishment of a level of trust similar to existing currencies, by letting the virtual currencies be armed with mechanisms similar to banking regulations, deposit insurance, monetary policy operations, and other relevant things by which traditional monies are protected. Without that, a virtual currency will not be used as a form of money that everyone is willing to accept. The initial use of blockchains will be in the world of goods and services; their use in the world of money will still be considerably far into the future.

Cho: If the role of existing currencies will not change significantly in the near future, what then is the significance of virtual currencies for existing currencies and central banks?

Okina: Certainly, I do not think that virtual currencies are likely to replace existing currencies any time soon. However, the fact that virtual currencies are now able to be traded means that they can be thought of as representing the antithesis of existing currencies. The increase in Bitcoin trading that occurred during the financial crisis in Cyprus reminded me of how important it is that central banks retain people's confidence. It may well be that use of virtual currencies will continue to grow and play that role.

Cho: What about the use of blockchains in asset transactions?

Okina: I believe that blockchains have many potential applications. As you noted, the new technology for electronic endorsements in decentralized networks may well replace the transfer control mechanisms that have existed up to now that involve a central administrator. There is interest in many sectors, including securities trading and real estate registers, and I hear that there are initiatives in this direction being undertaken by the government in places like Estonia. In that sense, the blockchain can be thought of as a technology that has the potential to bring about an efficient transformation in various trading systems used by society, both in the private and public sectors.

Toshiya Cho

Senior Vice President, Financial Innovation Center, Business Planning Unit, Financial Information Systems Sales Management Division, Financial Institutions Business Unit, Hitachi, Ltd.

Joined Hitachi, Ltd. in 1985. After serving in roles including systems engineer for the securities industry, CRM solution development for financial institutions, and business consulting, he was appointed to his current position in 2016. Mr. Cho is a member of the Governing Board of the Hyperledger Project of The Linux Foundation, and is a part-time lecturer in the graduate school at Kyushu University.

Services being Transformed by Big Data and AI

Aoki: I would now like to look at FinTech in its role as a technology. We discussed earlier that the core of FinTech, from the perspective of the financial business, would be customer interface and transfer infrastructure. What then will be the essence of FinTech in terms of technology?

Cho: Seen in terms of technology, FinTech can be split into two layers. The first is the interface and infrastructure layer, which is close to business, and the second is the layer composed of big data, AI, and security that underpins the first layer.

First, with respect to interfaces, open application program interfaces (APIs) are one notable example. APIs provide a simple means for making some of the functions of applications and other software available for use by other systems, and those APIs that are made available to third parties are called open APIs. If end users are to be able to freely choose services that suit their lifestyles, then it is necessary to coordinate services across industries, and it is also necessary for financial institutions to deliver new services quickly. APIs will likely play a vital role in the interoperation between existing systems and new services. If the operations of financial institutions are provided through APIs, the standardization of interconnections with external services will make

it possible to offer advanced financial services that involve open innovation in the IT sector.

Okina: While blockchain will be a key technology for infrastructure, what possibilities and challenges do you see for blockchains from a technical aspect?

Cho: With respect to blockchains, there were numerous studies and trials that were undertaken overseas in 2015, and there were moves to call 2015 the first year of the blockchain era. The fact is, however, that blockchain remains a work in progress, and there are outstanding technical issues including confidentiality and processing speed that remain. First of all, based on the recognition that blockchain is a technology with potential for enabling innovation across the entire social infrastructure, Hitachi is promoting its wider adoption and has become a premium member of the Hyperledger*3 Project, a joint international program set up to standardize blockchain technology by The Linux Foundation*3, a non-profit organization in the USA. In parallel with this, Hitachi is also working to overcome technical challenges, especially by improving the functions required for financial trading.

Aoki: What is your technical outlook for big data and AI, two topics that were mentioned earlier? And what changes do you think they will bring to financial services?

Cho: The age of big data has increased the amount of data available to financial institutions by an order of magnitude, and it is becoming difficult to make use of this data on the basis of past analysis techniques, rules of thumb, and intuition. Accordingly, we are working on applying AI to big data analytics for identifying correlations in the data.

*3 Hyperledger is a trademark of The Linux Foundation. Linux Foundation is a registered trademark of The Linux Foundation. Linux is a registered trademark of Linus Torvalds.

While rules of thumb and intuition can be useful, the application of AI can uncover correlations that were not previously suspected, and this can lead to business improvements and efficiency gains. We are also utilizing question-answering AI that analyzes and interprets large amounts of text data on topics with arguments for and against to provide the basis and reasons for those arguments, and are working on using it with big data.

We also expect big data and AI to be combined and to provide more sophisticated financial services, such as the calculation of insurance premiums automatically from data on vehicle use obtained using IoT technology.

Considering the Future of Financial Infrastructure for Society as a Whole

Okina: Interfaces and transfer infrastructure are dogged by concerns over security. Given that improvements in convenience and efficiency will fail if they do not also improve security, what advances in security are being made in terms of technology?

Cho: A wide variety of security measures are being used in financial systems already, a typical example is the use of biometric authentication in automated teller machines (ATMs). The fact is that issues of convenience remain with regard to the current method of storing biometric data on an integrated circuit (IC) chip. A new security technique developed by Hitachi to overcome problems like this is called public biometric infrastructure (PBI). This works by putting the biometric data through a one-way transform at the time of registration to generate a public key and storing this key in the cloud, so once a user has provided their biometric data, it can be made available for use by a

wide variety of applications. Instead of relying on a credit card or debit card, this enables “empty-handed” authentication in which the biometric means of identification provides both security and convenience.

Okina: What is Hitachi doing in the field of FinTech? And, what value do you see it having for use by existing financial institutions?

Aoki: The research and development group at Hitachi is actively deploying both human and capital resources on a wide range of technologies, including FinTech. In addition to the blockchain research mentioned earlier, we have also established our Financial Innovation Laboratory in Silicon Valley in the USA and have set about building relationships with local FinTech companies and exchanging information about the latest innovations. While it is through initiatives like these that we are able to establish the capabilities for providing customers with the newest and best tools and solutions, we also naturally work with customers to consider first the “what” questions, namely, what type of services should they be providing and what type of services are feasible. Hitachi is using FinTech as an opportunity to propose new business models to financial institutions and to engage in collaborative creation, not only supplying technology, but also offering solutions that take account of the nature of the services financial institutions provide. We intend to boost these activities further in the future.

Cho: Hitachi’s involvement in FinTech places an emphasis on the four fields we discussed earlier, namely, interfaces (including APIs), big data and AI, new financial infrastructure (including blockchains), and security (including PBI). These technologies can function independently or in tandem, and our aim is to use them as a basis for providing new value. Moreover, in addition to Hitachi’s own technologies, we also hope to engage in collaborative creation with financial institutions, while also using mergers and acquisitions (M&A) or collaborating with FinTech companies as necessary.

Aoki: Banking and finance is an information industry, and it has been the use of technological innovation, either in the front or the back office, that has made the industry’s growth and prosperity provide. Meanwhile, the recent rise to prominence of FinTech has a different character than past combinations of finance and technology. It is emerging powers promoting a tendency toward the usurpation of bank customer interfaces and existing payment infrastructure. It is anticipated that FinTech will continue to develop as a technology, so a major issue for existing financial institutions will be how they can protect or change their customer bases or interfaces. We seem to have reached the stage where society as a whole is thinking about what form the financial infrastructure, including payment media, should take in the future.

With population growth slowing in developed countries, innovation-driven improvement in productivity is becoming increasingly important. In such an environment, we cannot ignore the trend toward the use of FinTech in finance as well as in other sectors. In particular, we can look at this as a critical moment for traditional financial institutions in terms of how they respond to this trend. Drawing on knowledge from a wide variety of industrial domains, not limited to finance, Hitachi is on the lookout for ways that it can apply its knowledge as future social infrastructure with a view toward “FinTech & Beyond.” Thank you both for your time today.

Overview

Digital-driven Financial Innovation and Hitachi's Involvement

Takeshi Yoshikawa
Nobuhiko Sato
Toshiya Cho
Atsushi Uchizono

ENVIRONMENT SURROUNDING FINANCIAL INSTITUTIONS AND THE RISE OF FINTECH

SINCE the introduction of a negative interest rate policy, Japanese banks and other financial institutions have been facing a downturn in their revenues due to lower lending rates and investment yields, with many predicted to declare losses or lower profits for the fiscal year ending in March 2017.

Faced with this business environment, many financial institutions have adopted the use of financial technology (FinTech) as their immediate strategy, while boosting non-interest income and the use of information technology (IT) for operational efficiencies.

The term "FinTech" has in the past been mainly used to refer to startup companies, especially those that use IT to provide new financial services, and this trend has often been seen as a threat to the business of existing financial institutions because of the way it takes over (unbundles) certain functions of finance.

Despite this, along with the spread of open APIs[(a)], the new phenomenon of "rebundling" has also started to emerge with the aim of providing greater convenience by collaborating and coordinating with financial institutions.

Moreover, financial institutions have also started to make moves toward actively working with FinTech startups that have sophisticated technology or services in order to take advantage of their respective strengths, with the aim of delivering highly convenient financial services.

ADVANCES IN DIGITALIZATION AND ITS USE IN FINANCE

Meanwhile, advances in new digital technologies such as the Internet of Things (IoT), big data, and artificial intelligence (AI) are leading society and the economy with unprecedented speed.

The digital innovations in industry highlighted by Germany's Industrie 4.0[(b)] are spreading through a variety of fields, in a trend called "digitalization." Japan has come up with its own concept, Society 5.0[(c)], which broadly recognizes this digitalization as a way to resolve societal challenges.

Business cycles (ecosystems) in which new value is created by linking many different things together, representing them as data, and collecting and analyzing the resulting large quantities of data (big data), have seen initiatives being launched for implementation in a wide range of fields along with advances in IoT technology (see Fig. 1).

As the lifeblood of the economy, finance also needs to deal with the new ecosystems that digitalization will produce.

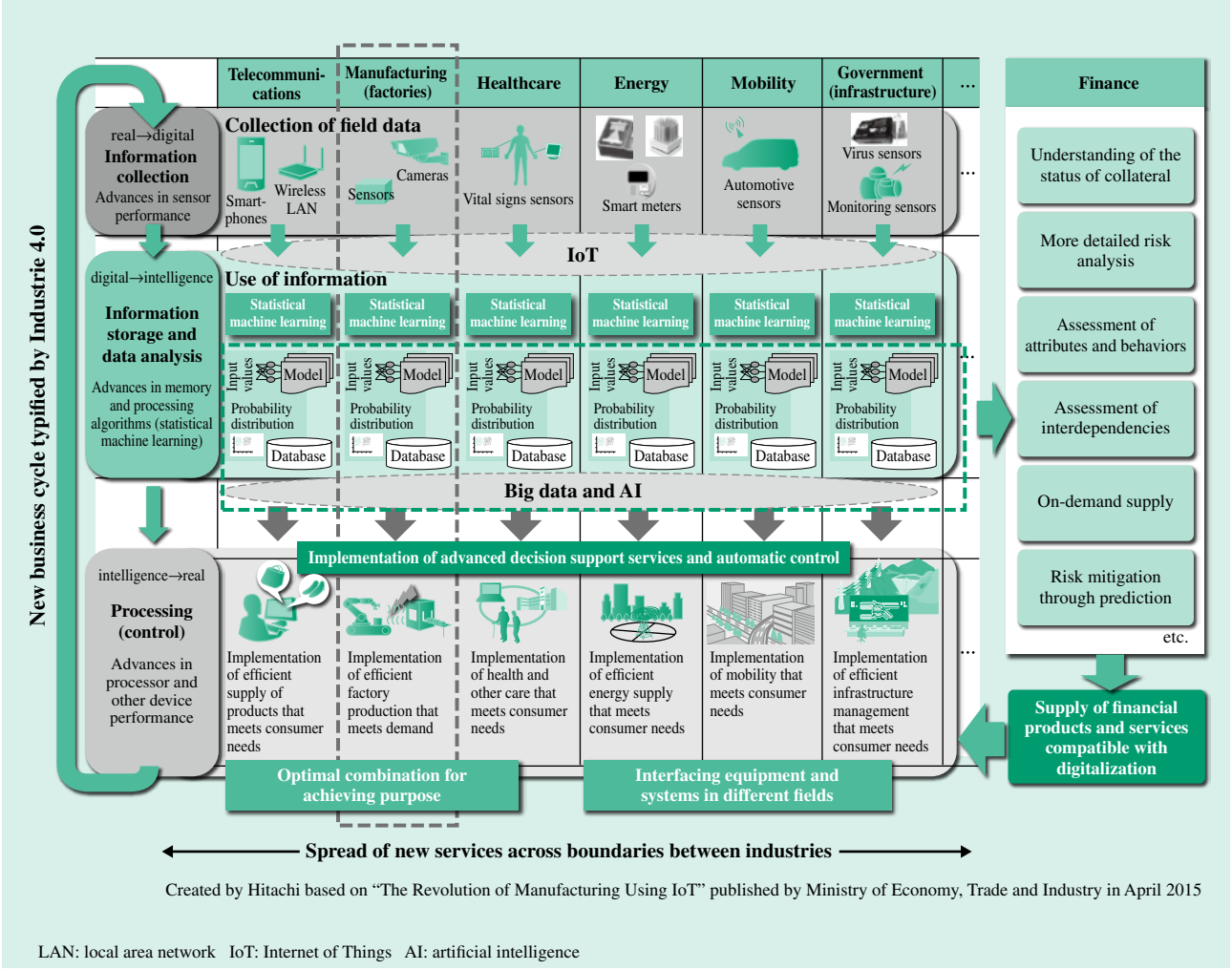
FINTECH AND DIGITALIZATION

This raises the question of what role the FinTech developments taking place in finance will play amid this overall trend toward digitalization.

(a) Open API
An abbreviation of "application programming interface," an API is a mechanism for using programs that are shared by different software to be consolidated in the form of components that can be called from applications. Because the use of APIs avoids the need to develop similar functions from scratch, it increases the speed and reduces the cost of development. Open APIs are APIs that are made available for use by third parties. Their advantages include encouraging the creation of new services that incorporate functions from the company's systems.

(b) Industrie 4.0
A high-tech strategy of the German government that anticipates the fourth industrial revolution. It aims to make all aspects of wide-scale industrial processes smarter and more standardized, including logistics, through the use of information technology (IT), including machine-to-machine (M2M), big data analytics, and the integration of industrial and business systems.

(c) Society 5.0
A series of measures aimed at creating a "super smart society" that can deal with the diverse needs of the public in an efficient and detailed manner through a sophisticated combination of cyberspace and the real world (physical space). The naming describes a new type of society that will be led by innovations in science and technology, following on from hunter-gatherer, pastoral-agrarian, industrial, and information.



Created by Hitachi based on "The Revolution of Manufacturing Using IoT" published by Ministry of Economy, Trade and Industry in April 2015

LAN: local area network IoT: Internet of Things AI: artificial intelligence

Fig. 1—Advances in Digitalization and Its Use in Finance.
Digitalization is advancing through technological innovations such as the IoT, big data, and AI. It creates new value by representing many different things in the form of data, and by linking and combining them.

The FinTech startups that have begun utilizing digital technology in financial services to supply greater convenience and efficiencies from the customer's perspective can be thought of as the pioneers of digitalization in finance.

There has been renewed awareness of the importance of the financial system to society since the global financial crisis (Lehman shock), even if in the negative sense of it having come so close to collapse, and the resultant tightening of expanded global financial regulation has forced the business of financial institutions back to a more traditional and prudent approach.

The FinTech startups that have emerged to fill this gap have expanded their businesses by winning over users. However, as they reach a certain business scale and establish a role for themselves as financial services, it is anticipated that they will find a place for themselves coexisting with or complementing the financial system made up of the existing financial institutions.

Meanwhile, these existing financial institutions are themselves taking active steps to adopt new digital technologies and are seeking to apply them in boosting their own operational efficiency and improving service.

Blockchain[(d)], for example, is seen as the technology that will have huge impact on the financial system and operational efficiencies. The organizations that underpin the international financial system,

(d) Blockchain
A distributed database system that serves as the basis of a virtual currency. Blockchain works by combining transaction records (deposits and withdrawals) for a certain time period together with the solution of a computational problem (which users compete to provide) into a single "block" that is sent to all users for them to keep. The name blockchain comes from the way the blocks are chained together in chronological order. The impossibility of going back and changing transaction details provides the irreversibility and prevention of duplication of transactions that is essential to a virtual currency. These attributes are also anticipated to make blockchain suitable for use in other fields.

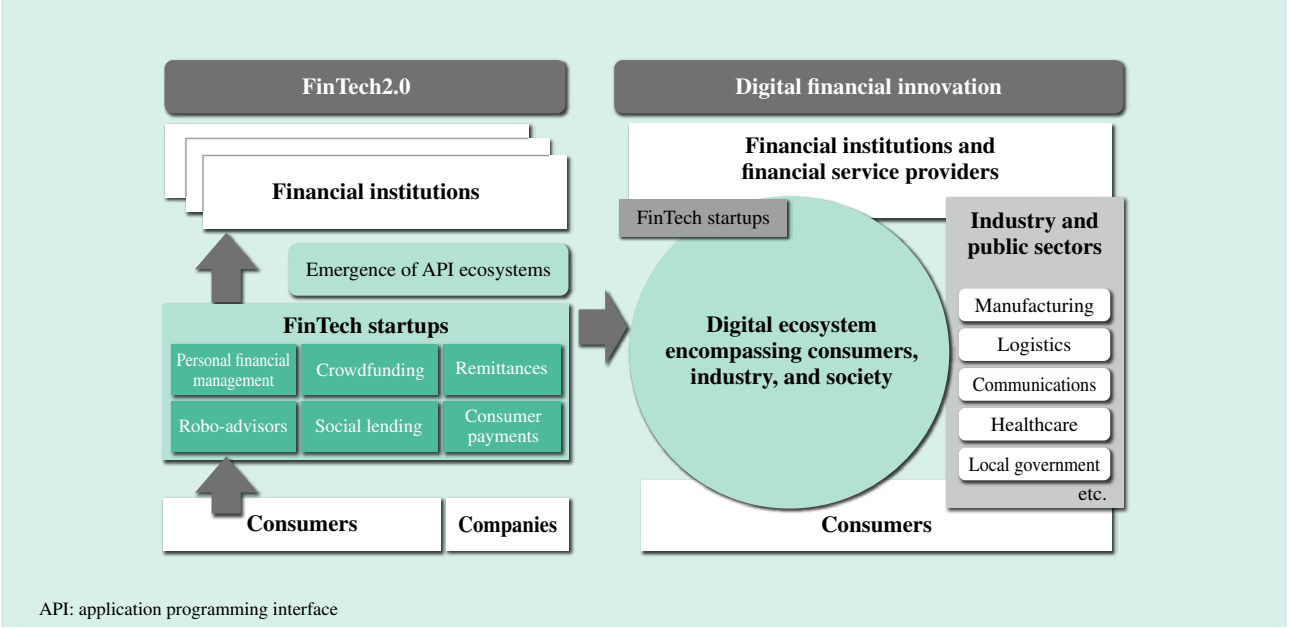


Fig. 2—Advances in FinTech and Digitalization.
While FinTech startups from outside the finance industry have attracted interest as providers of financial services, in the process of ushering in innovations in financial business, the trend toward digitalization is also drawing in existing financial institutions, industry, government, and consumers.

such as the international consortiums of major financial institutions and the Society for Worldwide Interbank Financial Telecommunication (SWIFT), are looking at applications and undertaking trials in which the technology will provide a basis for next-generation systems.

In this way, the emergence of FinTech startups and the digital initiatives of the existing financial institutions by this can be thought of as the start of genuine innovation in finance in an era of digitalization that uses digital technology to connect consumers, industry, and society (see Fig. 2).

DIGITAL-DRIVEN FINANCIAL INNOVATION

Hitachi anticipates that the financial innovations made possible by digital technology will evolve through the following three stages.

Stage 1: More efficient and convenient financial services

Stage 2: More efficient financial systems and financial institutions

Stage 3: Innovation in financial products and businesses

Stage 3 is expected to involve the emergence of various service platforms, with digitalization spreading to all areas of society, and with finance, too, being required to incorporate digitalization into its products and services.

At the present time, Hitachi believes that stage 1 is in progress and that financial institutions have begun initiatives aimed at stage 2.

Stage 1: More Efficient and Convenient Financial Services

While the efficient and convenient financial services provided by FinTech startups are underpinned by their characteristic easy-to-use and attractive user interfaces and functions, and by a fast delivery cycle, it is also true that they do not necessarily provide all of the financial services that users want.

Recent examples can be found of seamless financial services between existing financial institutions and FinTech startups, which is achieved by linking them together via open APIs.

From the perspective of the financial institutions, these open APIs are used not only to support FinTech, but also to provide an interface for coordinating their own financial services, within their financial group and with partner companies, or with customers and others.

In the future, it is expected that progress will be made on establishing API ecosystems that provide links between businesses, with studies on issues like the standardization of interface specifications, the establishment of user authentication techniques, and security (see Fig. 3).

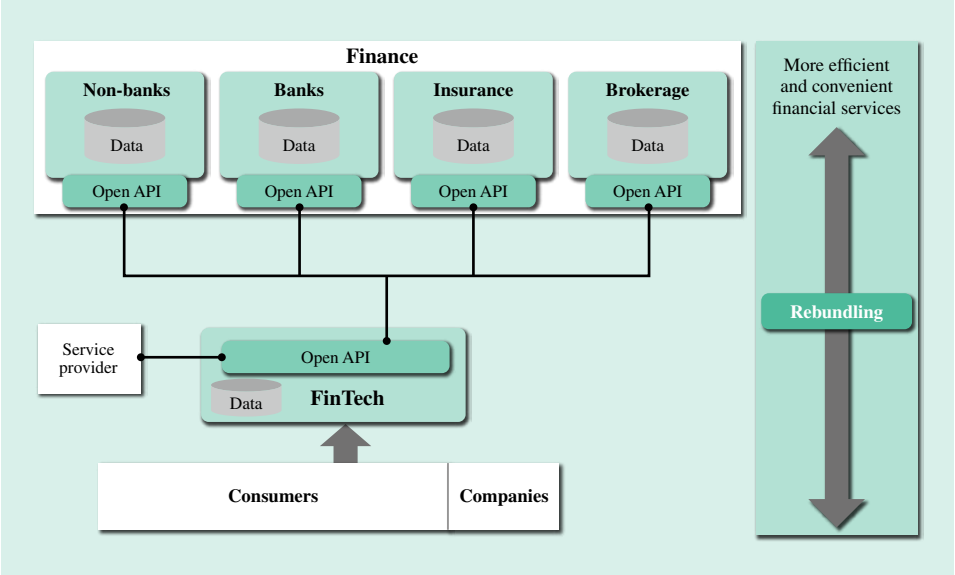


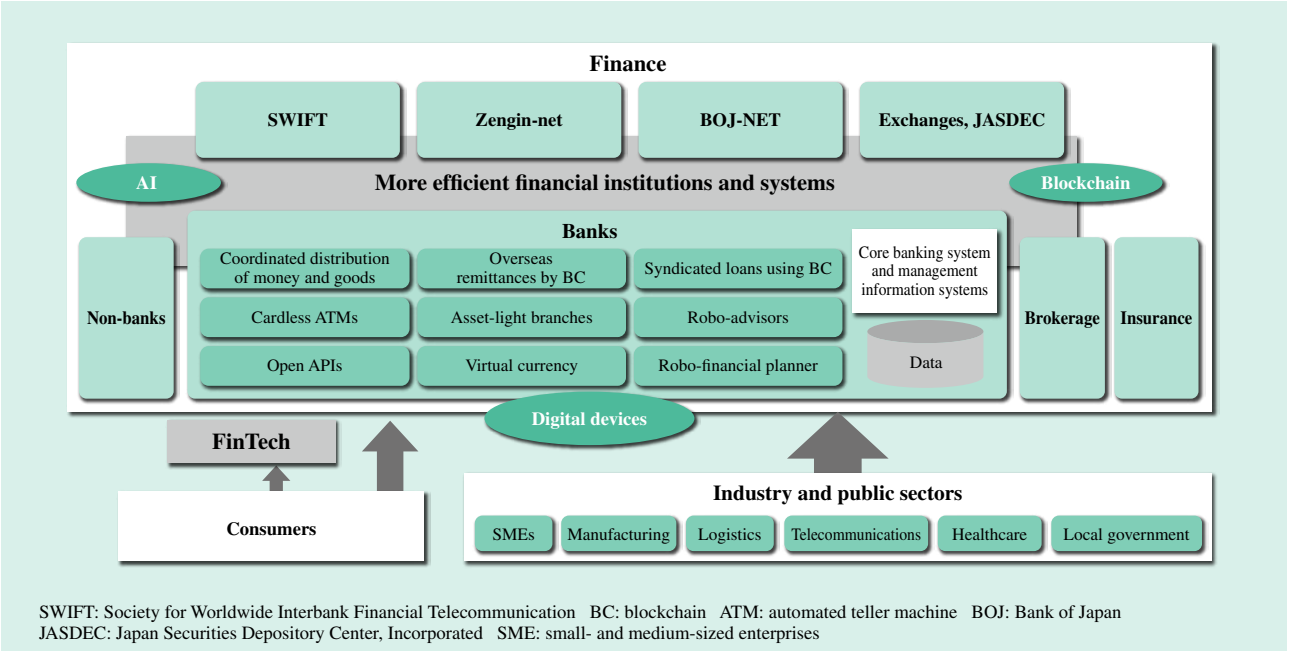
Fig. 3—Stage 1: More Efficient and Convenient Financial Services.
The financial services that FinTech supplies strengthen relationships with existing financial institutions and form API ecosystems. FinTech supplies financial services that are highly convenient to users, by leading financial services through a transition from unbundling to rebundling.

Stage 2: More Efficient Financial Systems and Financial Institutions

Meanwhile, financial institutions are starting to trial various ways of applying new digital technologies.

Trials involving the application of AI in finance extend from things like supporting call center operations and reducing reception workloads, to marketing analyses and fraud detection combined with big data analytics. The trials also extend to activities more closely associated with finance, such as the analysis of financial markets and investment portfolios.

Furthermore, the use of digital devices in financial services is also transforming the role of financial institution branches, not only by significantly improving the convenience of mobile banking, but also by driving major changes in how branches and automated teller machines (ATMs) are used by eliminating the need to carry cash cards and credit cards.



SWIFT: Society for Worldwide Interbank Financial Telecommunication BC: blockchain ATM: automated teller machine BOJ: Bank of Japan
JASDEC: Japan Securities Depository Center, Incorporated SME: small- and medium-sized enterprises

Fig. 4—Stage 2: More Efficient Financial Systems and Financial Institutions.
Innovations such as practical uses for AI and blockchain are being introduced along with greater use of digital devices among financial institutions. Work on improving the efficiency of financial systems, such as more advanced settlement methods, is accompanied by progress on using digital technology to improve the efficiency of financial operations and transactions.

In the case of blockchain, studies and trials are being undertaken that involve a variety of different use cases, and while obstacles to the technology's entering widespread use in finance are being uncovered, it has come to be recognized as the technology with the greatest potential for making fundamental efficiency improvements and cost savings at financial institutions and in market systems.

Along with the progress in payment systems, the anticipated benefits of the technology include cutting costs across the financial sector and speeding up settlement services by improving the efficiency both of internal procedures at financial institutions and of the financial system as a whole (see Fig. 4).

Stage 3: Innovation in Financial Products and Businesses

Having industry and the public sector become fully engaged with advances in the IoT, big data, AI, and other digital technologies will likely lead to numerous innovations, including new practices in the value chain from industrial workplaces to distribution and retailing; innovations in mobility; smarter healthcare, education, and government; and efficiency gains in industries like agriculture and tourism.

In the industrial sector in particular, while numerous industries are working at a global level to maintain international competitiveness, service platforms are required to support the introduction of such measures.

Service platforms provide functions for linking and combining by collecting, storing, and analyzing the large amount of data generated by IoT, and controlling data on transactions between ecosystem participants based on their relationships and dealings.

By using these service platforms, the finance industry has the potential to develop and supply innovative financial services that work with new ecosystems, achieving this linking and combining by sharing digital services and the big data of financial services users.

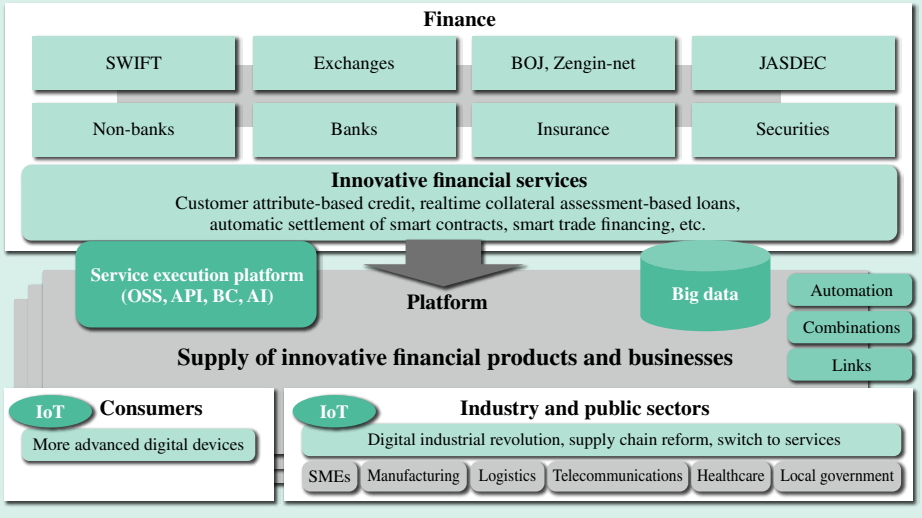
Moreover, these new financial services also offer the potential to differentiate financial products from those of competitors by combining them with know-how from institutions' own fields of expertise (see Fig. 5).

While it is anticipated that financial and other deregulation, will be needed to achieve this, what will also likely be necessary will be coordinated efforts by the public and private sectors so that the finance industry can achieve its own innovations along with the digital innovations of society and industry.

HITACHI'S INVOLVEMENT IN ACHIEVING DIGITAL FINANCIAL INNOVATION

As considered above, the digitalization that FinTech is bringing to the finance industry is also closely related to changes in industry and society, and represents a major development that presents opportunities for innovation in financial products and businesses themselves.

Hitachi is not only developing and supplying products, services, and solutions that incorporate new digital technologies to support digital financial



OSS: open source software

Fig. 5—Stage 3: Innovation in Financial Products and Businesses.
With the expansion of the IoT, accumulation and use of big data, advances in AI, and practical uses for blockchain, platforms are being provided for these functions that enable the development of innovative financial services through mutual links, combinations, and automation.

innovation by its customers who supply financial services, but also helping transform the finance business through collaborative creation with those customers.

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Featured Articles I

FinTech Accelerating with Growing Digitalization

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Yoshiyuki Yamamoto
Kenichi Suzuki
Ippei Nishida

OVERVIEW: With the IoT and other digital technology innovations being linked with EC and SNS, and in anticipation of regulatory reforms, there has been an expansion of digitalization that is stimulating the transformation of supply chains and business models by directly connecting individuals with companies. IT and financial systems have continued to advance while maintaining an inextricably close relationship to each other. The digitalization of financial flows using FinTech links capital providers and users directly, enabling low-cost fundraising, account settlement, and collections. By working with commercial flows and logistics, FinTech is enabling transactions that are smaller, higher-frequency, and more diversified. Constructing distributed financial platforms such as blockchains will become important.

INTRODUCTION

IN 2012, Silicon Valley entrepreneur, Janusz Bryzek, predicted that the number of sensor deliveries would exceed one trillion units annually by the beginning of 2020. With the spread of sensors into every aspect of society, things that never before existed as data have become digitalized and connected to networks, enabling finely-tuned data exchanges in realtime, with impacts on business value chains. Increasingly advanced analysis technologies such as artificial intelligence (AI) and simulations are enabling useful information to be extracted from massive amounts of obtained data, and are leading to service innovations.

Linking these types of digital technologies with communities and markets such as electronic commerce (EC) and social networking services (SNS) is anticipating regulatory reform by linking companies and individuals directly, and accelerating changes in supply chains and business models. In addition to expanding market participation by prosumers, service delivery innovations are advancing and seamlessly connecting the contract-payment-delivery series of transactions, enabling transactions to be completed in the digital environment.

Growth is currently centered around services aimed at individuals, such as car-sharing and homestay services, but in the finance sector, financial technology (FinTech) is creating financial flow innovations that enable new services that use digital technologies to link capital providers and users directly at low cost.

FINTECH DRIVEN BY CLIENT NEEDS

Currently, in the world's financial systems, FinTech and innovations that combine digital technologies and EC are advancing in the three fields of investment, account settlement, and information.

Specifically, there are three growth areas: (1) investment by crowdfunding [peer-to-peer (P2P) finance] that matches lenders and borrowers directly, (2) rapid account settlement done by mobile payments made from mobile terminals, and (3) mass-customization of financial services using information on personal activity and personal characteristics such as settlement history, SNS, and biometric information.

Growth of Crowdfunding in the Investment Field

In the investment field, crowdfunding has recently been gaining attention as a method of investment by using the Internet to link investors that have capital directly to borrowers that need capital. Crowdfunding's use as a fundraising method has expanded rapidly in the USA and elsewhere overseas, and the global fundraising volume for 2015 is estimated to be $34.4 billion (based on research by Massolution), and is expected to continue having a high rate of growth in the future. Crowdfunding lets an individual or company use an SNS or similar service to appeal to the general public for project funding. Once the fundraising target is achieved, the project is executed (see Fig. 1).

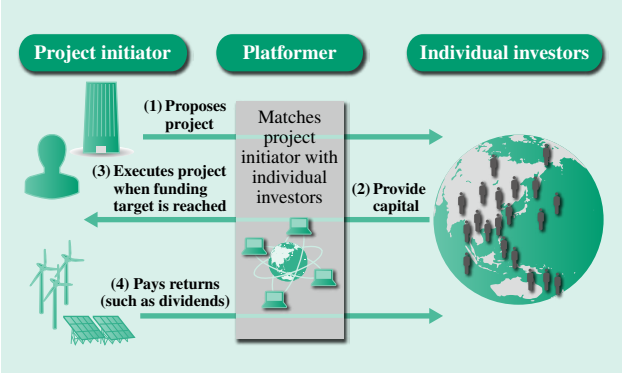

Fig. 1—Basic Scheme of Crowdfunding.
Crowdfunding works through an intermediary, known as a platformer, which directly matches a project initiator that is seeking funding with individual investors who will provide capital.

Crowdfunding uses an intermediary known as a platformer to match individual investors with those who need capital based on information about their characteristics. A 2- to 3-minute loan screening process is done via the Web to complete a loan or funding agreement.

Since there are many investors with different levels of risk tolerance, crowdfunding can offer various benefits such as the ability to raise funds for even small-scale risk ventures and, depending on matching, the ability to raise funds at a lower cost than the market interest rate. Crowdfunding also brings a wide range of financial products to the market. For example, some projects also offer non-monetary returns on investment by being primarily oriented toward corporate social responsibility (CSR) efforts such as low-cost sales of new products for investment, and reinvestment in the development of communities or developing countries.

Although the most users of crowdfunding as a fundraising method have so far been individuals and small- to medium-sized businesses, global companies have already started to use it also. Sony Corporation and Nissan Motor Co., Ltd. have used crowdfunding for developing new high-risk products such as smartwatches and electric vehicles, while the City of Memphis and the Coca-Cola Company have used it for highly community-oriented projects mainly designed to give back to the local area. When in-house R&D is underway for a cutting-edge project of unknown marketability, crowdfunding can provide an alternative to discontinuing development or selling out to a competitor. It provides a source of risk capital that can be used to gauge marketability and to continue development.

On the other hand, some financial institutions such as Banco Santander, S.A. and ABN AMRO Bank N.V. are also responding to the growth of crowdfunding by using it to finance projects in collaboration with individual investors. The use of crowdfunding by corporations should continue to grow in the future, along with the presence of financial institutions serving as lenders of last resort.

Increasing Financial Disintermediation Enabled by New Account Settlement Methods

In the account settlement field, the provision of inexpensive mobile payment services centered around mobile phone service providers is expanding. These services work by having the user pay cash to the service provider, who then forwards the payment to the payee (prepaid method). This method eliminates credit risk, while letting users send money (settle accounts) from their mobile phone or smartphone without using a bank account. The commission is low and the procedure is simple.

The benefits of mobile payment services are low cost and immediacy. For example, the commission for sending (settling) $100 from Japan to the USA using the USA's PayPal[*1] service is less than 400 yen, instead of the 6 to 8 thousand yen charged by conventional payment methods, and payment takes only 2 or 3 seconds instead of the conventional 2 or 3 business days. And, in many cases, mobile payments can also be made just by specifying the payee's mobile phone number, email address, or SNS account, making the procedure simple.

The use of mobile payment services offering high speed, low cost, and universal availability is expanding mostly among emerging countries where mobile phone use is spreading, followed by the USA and other developed countries. For example, the number of PayPal and Alipay[*2] accounts greatly exceeds the number of accounts held by major commercial banks. Some companies are trying to harness this rapid expansion of mobile payment services users by coordinating aspects of their own business with these services to change their business models or to improve their cash flows. Germany's BMW Group is developing a pay-per-use car rental service by linking mobile payment services to connected cars. The renter simply provides identification by touching a terminal built into the vehicle, and is then ready to begin their

*1 PayPal is registered trademark or trademark of Pay Pal, Inc. in the United States and many other countries.
*2 Alipay is a registered trademark of Alibaba Group Holding Limited.

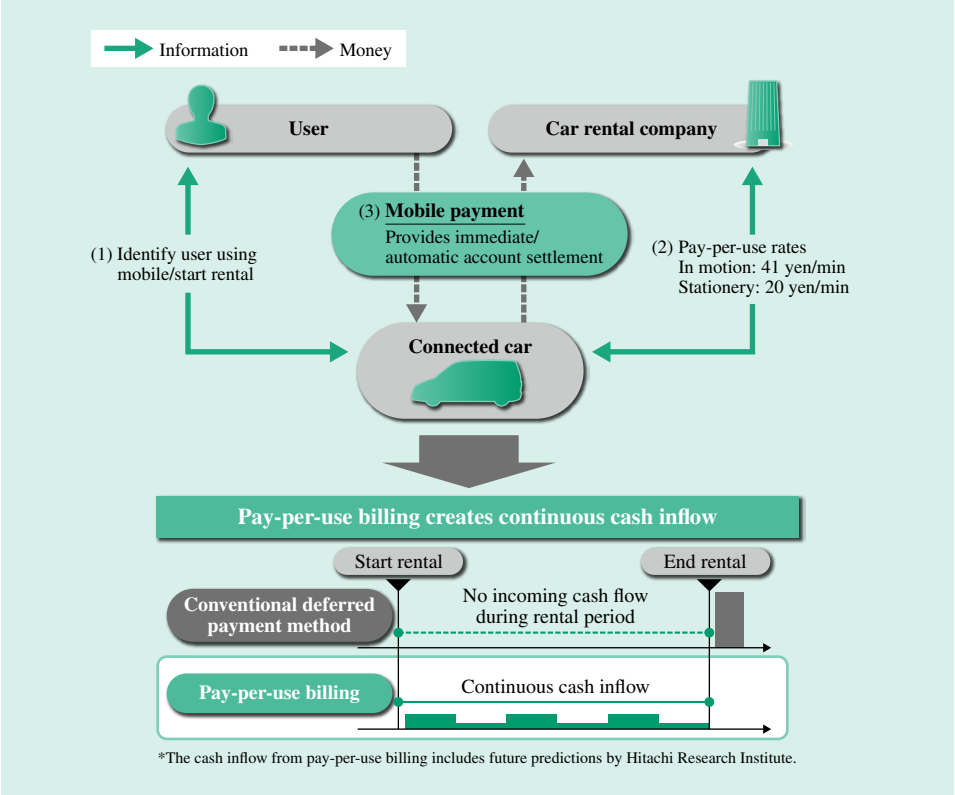

Fig. 2—BMW's Pay-per-use Car Rental Service.
Pay-per-use services driven by mobile payments can improve the certainty of corporate capital recovery.

trip. Billing is done automatically according to the status of the vehicle, taking moving and stationary time into account. These types of pay-per-use services allow users to pay in proportion to the amount they use, and since charges are generated and settled whenever they are used, companies can expect continuous and immediate cash inflow (see Fig. 2).

Organizations in the USA, UK, the Kingdom of Sweden, and other Western countries have started working together by using a bank settlement system with messages written in Extensible Markup Language (XML) conforming to ISO 20022 (an international standard), and by creating real-time remittance services such as services for year-round, round-the-clock, immediate transfers between financial institutions. Standardization of inter-bank networks and other account settlement infrastructure and strategic work on financial infrastructure to enable linking with FinTech through function expansion and improvement will be important tasks for many countries, including Japan, in the years ahead.

Mass Customization of Financial Services Leveraging User Information

With the expansion of transactions done via smartphone applications, EC, and SNS, work has started on improving financial service accessibility through the use of authentication data such as biometric information, service usage history, and a wide range of other data on customer characteristics.

Examples of these efforts include work on automatic loan screening using mobile payment account settlement histories or household account book application information, and on proposals for financial products that are optimally tailored to individual customers by text mining of SNS profiles and online comments in order to analyze preferences.

Japan's financial institutions have started providing handy financial services with authentication using fingerprint, vein, iris, or facial biometric data. For example, AEON Bank, Ltd. is demonstration testing automated teller machines (ATMs) that authenticate users by fingerprint alone without the use of bank cards, while Resona Bank, Limited is letting customers open accounts using finger veins in place of the personal identification stamp (hanko) normally used in Japan.

This use of user characteristic information can be linked to real-time, dynamic information obtained from the Internet of Things (IoT) to improve the accessibility to financial services and to create the potential for financial service mass customization.

For example, in the field of car insurance services, information obtained from user interviews has been used to divide users into clusters and calculate risks.

But the use of micro-information such as driving preferences obtained from telematics is enabling insurers to provide flexible premium plans and policyholder incentives directly to users.

The use of the IoT should also help expand the market for loans secured by movable property such as inventory. Attaching sensors to products in stock or to warehouse equipment will enable conditions such as quality and quantity to be managed remotely and in realtime. By reducing the cost of operations such as collateral value estimation and periodic monitoring, this innovation will enable customers to obtain movable property financing tailored to their characteristics, something that has been difficult to obtain in the past.

Advanced wholesale financial services previously only available to professionals such as financial advisers are now increasingly being offered to individuals and small- to medium-sized businesses with relative convenience. Based on attribute information and management policies relating to the user's personal risk tolerance level, robo-advisory services use algorithms to automatically create portfolios of financial assets such as publicly traded mutual funds, and rebalance them in line with performance. Robo-advisory companies such as Wealthfront Inc. in the USA provide asset management services with low commissions. More precisely targeted management proposals will become possible in the years ahead by using log data such as the user's management performance and transaction history. In Japan, a growing volume of services is expected to be provided by the major financial institutions that manage the bulk of publicly-traded mutual funds, along with the country's emerging management startups.

BACK-OFFICE INTEGRATION THAT IS IN DEMAND

Japan's Financial Services Agency is planning to complete a report on an open application programming interface (API) policy during fiscal 2016. The policy will be designed to enable smooth transactions between financial institutions and non-financial companies by setting standards for linking information related to financial flows such as personal authentication, account inquiries, and fund settlements. It is expected to enable connections to the IoT, SNS, EC, pay-per-use services, and public infrastructure from platforms such as smartphone apps. As digitalization accelerates in the years ahead, the types of user data handled and the service business models connected will become increasingly diversified. There will be a demand for constructing financial infrastructure for completing the contract-payment-delivery process flow while dynamically linking with services that execute high-frequency transactions. Back offices will therefore need to have systems enabling secure and low-cost linking, integration, and management of information and transactions pertaining to increasingly complex commercial flows, financial flows, and service deliveries.

A blockchain is a method of recording and sharing data that prevents rewriting or falsification using encryption and distributed network technology. A blockchain functions as the electronic equivalent of an endorsement on a check, and (like Bitcoin[*3] and other digital currencies) is gaining attention as a core technology for executing transactions on networks. A blockchain creates a list of records representing the history of transactions among users, which is stored in a location enabling it to be held or shared by each market participant. Blockchains are expected to enable lower transaction costs by eliminating the need for a large central management system, etc. Their use for contract execution will enable automatic linking of commercial flows, financial flows, and service deliveries.

The use of blockchains for contract execution is a concept known as smart contracts, which enable transactions to be executed securely by recording the execution conditions for the contract-payment-delivery process in the blockchain ledger, so that these conditions can be shared and mutually referenced by all of the systems related to commercial flows, financial flows, and deliveries. In addition to the business-to-business (B2B) field, the use of blockchains to integrate these three flows (commercial flows, financial flows, and service deliveries) will help create new markets such as end user-to-business (E2B) and even end user-to-end user (E2E) (see Fig. 3).

By working with commercial flows and service logistics, FinTech is enabling transactions that are smaller, higher-frequency, and more diversified. The importance of constructing distributed financial platforms such as blockchain technology is growing.

CONCLUSIONS

As low interest rate policies become entrenched, centering around the developed countries, users and financial institutions are facing an increasingly severe

*3 Bitcoin is a registered trademark of bitFlyer, Inc.

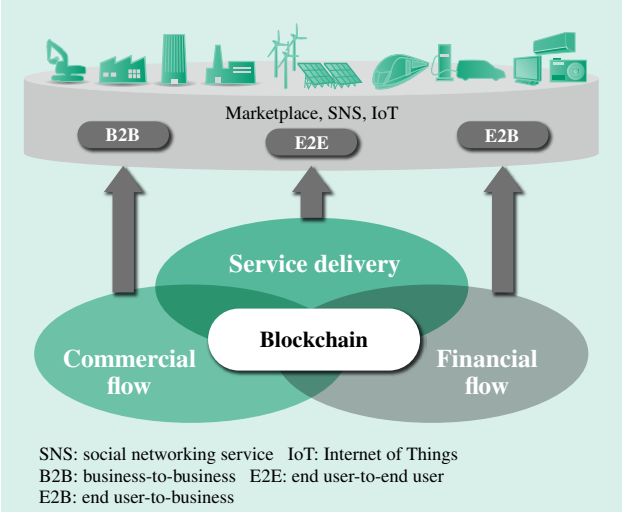

Fig. 3—End User-driven Business Model Approach. Blockchains accelerate the integration of commercial flows, financial flows, and service deliveries (three flows).

management environment. As a result, for financial institutions, the importance of working on FinTech as a way of innovating the delivery of financial services using digitalization is growing.

FinTech will encourage mass customization and diversification of financial services, and holds the potential to actively manage and reduce risk by providing incentives based on detailed information analysis and transaction performance data.

Hitachi Research Institute will continue to explore innovations in financial service business models, while looking at the latest trends in cutting-edge digital technologies, FinTech-related policies, and user needs.

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Featured Articles I

Creating Blockchain-driven Financial Services and Business Models

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OVERVIEW: Blockchains are gaining attention as a new platform technology for financial transactions, offering the benefits of lower intermediation costs with more transaction impartiality and transparency. Their use as a financial transaction platform has the possibility not only to bring about changes in the business models of existing financial services, but also to create new financial services and businesses. This article discusses the technical features of blockchain technology and its potential applications in the finance sector. It also looks at the ways of linking blockchain technology with the IoT and other industries to create new services and businesses, and examines the challenges to be overcome upon achieving them. Hitachi aims to overcome these challenges to pioneer new services and businesses through collaborative creation with customers.

INTRODUCTION

BOOSTED by the popularization of smartphones and social media, and by advances in technologies such as big data analysis, financial technology (FinTech) is gaining momentum in the finance sector for its ability to redefine financial services from the end user's perspective. FinTech is used to provide a wide variety of services spanning areas such as payment, personal financial management (PFM), financing, and asset management, and among those services is blockchain. Blockchain is used as a platform technology for Bitcoin*(1) and has been gaining attention as a technology with the potential to replace the financial infrastructure used for transactions such as international remittances. The potential uses of blockchain technology in various applications outside of the finance sector are also attracting interest. Financial institutions have responded to the rise of blockchain technology by starting various forms of demonstration tests to assess its potential.

This article describes the technical features of blockchain technology, the potential applications for it in the finance sector, and also the potential for new financial services and businesses, including those that link with the Internet of Things (IoT) and other industries.

* Bitcoin is a registered trademark of bitFlyer, Inc.

BLOCKCHAIN FEATURES

Technology Components that Constitute Blockchains

A blockchain is a distributed transaction recording technology that lets multiple network nodes share the transaction records of transactions such as remittances, thereby eliminating the need for a designated organization serving as the transaction intermediary or central manager of transaction records. Blockchains are composed of the following three technology components:

(1) Transaction data generation technology

This component adds stakeholders' electronic signatures to transaction data that records the transaction details to certify their agreement to the transaction. It prevents falsification of past transaction information by adding a chain of transaction data hash values.

(2) Distributed consensus technology

This technology prevents duplicate transactions by grouping together a fixed amount of transaction data as a block and adding the data to the blockchain based on a consensus among the participants after confirming it to be a unique transaction on the network.

(3) Operational autonomy technology

This technology uses an algorithm that allows the participants to control the cost and benefits associated with the distributed consensus technology described above, enabling autonomous operation driven by rational decisions made by the participants.

The technologies above prevent falsification of transaction details and duplicate transactions, enabling autonomous transaction record operations without the need for a designated administrator. A typical use case that can be achieved by taking advantage of this feature is remittances using a virtual currency such as Bitcoin. Conventional remittance transactions are done by rewriting the ledger that centrally manages the payer's balance information. International remittances and other transactions that involve multiple intermediary financial institutions or systems incur several intermediary commissions. In contrast, transactions using blockchains enable low-cost remittances by recording value transfers in the transaction records shared by the participants.

Blockchain Features and Benefits

The benefits of blockchains for financial transactions and operations are listed below.

(1) Reduced intermediation costs

Since blockchains enable impartial transaction execution without a designated intermediary, they can achieve major reductions in intermediation costs and faster execution of transactions. Taking advantage of this feature enables cheaper and faster international remittances, and small-value transactions (micropayments) that would not be worth the commission costs when using conventional methods.

(2) Greater transaction impartiality and efficiency

Blockchains leave the transaction details as an unfalsifiable record, improving transaction reliability. Blockchains can also be used with technologies called smart contracts and multisig to enable contract procedures involving multiple stakeholders to be processed impartially according to the transaction status. Smart contracts record the execution conditions in the transaction details, and multisig adds multiple electronic signatures to the transaction details. This feature enables more impartial and efficient processing of trade finance and syndicate loan operations that are conventionally done manually on the basis of contract documents.

(3) Improved transaction transparency

Since unfalsifiable transaction records are shared openly, this leads to the prevention of improper

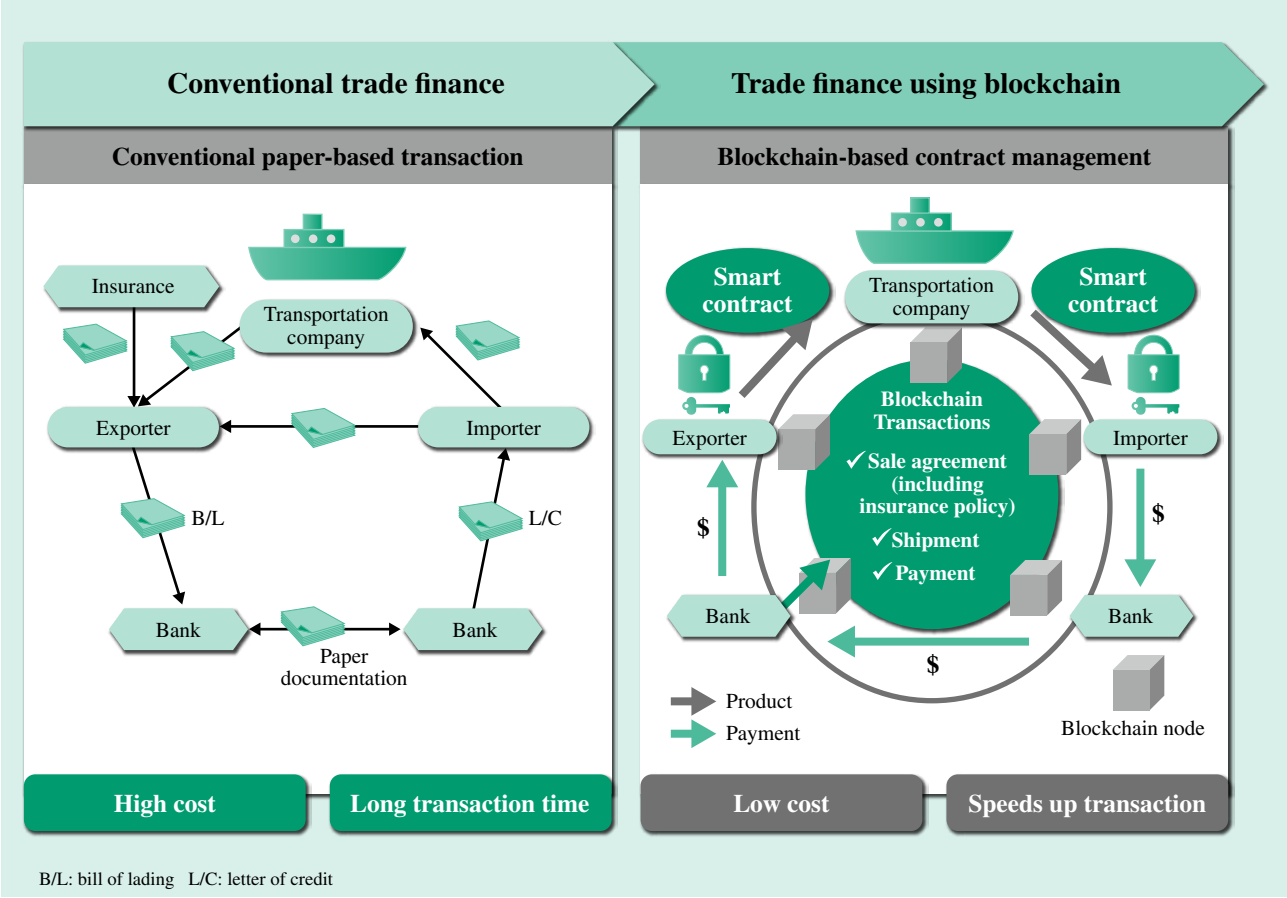

Fig. 1—Trade Finance that Takes Advantage of Blockchain Features.
Using blockchains to record trade finance transactions can improve transaction impartiality and speed.

transactions and the improvement of market transparency. In addition, using blockchains as an information-sharing platform among a company's multiple sites, group companies, or industry bodies, leads to the speeding up of information-sharing and the prevention of discrepancies. Taking advantage of this feature enables the reduction of audit costs, the monitoring of improper transactions, and the rapid sharing of know your customer (KYC), anti-money laundering (AML), and customer identification program (CIP) information.

Example Use Case in the Finance Sector

Trade finance provides one example of a use case that takes advantage of blockchain features. In a conventional trade transaction, the bank assumes the credit risk of the importer and exporter and intermediates the account settlement process to ensure that the exporter receives payment and the importer receives delivery (see Fig. 1). But the processes from the signing of the sale agreement to shipment and account settlement are done manually using paper documentation, creating the problems of high administrative workload and long processing time. Using a blockchain for this transaction enables it to be processed impartially as specified in the sale agreement, and speeds up the transaction by letting the stakeholders share transaction statuses in realtime.

CREATING NEW BLOCKCHAIN-DRIVEN SERVICES AND BUSINESS MODELS

Reforming Existing Financial Service Business Models

The trade finance use case illustrates how smart contracts enable the impartial execution of transactions, which can significantly reduce the bank's operation costs and lower its liability risk. These benefits enable banks to focus on services that have higher added value, such as new financial services driven by transaction histories stored in blockchains. In this way, blockchains have the potential to bring about reforms in the business models of existing financial services.

Creating New Services and Businesses

Unlike conventional financial infrastructure such as bank ledger systems, blockchains are a peer-to-peer (P2P) transaction platform driven by transaction history information. This feature can be used to create services and business models based on a new concept, unlike any of the conventional services provided with today's bank accounts (see Fig. 2).

Below are some examples of the wide range of services that could be made possible by a service concept that provides a transaction community enabling equal participation by everyone, and helps them connect through various value exchanges driven

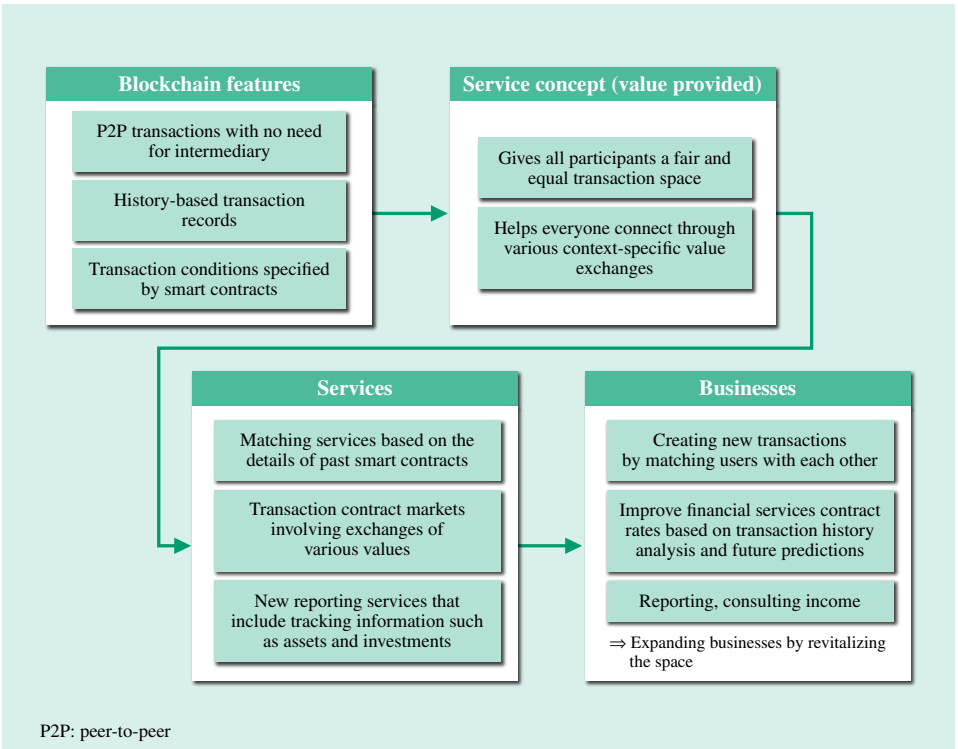

Fig. 2—Creating Blockchain-driven Financial Services and Businesses.
Creating a service concept that draws on blockchain features will enable the creation of new financial services unlike anything previously available.

by smart contracts that participants can customize themselves.
(1) Prediction of future behaviors from transaction conditions and details, and financial services based on these predictions.
(2) Matching services based on transaction conditions and details
(3) Consulting services for transaction details, grounded in asset management and legal knowledge

These services will enable the revitalization of communities and the harnessing of new transactions to further expand business growth.

Thus, by creating a service concept that draws on the features of blockchains to change how consumers and businesses approach financial behaviors, it will become possible to create unprecedented new services and business areas.

Expanding Services and Businesses through IoT/Industry Coordination

The services and businesses discussed above could be further expanded by coordinating them with the IoT, which interconnects devices using IT. For example, the non-life insurance industry could improve the impartiality and efficiency of policy management and claims payment processes by using blockchains to record insurance policies and using the IoT to monitor those policy provisions. There could also be use cases in which a network-connected device is enabled based on an insurance policy recorded in a blockchain. So coordinating blockchains and the IoT could enable transactions and events that were previously managed and evaluated individually to be processed more efficiently as more wide-scale transactions. Fig. 3 shows how use cases could be expanded in an industry-coordinated space that includes linking with the IoT.

CHALLENGES FOR CREATING NEW SERVICES AND BUSINESSES

Some of the challenges that will need to be overcome to create new blockchain-driven financial services and businesses are described below.

Firstly, there are technical challenges. Implementing proper access controls and hiding transaction details are mandatory requirements when using blockchains for financial transactions. Some use cases also will need performance and reliability improvements.

Secondly, there are clerical and systematic challenges. While blockchains enable impartial execution of the trade finance processes described in the second chapter, various exceptional processes such as revising contract details and handling discrepancies can arise in actual practice. How to deal with these processes using blockchains and peripheral processes will need to be studied. Financial transactions are

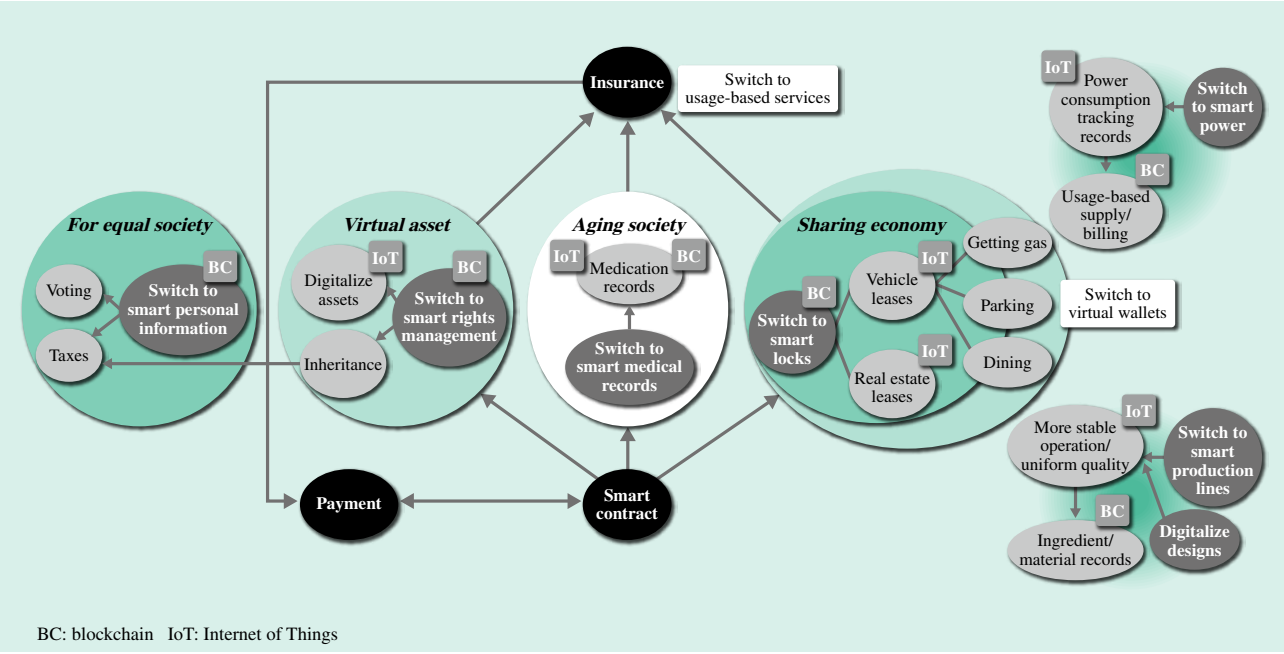

Fig. 3—Expanding Services through Industry Coordination.
Coordinating with industries such as energy, healthcare, and public-domain records could enable the expansion of various types of services, improving business efficiency and creating new services and businesses.

also governed by various laws and regulations and industry standards, which blockchains will need to accommodate in order to match the transaction features.

Thirdly, there are challenges in coordinating with peripheral systems. Blockchains are basically a transaction-recording technology, and do not provide the matching functions provided by securities exchanges, or the netting functions provided by the Bank of Japan Financial Network System (BOJ-NET) (the financial system network operated by the Bank of Japan). Since blockchains alone will not be able to replace every financial infrastructure function, the division of blockchain functions and related functions will need to be organized, and the overall architecture will need to be designed. ID management technology used to uniquely define each item on a blockchain will also be needed for coordinating with the IoT. The method used for coordinating with other systems and blockchains will be another challenge for industry coordination.

Furthermore, new challenges may also arise from the user's perspective. For example, if blockchain-based P2P transactions become commonplace, contracts will be executed between individuals in the manner of smart contracts, which may increase the workload done by individuals. Blockchain acceptance could also start to change as users start to feel uneasy about how the technology accumulates and stores various transaction history records and connections to other users. Technologies and services that accommodate such a change in values will need to be studied.

CONCLUSIONS

This article has discussed the features of blockchains and looked at how the technology could be used to create new financial services and businesses in the finance sector. While blockchains could be used to create new financial services and businesses driven by a concept unlike anything previously available, the technology still faces the various challenges described in the previous chapter.

Through collaborative creation with customers, Hitachi aims to concretize the potential use cases of blockchains and to pioneer new services and businesses by overcoming the various challenges facing the technology.

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Featured Articles I

Work on the Potential and Challenges of Blockchain Technology

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OVERVIEW: Blockchains have attracted interest as an innovative technology designed to lower transaction costs by securely enabling direct transactions among an indeterminate number of mutually untrusted users. Hitachi is working on blockchain R&D by drawing on the security technology and distributed data processing technology it has accumulated from building mission-critical systems. This article discusses the challenges that were of greatest concern in discussions with blockchain user companies, and summarizes Hitachi's work on overcoming these challenges. Through Hyperledger Project community activities, Hitachi aims to develop standardized blockchain platforms, to develop highly dependable functions, and to create blockchains that can be applied in social infrastructure.

INTRODUCTION

BLOCKCHAINS have attracted interest as an innovative technology expected to offer significant cost reductions by enabling transactions to be executed as peer-to-peer (P2P) processes directly between users. It offers an alternative to the conventional method of using a trusted third-party organization (such as a financial institution or government agency) as an intermediary. Currently past the Technology Trigger phase of the hype cycle, blockchains are now positioned somewhere after the Peak of Inflated Expectations. Many vendors and user companies are conducting their own demonstration tests to uncover the technology's challenges, working independently to improve it and to enable its practical application. Surmounting the anticipated Trough of Disillusionment on the hype cycle and expanding the range of blockchain applications further will require standardizing today's messy array of blockchain technologies and developing technology to enable cross-industry use cases such as those coordinating finance and logistics, or settling small amounts from devices connected to the Internet of Things (IoT). Since today's blockchain technology still has many challenges to overcome, making it more reliable is a crucial requirement when using it in the systems that underpin social infrastructure in areas such as finance or government.

This article discusses the challenges facing blockchains and presents the results of repeated discussions with financial institutions and related government agencies that are blockchain user companies. The article also looks at Hitachi's approach to working on these challenges, its community activities in The Linux Foundation's[*1] Hyperledger[*1] Project, and its work on developing highly dependable functions.

BLOCKCHAIN FEATURES AND CHALLENGES

Blockchain Features

Blockchains have attracted interest as the technology underlying the Bitcoin[*2] cryptocurrency. Various derivative technologies based on the three Bitcoin blockchain design concepts below have been proposed and are currently evolving.

(1) P2P transactions among users on a blockchain network by participant approval without using a third-party organization as an intermediary

(2) Grouping multiple transactions into blocks, recording them in distributed ledgers chained together, and performing hash calculations on consecutive blocks to make modification effectively impossible

(3) Enabling transactions to be verified by all participants by sharing the same ledger data among all participants

*1 Hyperledger is a trademark of The Linux Foundation. Linux Foundation is a registered trademark of The Linux Foundation. Linux is a registered trademark of Linus Torvalds.
*2 Bitcoin is a registered trademark of bitFlyer, Inc.

TABLE 1. Blockchain Challenges
The table shows the top five challenges that were of greatest concern in discussions with user companies. The challenges mainly concern the private domain.

No.	Challenge
1	User privacy protection
2	Processing speed, number of processes per unit of time
3	Finalizing transactions
4	Coordination with existing systems
5	Blockchain reliability

Blockchain Challenges

Hitachi has held repeated discussions with over 50 blockchain user companies, including financial institutions and government agencies, that have studied the use of blockchains. Table 1 lists the top five challenges discussed.

Almost all the user companies mentioned privacy protection, processing speed and finalizing transactions in the discussions. These are security and system performance issues related to non-functional requirements. Since block data is shared by all network participants, analyzing all the data could create issues, such as the ability to track the amount of a remittance made from a payer to a payee (No. 1 in Table 1). Since processing time is needed to approve a transaction and maintain ledger consistency, the number of processes per unit of time will be low (No. 2 in Table 1). When using an approval algorithm called a proof-of-work (POW) to approve a transaction, the probability of transaction finality increases over time, and the transaction is not finalized rigorously (No. 3 in Table 1).

Many users said they want to start using blockchains on a limited basis and gradually expand their usage, but there are challenges with linking one blockchain to another and with coordinating blockchains with existing systems (No. 4 in Table 1). There were an equal number of discussions about system reliability once blockchain use gets fully underway in the future (No. 5 in Table 1). For example, there were discussions on continuous system operation and the potential for database expansion.

HITACHI'S EFFORTS

Work Approach

Hitachi takes a three-phase approach to expanding the application of blockchains (see Fig. 1).

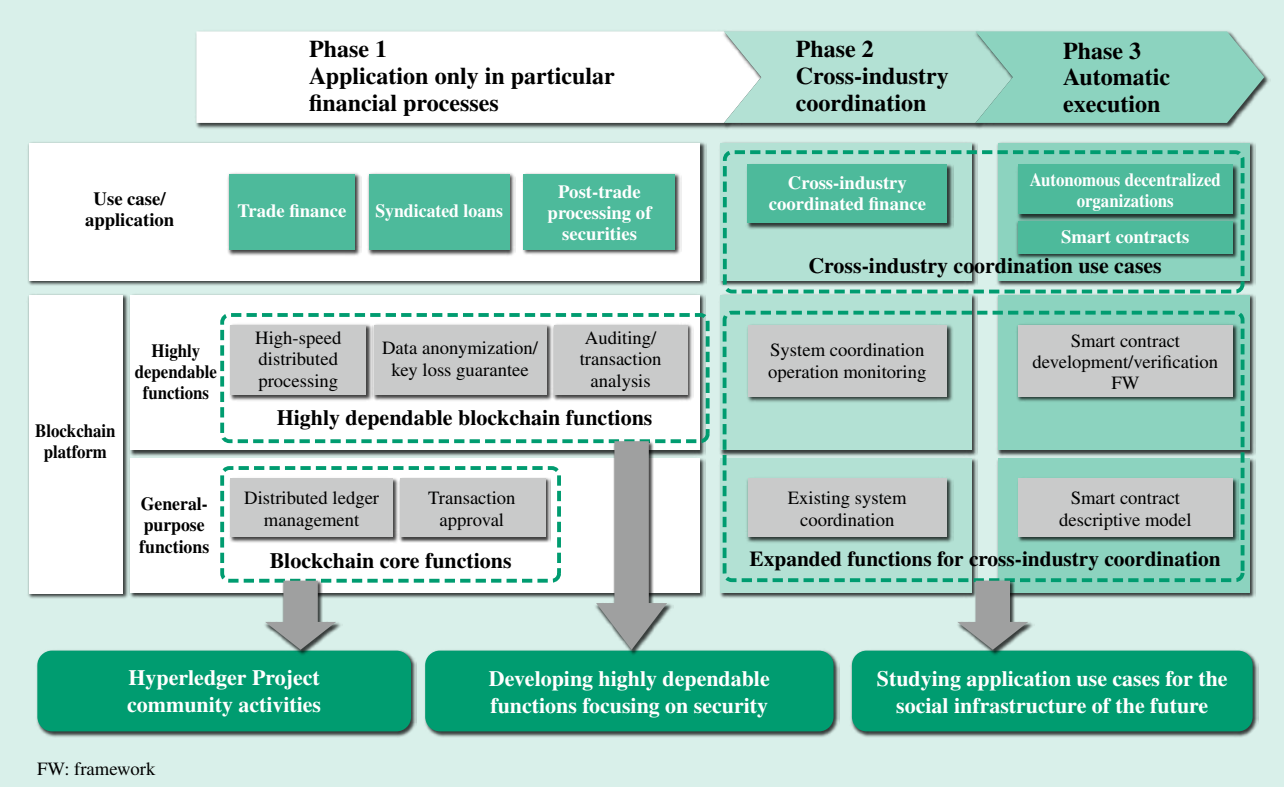

Fig. 1—Hitachi's Approach to Expanding the Application of Blockchain.
Starting with the application of blockchains only for particular financial processes, Hitachi is expanding its application to cross-industry coordination, and automatic execution using smart contracts.

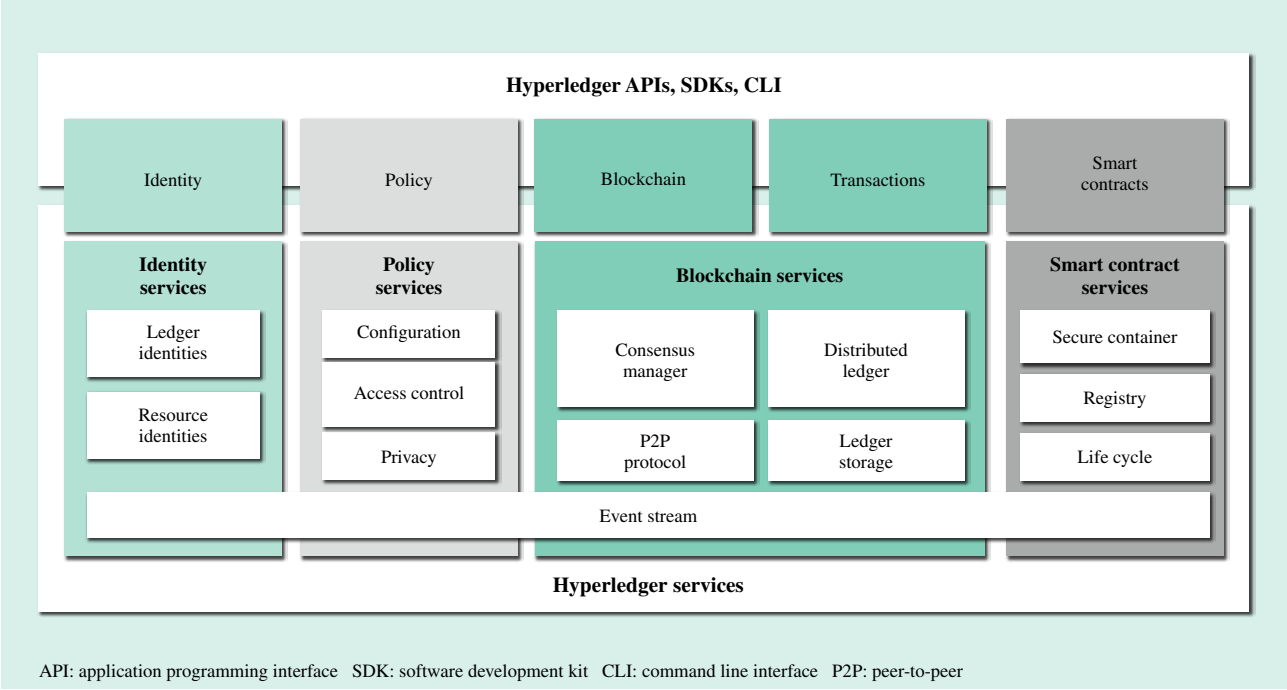

Fig. 2—Platform Architecture Developed by Hyperledger.
The platform architecture consists of five main component elements.

In Phase 1, Hitachi will study the use of blockchains for particular operations in the financial industry (which is actively working on blockchains), such as syndicated loans and post-trade processing of securities. It will also examine and improve the functions provided by blockchain platforms. Specifically, Hitachi will take part in Hyperledger Project community activities to develop globally standardized versions of core functions provided by blockchain platforms such as distributed ledger management and transaction approval. Another crucial requirement will be strengthening the blockchain platform functions that are mostly unrelated to blockchain functionality itself (as described in the list of challenges in the previous section), since financial infrastructure demands high reliability. Hitachi will develop highly dependable functions designed for application in financial infrastructure such as data anonymization and auditing functions. This work will be done by demonstration testing informed by Hitachi's expertise in constructing mission-critical financial systems, and by research findings in areas such as security and data processing technologies.

In Phases 2 and 3, Hitachi will investigate coordination between finance and other industries such as logistics or healthcare. It will also draw on knowledge it has acquired from a wide range of business domains to investigate use cases for cross-industry coordination between industries that will underpin social infrastructure in the future. Examples include smart contracts involving the IoT and artificial intelligence (AI) designed to enable the creation of autonomous decentralized organizations. It will develop expanded functions for cross-industry coordination to enable these use cases, further enhancing the reliability of blockchain platforms. These expanded functions will include functions that coordinate blockchains with existing systems, and functions that verify smart contracts have been implemented properly in line with the specifications.

Hyperledger Community Activities

(1) Overview of community activities

The Linux Foundation created the Hyperledger Project in February 2016 as a way to develop blockchain platforms with open source software. Hitachi has been a premier member of the project since its inception, and has worked with other participants such as The Depository Trust & Clearing Corporation (DTCC) and JPMorgan Chase & Co. to engage in community activities such as studying use cases and developing blockchain platforms. Specifically, Hitachi is helping develop standardized blockchain platforms by taking part in the Technical Steering Committee, through which researchers from the Santa Clara-based Hitachi Financial Innovation Laboratory coordinate with researchers in Japan to study technologies.

(2) Architecture

Since different blockchain application use cases will have different platform requirements, the approach being used in the Hyperledger Project development work is to modularize platform functions as much as possible. Switching the modules as necessary to match the use case requirements will improve development speed and reduce cost.

The blockchain platform architecture being developed by Hyperledger consists of five main component elements (see Fig. 2). Table 2 shows the main elements and summaries of the other elements. The Practical Byzantine Fault Tolerance (PBFT) consensus algorithm and the algorithms that extend it are used for approving transactions. Among the challenges listed in the previous section, these algorithms solve the challenge of finalizing transactions[3].

(3) Future approaches

Hyperledger is planning to expand functions, such as those described in (a) and (b) below. Among the challenges listed in the previous section, (a) is one attempt to solve the issue of blockchain reliability, and (b) is one attempt to solve the issue of coordination with existing systems.

(a) PBFT requires that there are a fixed number of verification nodes governing the approval of transactions, which was a challenge because the algorithm is unable to satisfy the desire for continuous system operation. Hyperledger will develop a PBFT algorithm that enables the number of verification nodes to be changed dynamically.

(b) Using blockchains to replace existing systems previously developed by user companies is difficult because of the time and cost required, making a function that coordinates existing systems with blockchains a crucial requirement. These functions will therefore be developed along with functions that coordinate blockchains with each other.

Developing Highly Dependable Functions

Concurrent with the Hyperledger Project community activities, Hitachi is working to enable the use of blockchains in financial infrastructure by developing highly dependable functions that harness the security technologies and distributed processing technologies that are Hitachi's strengths.

To solve the challenge of privacy protection for users, which is of great interest to user companies, Hitachi is developing data anonymization technology in the form of highly dependable functions driven by its security technologies. This data anonymization technology uses an encryption method called zero-knowledge proof to anonymize blockchain data, and it offers the benefit of making it impossible for a third party to correlate the sender with the receiver even by analyzing all of the data in the blockchain. Only the designated auditor can correlate the sender and receiver.

Transactions can no longer be performed on a blockchain once the key is lost. In the case of a virtual currency, losing the key results in the currency owner no longer being able to perform transactions and losing the currency. To solve this challenge, Hitachi is developing a key loss guarantee function driven by biometric authentication. If the secret key is lost, this function enables the secret key and public key certificates to be reissued using biometric authentication to enable continued transactions.

Table 2. Summaries of Architecture Component Elements

Summaries of the component elements in Fig. 2 are shown below.

Component element	Description
Identity services	This component manages the IDs of all network objects (such as blockchain network participants, smart contracts, and verification nodes used for consensus).
Policy services	This component manages policies. It provides access control and authority management, and manages areas such as participant privacy and consensus rules.
Blockchain services	This component contains elements such as the P2P protocol, distributed ledger, and consensus manager. • P2P protocol: This element provides P2P functions such as bidirectional streaming, flow control, and request multiplexing. It works in coordination with existing networks. • Distributed ledger: This element manages the blockchain and status. • Consensus manager: This element provides the interfaces for plug-in consensus algorithms such as the PBFT interface.
Smart contract services	This component provides the means for executing smart contracts on verification nodes. It contains a secure execution environment, and smart contract life cycle (deploy-update-terminate) management functions.
Event stream	This element provides pub/sub event management functions. For example, it enables outside systems to detect distributed ledger events.
API	This element provides the API for the component elements above. It also contains open source APIs.

PBFT: Practical Byzantine Fault Tolerance pub/sub: publish/subscribe

Hitachi is also working to further enhance the reliability of the system by developing a PBFT algorithm that enables dynamic node addition, a system monitoring function for assisting continuous system operation, and a scalable data store used to ensure blockchain data capacity expandability.

CONCLUSIONS

This article has described the blockchain challenges Hitachi uncovered through discussions with user companies, along with the work Hitachi is doing to overcome these challenges. To enable the use of blockchains in financial infrastructure, Hitachi will work steadily on developing standardized platforms through the Hyperledger Project. Hitachi would like to further enhance the technology's reliability through function expansion, and develop blockchain platforms that enable cross-industry coordination use cases that will shape the social infrastructure of the future.

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(3) Fabric, https://github.com/hyperledger/fabric/

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Featured Articles I

Work on Applying AI to Financial Institutions

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OVERVIEW: Hitachi has acquired a wealth of AI-related technologies by accumulating research experience over many years and working on AI applications for use in many fields. Hitachi also has a growing portfolio of cases that include successful combinations of these technologies in the finance sector. Seeking to enable rapid creation of applications for business processes, Hitachi has started work on increasing the reusability of AI, treating it as a component. This article looks at the different ways in which AI is being used, and discusses Hitachi AI Technology/H and Hitachi's debating AI, presenting examples of research on these technologies and their application by financial institutions. Attempts to more efficiently develop solutions driven by an AI core are also presented.

INTRODUCTION

RECENT technological breakthroughs such as deep learning and today's ongoing advances in computing performance are enabling various problem-solving applications of artificial intelligence (AI) that are attracting interest. Many financial institutions are looking into the use of AI. Work has started on the use of AI to replace the work done by humans as a way to improve work efficiency and to discover new facts among large quantities of data.

This article looks at the future potential of AI, focusing on examples of Hitachi AI applications for financial institutions.

AI AND BIG DATA

Hitachi has been applying AI to various research topics since the 1970's. Two types of AI that have been attracting interest recently are pattern recognition AI, for use in image and sound recognition, and question-answering AI, which looks promising for applications in areas such as call centers, customer service counters, and the Web. Hitachi AI Technology/H (hereafter referred to as H) contains Hitachi's proprietary leap learning technology. It is classified as a decision-making AI for system operation and as a correlation extraction AI. The feature common to all types of AI is the ability to find rules, patterns, and answers among large quantities of data, making AI closely related to big data analysis. The data traditionally handled by financial institutions has been mostly structured data expressed in tabular form. But since these institutions also need to use unstructured text or image data, previously nonexistent uses of AI are expected to arise.

Potential AI Uses for Financial Industry Work

AI can learn starting from a zero state with no information. While typical uses of AI learning are in games such as *go* and *shogi* and in autonomous driving, it can also be used in fields that enable testing and simulation, where learning can be augmented by the feedback of positive and negative test results to the AI. In these cases, a large quantity of facts is used to enable learning, so precision can be seen to generally improve in proportion to the quantity of data provided. However, when using AI learning for practical business in the finance sector, it may not be possible to test, and the work can be affected by changes in the economic environment, so precision may not necessarily improve with larger quantities of data. On the other hand, since the work done by financial institutions involves handling large quantities of data, this data can be used as teaching data to enable AI learning instead of starting a simulation from zero.

Financial institutions already perform various types of analysis on a routine basis. Coordinating with other departments or outside organizations to gather information and assessing the analysis results are tasks that need to be done by humans. But when these tasks are broken down into smaller component tasks, many of them can be done by AI. These component tasks are currently Hitachi's most common types of AI applications for financial institutions (see Fig. 1).

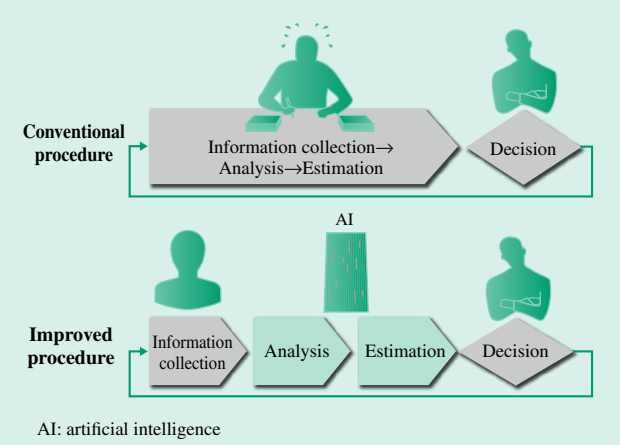

Fig. 1—Concept for Increasing Efficiency with AI.
While humans will still be needed to coordinate with other departments and outside organizations to collect information and to make critical decisions, it is highly likely that AI could take over other work.

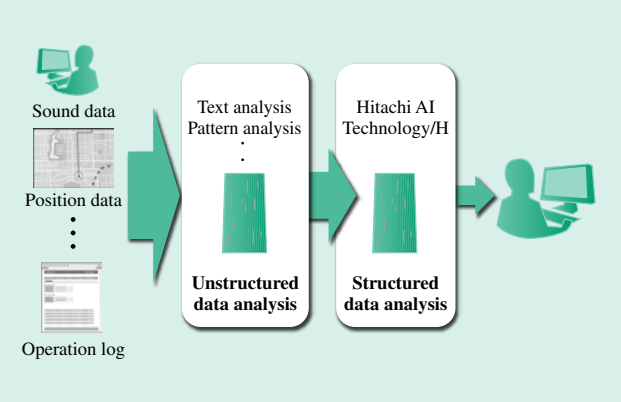

Fig. 2—Concept of Analysis Using Big-data AI.
A wider range of data can be used by combining unstructured data analysis with numerical analysis.

Hitachi AI Technology/H

H is a big data analysis engine that contains a combination of statistical functions and is used to efficiently extract causes of correlations. Specifically, data that are likely to affect the attainment of a particular objective are entered as the explanatory variables, the categories of explanatory variables are defined, and then these categories are combined to automatically generate a massive quantity of composite indicators. These composite indicators are searched to extract a list of composite indicators that are highly correlated to the outcome (sales, earnings, or other values that need to be improved in order to attain the objective). The extracted composite indicators are combinations of two conditions, such as "people who are at least 20 years old and who live in Tokyo." Focusing on highly correlated combinations enables the discovery of previously unnoticed hypotheses without relying on rules of thumb or intuition. It is a method that has already been used for various applications such as marketing and work efficiency improvement.

This AI can create scoring models from highly correlated composite indicators, so attempts have already begun to incorporate the created scoring models into systems to improve work efficiency. Specifically, researchers are looking into the use of models calculated by H in tasks conventionally done by humans such as demand forecasting, fraud detection, and financial product pricing.

While H is AI that analyzes structured data, it can also be used to analyze unstructured data when combined with other AI for applications such as text analysis or image recognition. For example, text analysis of sales records can be used to assess whether the consumer reaction to a particular promotional product was positive or negative, and to extract the features of the consumers who reacted positively and negatively (see Fig. 2).

Since H can search a wide range of data, it is more likely than conventional analysis (done by creating a hypothesis in advance) to find important overlooked factors. The discovered factors can help in creating business policy proposals or in uncovering useful tips. For example, one bank's marketing analysis consisted of a preliminary process that used another system to aggregate account balance history data, followed by a subsequent process that used H to help make new discoveries among the data.

AI for Assisting Human Decisions

Hitachi is also working on developing a question-answering AI. For this application also, Hitachi aims to use a combination of various AI technologies to assist or take over business processes. The intent is to develop more advanced customer support processes by combining sound recognition functions, text comprehension functions, and functions that can find answers among large quantities of text data.

One example is Hitachi's debating AI. This technology searches large volumes of text data to find text that is related to a particular debate topic, and then generates opinions both for and against the debate proposition based on multiple differing perspectives. Examining both the pro and con opinions output by the technology will enable humans to make assessments and decisions efficiently without having to study large volumes of text (see Fig. 3).

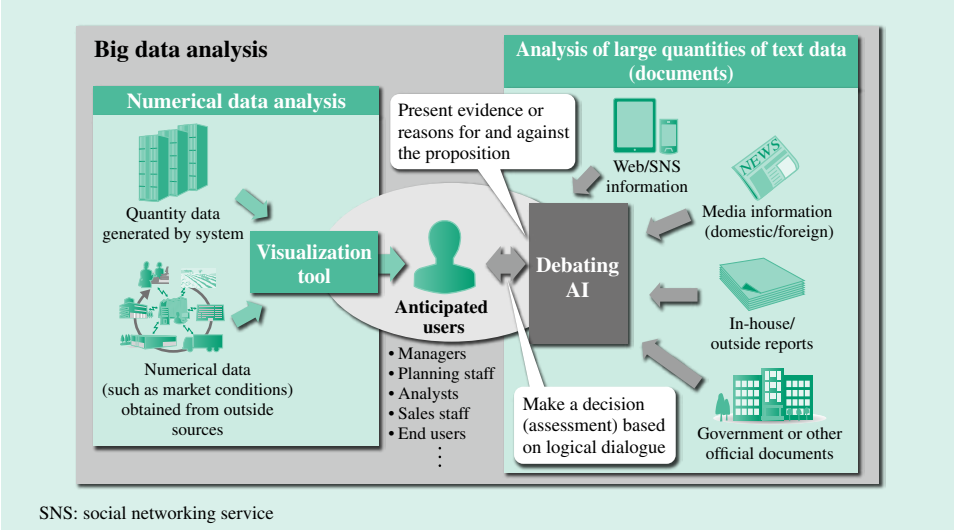

Fig. 3—Concept of Using Hitachi's Debating AI. Decisions can be made more efficiently by checking conventional numerical data after examining the evidence and reasons for and against a debate proposition presented by Hitachi's debating AI.

Financial sector work often consists of studying large volumes of documents on topics such as related financial laws and regulations. Investment decisions are also made by studying various data on topics such as economic conditions, markets, corporate information, and past trends. In the future, Hitachi's debating AI is expected to be able to improve the efficiency with which humans assess work, by searching large volumes of text to extract items that are relevant to a particular decision, and presenting pro and con opinion summaries. It can also be expected to help make more precise assessments efficiently by presenting general arguments and evidence that can be examined and then studied numerically by humans.

MORE ADVANCED USE OF AI

The human brain apportions the various processes of recognition, memory, and judgment to various parts that work together to function as a control tower for biological activities. AI also combines multiple functions to enable it to work that could not be done by one function alone. While many people picture humanoid robots when they talk about AI, it does not necessarily have to take this form. AI can assist humans over the Internet, from a tablet terminal, or in various other forms as the case requires.

Forms for Efficient Use of Multiple AI Technologies

Hitachi has a history of many years of research using AI to solve problems in various areas, and a variety of technologies. For example, Hitachi has used AI for application-specific problems in areas such as recognition, natural language processing, prediction, optimization, and statistical analysis. Hitachi has also responded to the recent rise in popularity of humanoid robots by creating robots that combine various AI technologies to enable interactions with people. But, since financial institutions have contact with their customers through various channels, they will need to use more than just humanoid robots for AI-based human interactions. AI-based human interaction methods adapted to these various channels will be needed too. To respond to this need, Hitachi is aiming to provide more advanced use of AI in finance, based on a system composed of a knowledge layer that handles data gathering, analysis and learning, a communication layer that handles dialoging and conversion, and an interface layer that serves as the point of user contact (see Fig. 4).

Key Points for Efficient Use of AI

The key points for enabling efficient use of AI in a variety of applications are to treat AI technologies as components to be combined, and to improve the reusability of each AI technology component. Hitachi has started working on organizing in-house and third-party AI technologies to improve reusability by breaking down business systems into general-purpose components and components that are specialized to particular industries or business processes.

General-purpose components are AI processing engines, engines that implement deep learning and H are examples of these components. Components that are specialized to particular industries or business processes include industry-specific terminology dictionaries and data aggregation processes. Data

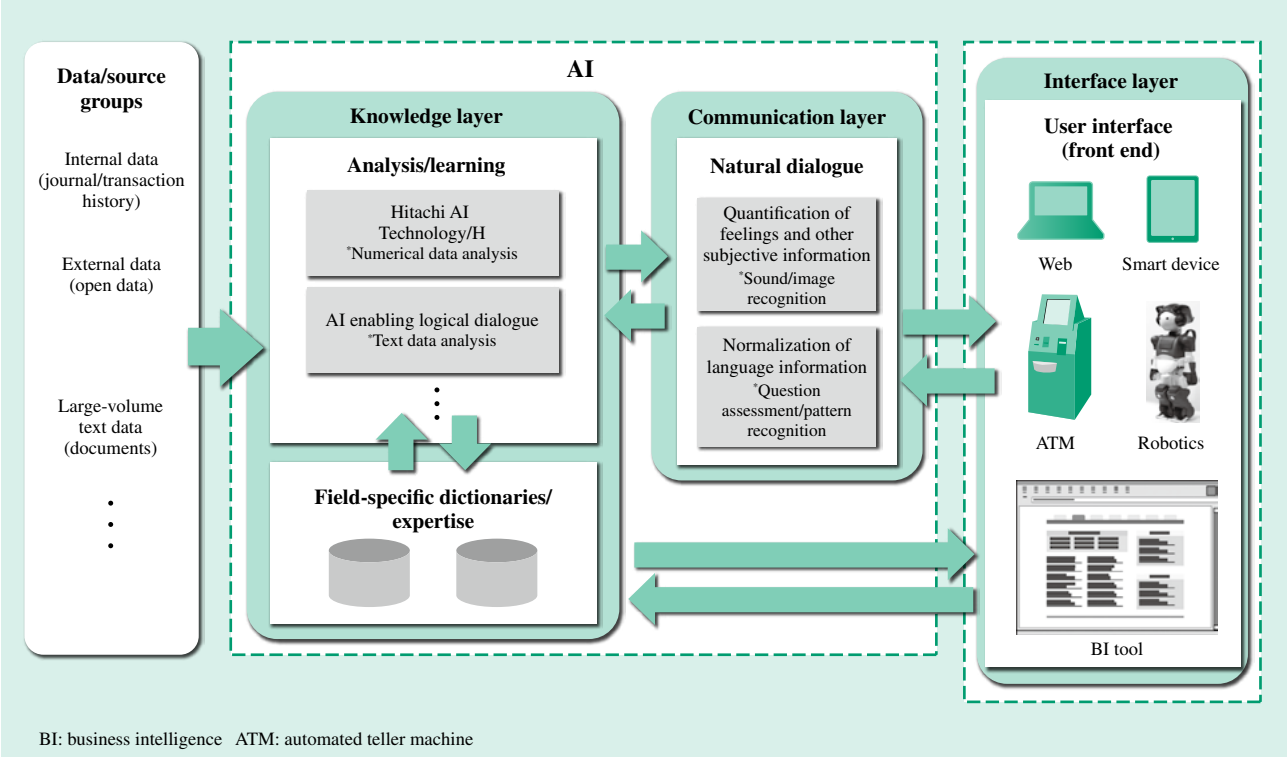

Fig. 4—Hitachi's Idea for a System that Uses AI.
The system will enable the use of AI for a variety of applications by organizing the roles of AI and other functions.

aggregation processes specialized to particular industries include, for example, processes such as data aggregation for extracting features from bank account balance histories, and data aggregation for extracting market features. Properly combining these general-purpose components and industry-specialized components will achieve a system that efficiently constructs and provides a variety of services and systems.

FUTURE USE OF AI

The human brain apportions various functions to various parts, and AI can provide functions that match or exceed some human brain functions. Many reports have been written about how these AI functions have been put to practical use. Combining AI component technologies can be expected to enable a wider range of AI applications. Financial institutions have also begun making attempts to use AI to assist the operations currently done by the human staff at branches and call centers.

Once the Internet of Things (IoT) becomes well-established, it will be possible to analyze various types of personal data with the owner's consent. This development could spur the emergence of new market entrants and enable the finance sector to provide more advanced services driven by information that has higher value. AI will play an indispensable role in that environment, serving as the core technology that enables large quantities of data to be used. And, a wider range of business processes should also start to incorporate AI as diversity and performance improvements increasingly enable it to take over human tasks.

Cost performance issues and other limitations are currently impeding the use of AI and other information technology (IT) for some applications, as embodied by the large number of financial institutions that still use paper forms. But as companies seek to cut costs by upgrading systems through outsourcing or process standardization, digitalization should continue to advance, and areas ranging from branch processes to Internet banking are likely to see growing use of AI.

The spread of AI could also have benefits for customers. AI learning that bridges the gap between the conventional knowledge and expertise of financial institution staff and the experience of individual customers could enable more customer-focused financial services tailored to those individual customers' values. The thought is that this could result in high-quality services that maintain continuity

and consistency across all channels and financial institutions. The time may also come when AI acts as a trusted partner that provides financial advice about potential risks that customers themselves have overlooked.

CONCLUSIONS

There has been recent concern about the prospect of AI taking over human jobs in the future, but the likelihood of losing a job to AI decreases in proportion to the importance of communication with humans in that job. Similarly, AI cannot be held liable for problems, so this will ultimately create a continued need for human judgment in the future, because humans will always be blamed for errors in design or operation that cause system or mechanical accidents.

These observations lead Hitachi to believe that the progress of the modern world is ideally produced by humans and machines working together in harmony.

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Featured Articles I

Creating New IoT-driven Insurance Services

Takahide Shinge
Genta Nishikawa
Masataka Araki

OVERVIEW: While insurance companies have traditionally responded (paid claims) after incidents occur, factors such as diversifying policyholder needs and advances in information and communication technologies are calling for the reformation of that role. To prepare for that reform in the insurance industry, Hitachi has been using its NEXPERIENCE methodology (which provides a systematic method for creating new service businesses) to enable more effective collaborative creation activities with insurance companies. These efforts have involved studying how best to design new IoT-driven insurance services by looking at how insurance services can be reformed from reactive to proactive types. This work is one example of how NEXPERIENCE is being used within Hitachi. This article presents the results of this study and looks at the future outlook for insurance industry reform.

INTRODUCTION

WITH Japan's changing demographics and customer needs steadily shrinking the domestic insurance market, insurance companies have been making various attempts to maintain persistent growth. Companies have tried various different approaches, but the following three common areas of focus have emerged.

(1) Expanding into foreign markets
(2) Differentiating products
(3) Optimizing claims payment expenditures

Items (2) and (3) call for insurance companies to reform their insurance products from the conventional reactive types, which respond to accidents and other incidents after the fact, to proactive types, which provide services in advance.

Proactive insurance is designed to provide a safe and secure societal systems by avoiding or lowering risk through active services provided by the insurance company to the policyholder. Insurance companies are now looking to provide proactive insurance, and are considering various service possibilities as they work to concretize the concept.

Hitachi has developed a design thinking-based methodology for creating service businesses, called NEXPERIENCE, that it is now actively using to pursue customer collaborative creation opportunities. To prepare for insurance industry reforms, Hitachi used the same methodology to study how best to design proactive insurance products.

This article presents the future outlook for insurance market reforms using specific service business proposals created by Hitachi's study.

CREATING SERVICE CONCEPTS USING NEXPERIENCE

Service Business Creation Methodology, NEXPERIENCE

NEXPERIENCE is a methodology that draws on the deep knowledge of customers and partners to enable collaborative creation while visualizing service businesses from multiple perspectives. This methodology improves the chances of successfully creating promising service businesses by enabling intensive, high-quality discussion over a short time period[(1)].

New Insurance Service Creation Process

Looking toward future collaborative creation business with insurance companies, Hitachi has used NEXPERIENCE to create an original service concept for proactive insurance. This concept was created in study workshops that brought together a wide range of knowledge from the entire company as 'One Hitachi.' Workshop participants included domain experts with insurance business knowledge, service designers with service knowledge, and technologists with technical knowledge.

The specific service creation process is described below (see Fig. 1).

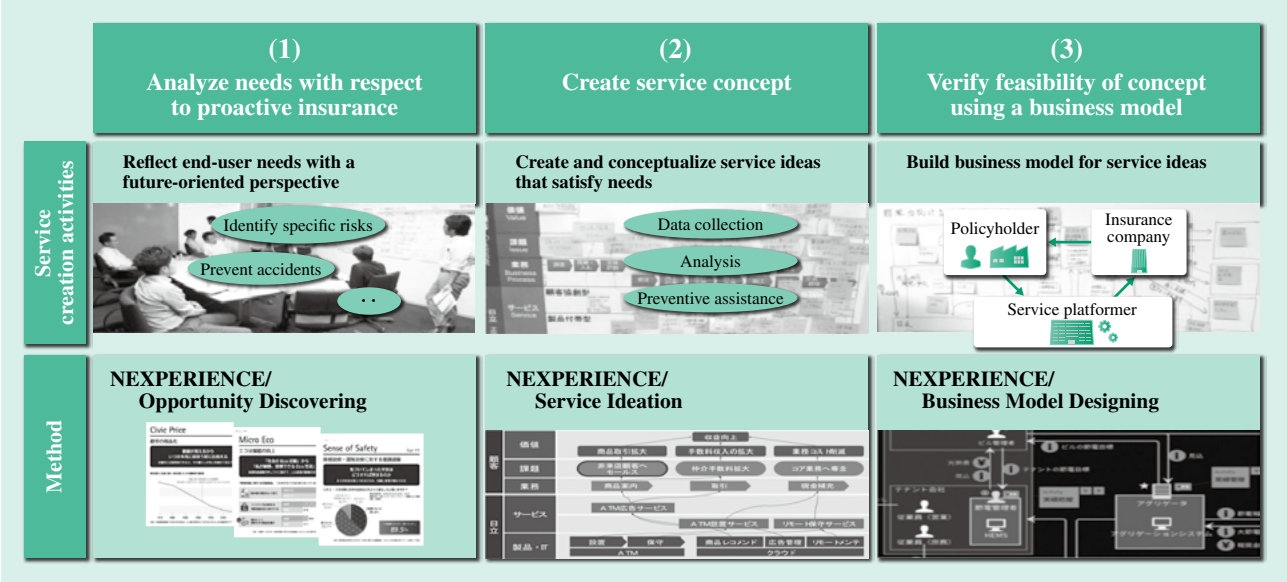

Fig. 1—Service Creation Process Using NEXPERIENCE.
The design ideas-based NEXPERIENCE methodology was applied to the insurance domain to formulate a service concept that accurately reflects end-user needs.

(1) Analyze needs with respect to proactive insurance

The needs of policyholders (both individuals and businesses) who would benefit from proactive insurance were extracted by referring to the findings of "25 Future Signs for 2025."(2)

25 Future Signs for 2025 is a booklet that describes coming changes that will affect Japan and the rest of the world. It was used as a method of extracting end-user problems and needs from a future perspective. This method was chosen because it was thought that a future-oriented approach that starts by accurately envisioning the future and then uses backcasting to design the business from that vision would be more effective for creating an innovative business than collecting data reflecting the present environment. Some examples of the end-user needs that were extracted are shown below.

• Knowing specific risks: End users want to know the specific risks applicable to their unique home life and work life.
• Having insurance tailored to specific risks: End users want to pay premiums that rationally correspond to specific risks.
• Preventing accidents: Instead of merely being compensated for accidents, end users do not want to have accidents. They want to know how to prevent accidents.

The term specific risk is used here to represent the hazard rate and degree of impact of each item (person, thing, or work activity) covered by insurance.

(2) Create service concept

Insurance service ideas that satisfy the extracted needs were created and then refined as a service concept. The technologies that will be needed to create actual services were studied in order to improve the feasibility of the service concept. Some examples of the service ideas that were created are shown below.

• Provide highly precise assessments of specific risks for accidents and medical issues
• Subdivide insurance premiums according to specific risks
• Provide early detection/prevention of medical issues according to specific risks
• Replace parts before they break according to specific risks

Implementing these ideas will require field data and knowledge in addition to the data possessed by insurance companies. The field data will be data from different industries that were not possessed by insurance companies previously, such as vitals data and equipment operation data. The knowledge referred to means analysis expertise to enable identification of information such as accident warning signs and causal relationships between field data and accidents.

However, the issues above are being steadily overcome by technological advances. Specifically, the Internet of Things (IoT) enables data to be acquired from sensors attached to various devices and people. Massive quantities of data gathered from the IoT can be analyzed by artificial intelligence (AI) and big data

analysis technology to make policy-specific accident predictions and to extract knowledge indicating how to avoid or reduce the risk of these accidents. The use of these technologies will enable the construction of risk analysis models that reflect knowledge.

The service ideas above were refined to create a service concept for proactive insurance. The service concept consists of the following three component elements.

(i) Data collection: Collect IoT data from sensors attached to various people and things in order to gather the data that insurance companies need to assess risk.

(ii) Analysis: Perform big data analysis of the collected data to identify various previously unrecognized warning signs (for future predictions and early detection). This process uses a statistical population that encompasses policyholders and everything covered by policies. It extracts high-risk individuals and things from this population, and analyzes the warning signs for risks causing major accidents.

(iii) Preventive assistance: Provide preventive assistance designed to reduce the hazard rate and degree of impact for high-risk individuals, things, and risk warning signs, as specified by AI-derived guidelines.

(3) Verify feasibility of concept using a business model

Expressing the service concept as a business model, the feasibility of the business was verified theoretically. Specifically, the stakeholders and resources that would be needed were identified, and the business value provided for each stakeholder was checked (since the existence of value for each stakeholder is a necessary condition in a business ecosystem that produces value from multiple organically linked stakeholders). For policyholders, the field data provided enables them to receive the proper preventive assistance services according to specific risks, helping them prevent accidents as a result. For insurance companies, avoiding and reducing risks enables the optimization of claims payment expenditures, and can lead to the differentiation of products in the form of proactive insurance services. For service platform providers such as Hitachi, obtaining IoT data and data measuring the effect of preventive assistance enables the creation of more advanced risk analysis models.

CONCRETE EXAMPLES OF PROACTIVE INSURANCE

Hitachi investigated specific examples of IoT-driven proactive insurance based on the service concept it created using NEXPERIENCE. The following sections present medical insurance as an example of the relationship of people with the IoT, and insurance for power companies as an example of the relationship of things with the IoT.

Medical Insurance

While the value provided by traditional medical insurance is primarily the payment of claims to policyholders when medical issues arise, the value of proactive medical insurance is primarily in reducing medical costs through the prevention and early detection of medical issues.

Fig. 2 shows an example of how proactive medical insurance could be implemented.

The data to be collected will include vitals data from sources such as wearable terminals, medical statement data from outside institutions, and test specimens from the policyholder.

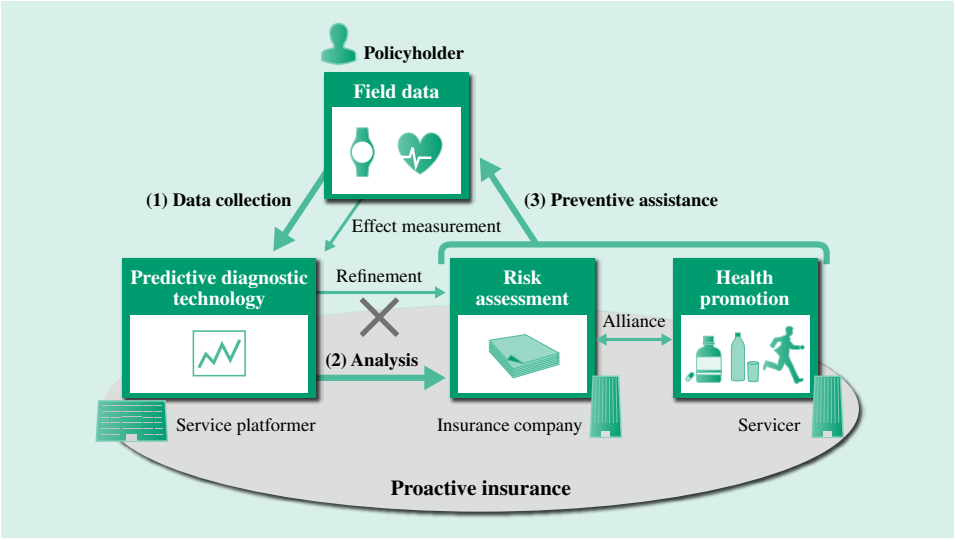

Fig. 2—Proactive Medical Insurance.
Proactive medical insurance consists of data collection that collects field data such as vitals data; analysis that uses predictive diagnostic technology to assess risks; and preventive assistance that promotes health through alliances with servicers.

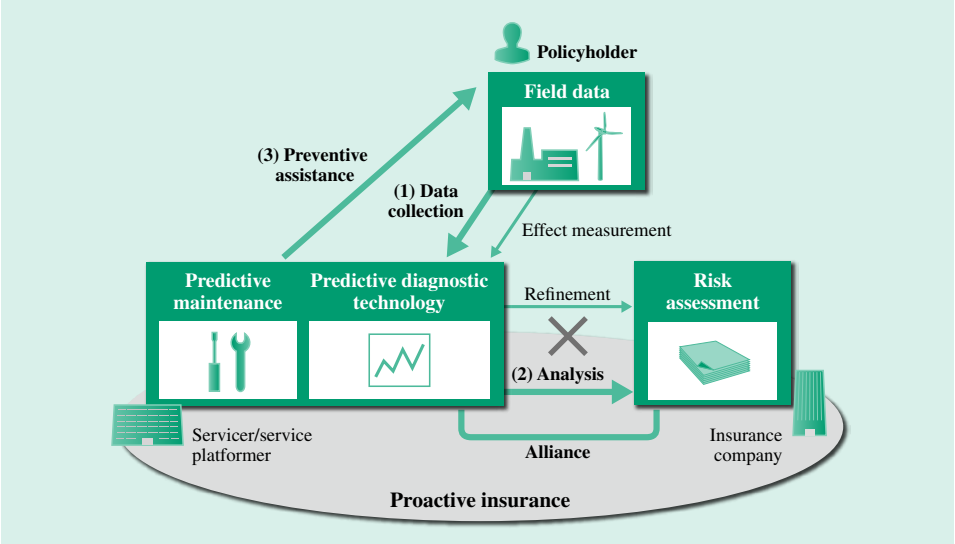

Fig. 3—Proactive Insurance for Power Companies.
Proactive insurance for power companies consists of data collection that collects field data such as device operation information, analysis that uses predictive diagnostic technology to assess risks, and preventive assistance provided through predictive maintenance.

The collected data will be used to provide detailed information about the policyholder's current health status, as well as to predict future risks of medical issues.

Medical issues are likely to become severe if left untreated until policyholders feel symptoms. Proactive insurance avoids the risk of unrecognized medical issues by providing policyholders with ongoing risk assessments instead of the single risk assessment provided by conventional insurance at the start of the policy.

Hitachi's medical cost prediction technology and medical condition transition model[(3)] could be used for risks assessments. These technologies can be used when policies are signed to detect high-risk policyholders and policyholders whose risks could likely be reduced through preventive assistance such as health guidance during the term of the policy.

This proactive approach will enable policyholders and insurance companies to respond to risks in a preventive manner. For example, it could be used to help develop medical insurance products with riders for assistance with medical costs and service fees spent on presymptomatic prevention. When providing preventive services or effective health guidance, the services should ideally be provided in coordination with the health promotion industry or food industry, so NEXPERIENCE has been used to research the creation of business models that span multiple industries.

Insurance for Power Companies

One of Hitachi's strengths is its successful track record of work on public infrastructure that it has accumulated over many years, such as its work in the power industry. In addition to building power plants, Hitachi also has a wealth of accumulated field data and knowledge obtained through the operation of systems for power generation, transmission, and distribution.

So it may be possible to provide proactive insurance for power companies by taking maximum advantage of such Hitachi strengths.

Fig. 3 shows an example of a service that could be provided by combining Hitachi's work in the power industry with insurance.

Along with building power plants and power transmission and distribution systems, Hitachi also provides power companies with predictive maintenance services designed to prevent damage from becoming severe by identifying accident warning signs and performing maintenance before failures occur. Combining Hitachi's predictive maintenance-based work in the power industry with insurance will enable proactive services to be provided. For example, proactive insurance premiums could be calculated dynamically in accordance with risk assessment results determined over the course of predictive maintenance processes, giving power companies an incentive to use Hitachi's preventive assistance or their own accident prevention measures.

Providing proactive insurance will involve collecting facility video data and environmental data such as terrain and climate data, and using Hitachi's remote monitoring systems to collect structured data such as equipment operation states, repair histories, and maintenance histories.

Using Hitachi's predictive diagnostic technology to assess specific risks from the collected field data will enable predictive maintenance and the detection of accident warning signs.

For power companies whose consumers demand a high-quality power supply with either no power failures or rapidly restored service after failures, this proactive approach will help stabilize operations by improving availability factors. It will also help insurance companies optimize their claims payment expenditures by reducing accident rates.

FUTURE OUTLOOK

Hitachi has created a business model proposal in the form of a service catalog containing the services described above. Using this service catalog as a general model during collaborative creation activities with insurance companies can be expected to have the following benefits.

• Stimulating more ideas when creating service concepts

• Efficiently identifying stakeholders when verifying the feasibility of the concept by the business model

Collaborative creation activities with insurance companies need not be limited to the insurance industry. Working with the industries Hitachi excels in (such as energy, construction machinery, and healthcare) to create new added value that spans multiple industries will lead to the creation of Social Innovation Businesses.

CONCLUSIONS

This article has presented some examples of proactive services in the insurance industry. Providing proactive services to various industries could help insurance companies predict accidents and prevent medical issues, fundamentally changing the role that insurance companies play in society.

Using IoT sensing technology and highly accurate prediction technology, Hitachi wants to provide proactive services through collaborative creation activities with insurance companies. Hitachi would like to continue to work with insurance companies to help provide safe and secure public infrastructure systems.

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Featured Articles II

Development of Financial Solution Concepts through Collaborative Creation with Customers

Yuuki Hara
Taiki Sakata
Hirofumi Nagano
Takuya Akashi

OVERVIEW: The finance industry is experiencing rapid changes, including the rise of new market players typified by non-financial institutions; the emergence of the blockchain, IoT, and other innovative new technologies; and changes in regulation around the world. These changes not only promise dramatic improvements in the quality of financial services that end users can enjoy, but they also present an opportunity to confront societal challenges that have appeared difficult to solve in the past. In addition to the development of products and systems for financial institutions, Hitachi is responding to these societal challenges and industry changes by focusing on collaborative creation with customers to produce innovative solutions for the future world of finance. This article describes Hitachi's approach to developing new financial solution concepts, and in doing so envisages what finance might look like in the future.

INTRODUCTION

THE finance industry is experiencing rapid changes, including the rise of new market players typified by non-financial institutions, changes in the structure of markets brought about by deregulation, and the emergence of new services based on such innovative technologies as the blockchain and Internet of Things (IoT).

In response to these changes, financial institutions in Europe and America are taking a fresh look at a back-to-basics approach to customers through which they seek to deepen relationships by providing highly-convenient solutions based on a reappraisal of end user needs.

In emerging countries, meanwhile, financial inclusion is improving at an accelerating rate, with the rapid spread of smartphones and the emergence of new technologies such as the blockchain prompting the development of solutions that give the unbanked (those who do not have a bank account) easy access to financial transactions.

Given that the finance industry forms part of the infrastructure of society, it is understood that financial institutions face a variety of new challenges in the form of demographic changes that include an aging population, longer life expectancies, increasing immigration, and urbanization; an increasingly borderless world; and global-level societal challenges such as the threat of conflict and terrorism in various parts of the world[1].

Recognizing these changes in the finance industry, Hitachi is, in addition to its existing work on developing products and systems for financial institutions, also seeking to create innovative solutions for the future world of finance. This article describes the approach adopted by Hitachi for working in collaboration with end users and customers to create new concepts for financial solutions by envisaging how societal challenges and industry changes will affect the future of finance.

LIKELY CHANGES IN FUTURE CONSUMER VALUES

Hitachi uses the *kizashi* method to anticipate future changes in consumer values and to develop attractive services that will suit such an era[2].

The *kizashi* method works by identifying dynamic social trends and determining what effects those trends will have on people so as to document the potential changes in consumer values that might result. The method is used to develop a common vision of the future with companies and other partners so as to collaboratively determine the best form for social systems and services. Specifically, it uses political, economic, social, and technological (PEST) analysis to identify external factors that will be present in the

future and then determines the relationships these factors have with each other. Scenarios for changes in consumer values are then developed to identify "*kizashi*" (future signs) that provide valuable insights for making sense of the future.

In 2011, Hitachi used the *kizashi* method to identify "25 Future Signs for 2025" that encapsulate changes in consumer values out to 2025, and published the results on the Internet (see Fig. 1).

Hitachi is currently using the *kizashi* method to promote the creation of future signs relating to finance. The objective is to obtain insights that will help in devising solutions for the future by determining how consumer behaviors will change over time in a finance industry where the border between finance and other industries is becoming increasingly blurred.

End user needs have been steadily evolving over recent years. Not only has the spread of the Internet and social media made consumer behavior more complex, it has also raised end user expectations for what services can provide. Likewise, the emergence of the millennial generation, a new type of end user with different outlooks and wants, has added impetus to the shift in power toward end users. In other words, the environment in which the finance industry operates is undergoing rapid changes that encompass end users as well as markets, regulations, and technologies. Accordingly, Hitachi believes it is possible to envisage a brighter future for finance by taking inspiration from future signs for the finance industry that point to changes in end user values.

Future signs for the finance industry include consideration of how developments in other industries influence the relationship between end users and money. The recent phenomena of the sharing economy and crowdfunding, for example, are giving rise to new relationships between people and money.

The sharing economy has expanded through the growth of a new layer of users who are prepared to share assets like vehicles or real estate, which people

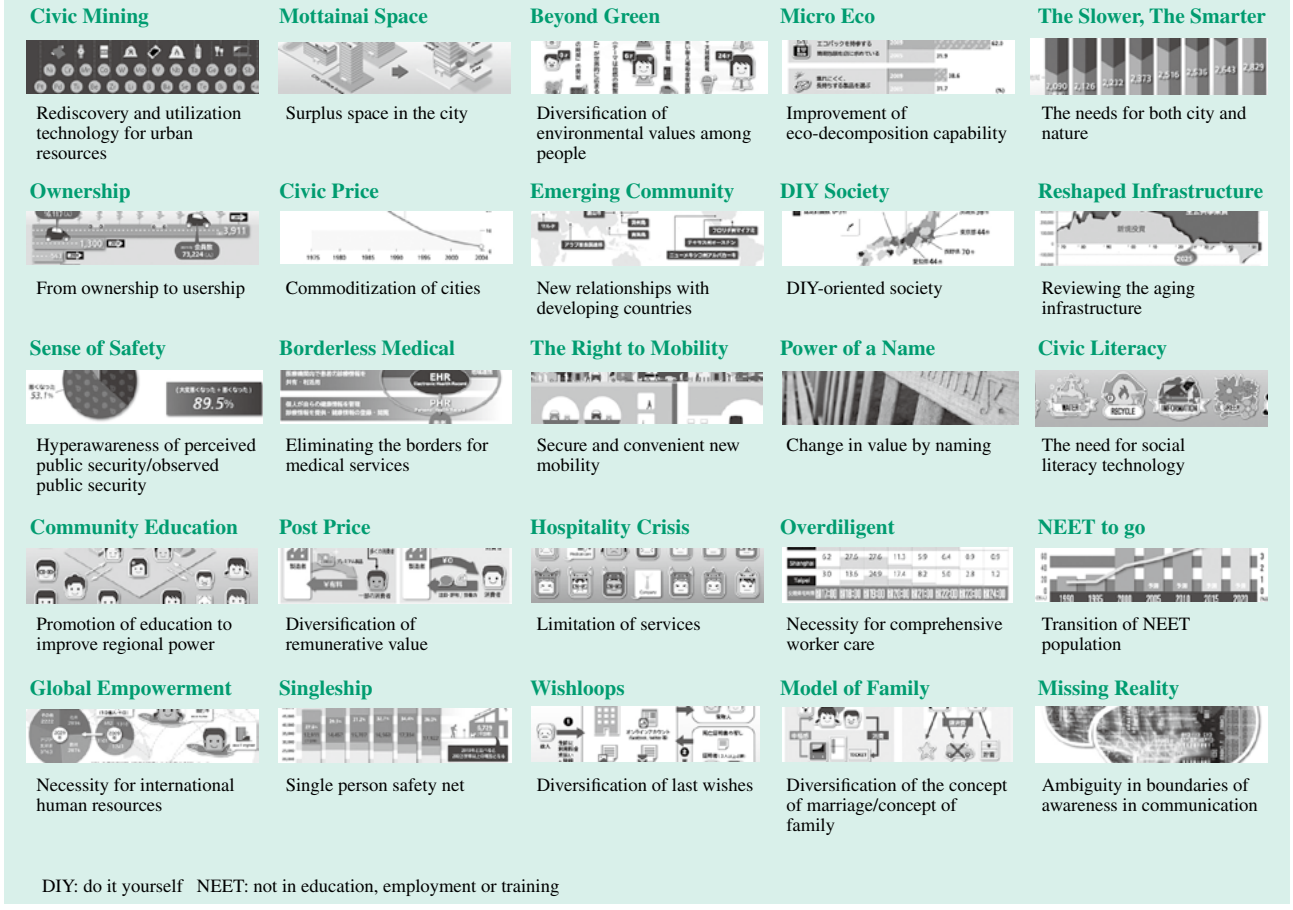

Fig. 1—25 Future Signs for 2025.
Hitachi captured the embryonic movements of change through insight into the future and came up with 25 signs of sustainable urban life.

have previously found meaning in owning as personal property. Along with the economic benefits of this practice, these users also see value in being part of a sustainable society in which finite resources are shared, indicating that they will also choose to use money in ways that reflect this world view[3].

In the case of crowdfunding, it has been reported that people who share common ideals and values are prepared to pay more[4]. This will lead to further increases in the number of end users looking for ways of using money that reflect their personal views. Such a future is likely to feature increasing demand for transparency in how the funds they invest are used, and expanding links between people who share the same ideals and values. This conclusion in turn provides insights into what sort of services can be provided in this future world, and what technological advances are required to do that.

Hitachi believes that these future signs for the finance industry can provide a source of inspiration for creating a more prosperous future while collaborating with a wide variety of stakeholders.

UNDERSTANDING THE LATENT NEEDS OF END USERS

Identifying Real Consumer Behaviors

One approach to developing concepts for financial solutions is to determine the attitudes and concerns that end users have with regard to how money is used, and then to use this as a basis for identifying latent needs so as to focus efforts on those concepts that are most feasible. In practice, Hitachi uses ethnographic research for this purpose, a technique in which researchers observe consumer behavior of local users based in the country or region concerned. Based on hypotheses developed in preliminary research, the researchers go out on the street to experience the retail stores and street vendors that the local people use daily. This involves inquiring into the attitudes and concerns that local users have about how money is used, while also having the researchers themselves visit the stores as customers to observe what payment methods are used.

For example, research of this nature that is conducted in emerging countries provides a sense of how consumer behaviors are different from those in developed countries. Such differences include people being reluctant to pay for products ordered from electronic commerce (EC) sites prior to receiving them due to a lack of confidence in the quality of both the products themselves and the delivery process; a preference for borrowing from family rather than financial institutions when purchasing high-value items; and that a consequence of low wages is that people spend money as they earn it rather than putting it in a bank account. By deepening the analysis to include aspects of the social context, such as the constraints and historical factors that give rise to consumer behaviors of local users, it is possible to investigate what service "touch points" and business models will best suit end users in the emerging countries (see Fig. 2).

Fig. 2—Observation of the Consumer Behavior of Local Users. Researchers clarify consumer behaviors while staying in the field and observing real consumption activities.

Identifying Operating Conditions and Challenges for Financial Institutions

Hitachi is also working to come up with solutions by considering needs and challenges from the perspective of financial institutions. Ethnographic research of the operations of such institutions, for example, involves researchers visiting insurance, banking, and securities offices (branches or agencies) and closely observing how they operate. This includes looking at coordination and decision-making practices that influence the quality of work as well as the actual sequence of tasks performed. By doing so, it is possible to consider the informal knowledge and skills that enhance the quality of work as well as the problems and requirements that staff face in the workplace.

Many operations at financial institutions involve work performed by people. The speed and quality of such operations will become increasingly important in the future because of their influence on things like customer retention and profitability. The uses for information acquired through ethnographic research

Fig. 3—Collaborative Creation Space for Customers at the Financial Innovation Laboratory in North America.
Hitachi established the Financial Innovation Laboratory in Silicon Valley to provide a venue for collaborative creation, meaning working with customers to achieve a common understanding of the challenges they face and to create new solutions.

in the workplace extend beyond improvements to existing business processes, also providing a resource for devising advanced business process models such as those that maximize staff capabilities by making use of innovative technologies in tasks that are performed by people.

Hitachi is also trialing techniques for developing innovative financial services through workshops with financial institutions. The workshops involve a detailed analysis and understanding of the management challenges and requirements of the financial institution, working together to come up with concepts for services that can overcome these challenges, and using business models to test the resulting concepts. Engaging in collaborative creation with financial institutions can accelerate the process of devising innovative technologies or ideas for services that can resolve a wider variety of societal challenges and expand business opportunities.

COLLABORATIVE CREATION WITH CUSTOMERS AT THE FINANCIAL INNOVATION LABORATORY IN NORTH AMERICA

In April 2016, Hitachi established the Financial Innovation Laboratory at its Global Center for Social Innovation – North America, a research and development (R&D) center located near a football stadium and amusement park in the center of Silicon Valley (see Fig. 3).

In addition to existing research, which covers research into new financial services and business models supplied by financial technology (FinTech) companies, etc.; involvement in community activities that are increasingly open and standardized, such as the blockchain; and Hitachi's own innovations, the laboratory is also engaged in collaborative creation aimed at creating new value by bringing other organizations together, such as financial institution customers and FinTech companies with original ideas. It provides a research environment where the scenarios developed by this process can be implemented to verify how well they work.

The laboratory also intends to develop new ideas that extend beyond the borders of finance to allow staff from the other non-financial innovation laboratories that share the same site, such as those for the automotive and healthcare industries, the data scientists who support their work, and IoT researchers, to freely participate in this collaborative creation. It will facilitate, for example, the development of new financial products and financial services such as insurance for operations or asset-backed lending that make use of IoT technologies for predictive maintenance or fleet management, for which models already exist.

Furthermore, the laboratory hopes to create a new ecosystem for the development of financial solution concepts by setting up joint research with other research institutions, including Stanford University, the driving force behind Silicon Valley.

CONCLUSIONS

The finance industry is experiencing a period of rapid change driven by the changing structure of the market and new business models and innovations such as those of the FinTech companies. This change carries with it the potential to transform society by creating new relationships between people and money, and by giving rise to new values.

To prepare for this future, financial institutions are entering a period in which they will transform themselves. Hitachi intends to contribute to society by working with financial institutions to develop a vision for the future and to create innovative solution concepts for a new world.

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Featured Articles II

Convenient Cash Card Services in the Era of Mobiles and Smartphones

Hiroyuki Hatanaka

OVERVIEW: The number of services using IC cards is expanding steadily, including electronic money, credit cards, and the use of staff IDs for access control. The finance sector is no exception, and numerous banks issue IC cash cards and provide services that combine them with biometric authentication and other technologies. The term "mobile cash card service" refers to the storage of account numbers and other information kept on cash cards in an NFC-enabled smartphone so that it can be used in place of the card. A high level of security is maintained by keeping the cash card information in a secure area on the smartphone and using a secure API for interconnecting between the smartphone and bank systems. Users typically keep their smartphones with them, and these services enable their use for a variety of banking transactions. This article describes how Hitachi sees banking transactions being conducted in the future in terms of the convenience provided by using a smartphone as a mobile cash card.

INTRODUCTION

INTEGRATED circuit (IC) card services can be found in many areas of our daily lives, including the use of public transportation cards (electronic money) to pay for fares or vending machine purchases, and the use of staff identification (ID) cards for building access control. Similarly, the issuing of IC cards by banks for credit cards and cash cards enables them to provide financial services that customers can use with peace of mind. Hitachi has contributed to the realization of financial systems that combine encryption and authentication technologies to ensure a high level of security through its past development of IC card systems for banks.

Currently, the IC cards issued by banks are contact-based, meaning they require physical contact between the IC chip and the reader. In contrast, the use of contactless IC cards is growing in the transportation sector with Suica[*1] and PASMO[*2] cards, and in the public sector with the basic resident registration card and driver's license cards, all of which are able to transfer data simply by tapping the card on the reader. Meanwhile, commercial services that operate on near field communications (NFC) and use a smartphone in place of an IC card are starting to emerge against the backdrop of a rapid penetration of smartphones throughout society. From the point of view of offering greater convenience to customers, banks also require a different approach from that adopted in the past, including the development of new services that utilize smartphones. This article describes the mobile cash card service Hitachi is working on that is intended to achieve this.

*1 Suica is a registered trademark of the East Japan Railway Company.
*2 PASMO is a registered trademark of PASMO Co., ltd.

CHANGES IN CASH CARDS

Support for IC Cash Cards

Prior to the emergence of IC cash cards, the standard practice was to use cards that have a magnetic stripe. The vulnerabilities of these cards have been pointed out, including their ease of falsification and the potential for users to divulge their four-digit personal identification number (PIN).

In March 2001, the Japanese Bankers Association (JBA) formulated a standard inter-bank specification for cash cards that covered the use of IC cards, automated teller machines (ATMs), and other devices for cash card transactions and related activities, "JBA IC Cash Card Specifications." The purpose of the standard

was to improve user convenience, to expand business opportunities, and to enhance security. Losses from fraudulent withdrawals made using counterfeit magnetic stripe cash cards have prompted the ongoing adoption of IC cards, because these are difficult to counterfeit.

Mobile Cash Cards

In the past, using a cash card at an ATM involved taking the card from the wallet and inserting it into the ATM, then putting the card back in the wallet after completing the transaction. Once it was put in a wallet, the card was of no further use until the next time it was inserted into an ATM. But imagine instead what might be possible if the cash card had its own input and communications capabilities.

Mobile cash cards store the account and other card information required for banking transactions in a secure area on an NFC-enabled smartphone so that it can be used in place of a conventional cash card. Moreover, some procedures, such as entering transaction instructions at an ATM or filling out forms at a branch, can be performed at any time or place with the mobile cash card.

THE CONVENIENCE OF MOBILE CASH CARDS

Using a mobile cash card provides users with an entirely new experience of banking transactions. Fig. 1 shows Hitachi's vision of how such a banking transaction service will work.

The ways in which ATMs, branches, and the Internet are used in banking are different for conventional cash cards and mobile cash cards. The following sections describe how mobile cash cards are used in various channels.

Preloading of ATM Operations

Mobile cash cards can replace inserting a cash card at an ATM and most operations on the ATM screen. Specifically, the ATM reads the cash card information when the customer taps the smartphone on the NFC reader installed in the ATM (see Fig. 2). In this case, if transaction instructions have already been loaded into the mobile cash card, the ATM can read these also, at the same time. Because tapping the smartphone on the NFC reader invokes reading of its data, even

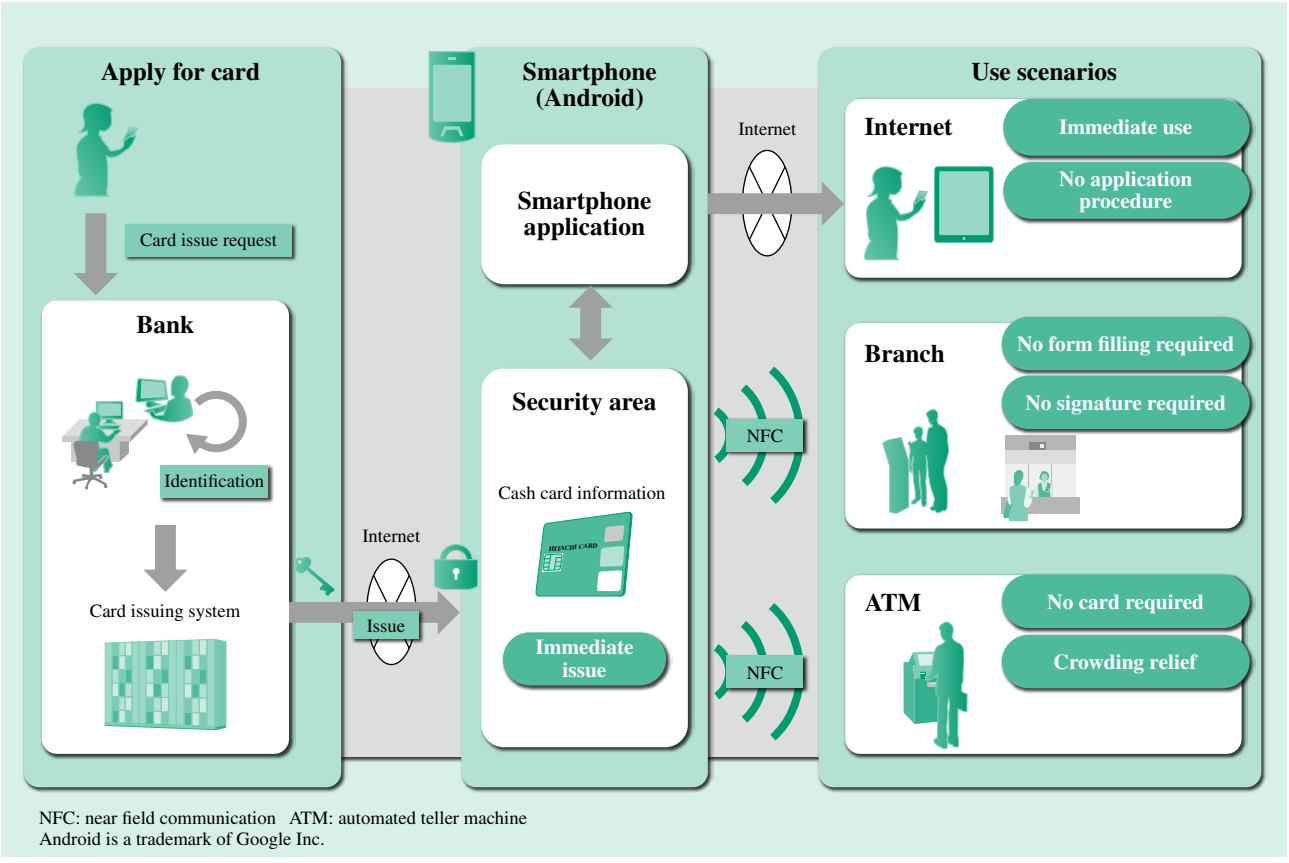

Fig. 1—Hitachi Mobile Cash Card Service.
This service will enable bank users to make cardless transactions at banks using an NFC-enabled smartphone.

Fig. 2—Using a Mobile Cash Card with an ATM.
The ATM is reading the cash card information stored on the smartphone.

if the device is in sleep mode, there is no need to operate the smartphone while standing next to the ATM. After the data has been read, the customer provides identification using the authentication required for the transaction in the same way as they would when operating the ATM using a cash card, and the transaction is completed.

This is anticipated to improve convenience because it reduces the number of steps that the user must perform at the ATM and enables them to complete withdrawal or other banking transactions quickly. For banks, the technology can be expected to relieve crowding at ATMs.

Linking Transaction Information at Branches

At a bank branch, mobile cash cards can be used as an alternative to filling out the paper forms provided at the customer counter. If the information that is normally entered into forms for opening an account or exchanging currency is preloaded into the mobile cash card instead, the cash card information and transaction details can be read at the same time by tapping the smartphone on the NFC reader at the counter (see Fig. 3). It is no longer necessary to enter transaction details at the bank branch, the user can enter this information using their own smartphone at any time. After that, the user can visit the bank branch and complete the transaction.

For users, this eliminates the need to spend time filling out paper forms at the bank branch's customer counter, while for the bank, linking the data should reduce the amount of time spent on administrative procedures at the counter. This should shorten waiting times for users at the bank branch.

In the past, when it has not been possible to issue a cash card immediately to a customer who has opened an account at a branch, it has typically taken about a week for the cash card to be delivered by post. In contrast, a mobile cash card can be made available for use much more quickly because it can be provided immediately by performing the steps from opening the account to authorizing the smartphone for use as a mobile cash card all at once. In the future, it is anticipated that issuing of plastic cash cards will become unnecessary.

Fig. 3—Using NFC at a Bank Branch.
Transaction information that has been preloaded into the smartphone is being read at the counter. Transactions from opening an account to issuing a mobile cash card can be performed on the spot.

Using Mobile Cash Cards for Internet Transactions

Balance inquiries and other bank transactions can be made via the Internet by using a mobile cash card for personal identification. Specifically, when preloading instructions for withdrawing cash into a smartphone using the ATM operations described above, the user can check their current balance to help decide how much money to withdraw.

In the case of transactions that do not involve cash, a mobile cash card can be used in the same way as Internet banking for things like transferring funds or giving notification of a change of address.

MOBILE CASH CARD SECURITY

When incorporating cash card functions into a smartphone, maintaining security must be given the greatest consideration. By using encryption, authentication, and other technologies developed for IC card systems, Hitachi has succeeded in providing mobile cash cards with a high level of security equivalent to that of IC cards.

The secure area in the smartphone is located on the universal integrated circuit card (UICC) provided by the carrier, which includes anti-tamper functions, and the information stored on the UICC cannot be read by anyone except the issuer of the mobile cash card. This protects the cash card information from unauthorized applications and devices.

CHALLENGES ASSOCIATED WITH MOBILE CASH CARDS

While mobile cash cards are known to improve user convenience in a variety of ways, a number of challenges remain with respect to their wider adoption.

The first challenge is how to serve users who have non-Android phones. Currently, third-party access to the NFC chip is restricted on smartphones in some cases. Such phones will become compatible with mobile cash cards in the future, when this restriction is lifted.

The second challenge involves how to link to carriers. Subscriber identity modules (SIMs) supplied by other than the three major carriers have been proliferating in Japan recently, and these companies have the potential to gain a significant market share in the future. In the years ahead, Hitachi plans to work on ways of providing mobile cash cards that do not depend on the carrier-supplied UICC [such as by using host card emulation (HCE)].

The third challenge is the popularization of NFC readers for installing in ATMs and the interoperability of this technology between banks. Just as magnetic stripe cash cards are still in use, it is anticipated that it will take some time for the number of ATMs that recognize mobile cash cards to increase and for interoperability to be achieved. In the meantime, it is necessary to continue providing users of mobile cash cards with an IC cash card that they can also use.

Hitachi intends to continue working on overcoming these challenges while keeping an eye on trends in the industry.

CONCLUSIONS

This article has described a vision of the future that will be brought by services that store the functions of banking cash cards in smartphones.

In addition to the use of NFC for banking transactions, as described in this article, other new cardless transaction services that can provide an alternative to cash cards are currently at the stage of being trialed by various banks, including the use of biometric information and QR Codes*3. These developments are indicative of a finance industry in which multiple innovations are starting to break out rapidly and in great numbers simultaneously. With progress also being made on supporting finance industry innovations in the areas of supervisory agencies and legislation, it is anticipated that the environment will continue to mature.

Hitachi intends to continue contributing to the realization of new financial services in its role as the best partner of banks.

*3 QR Code is a registered trademark of DENSO WAVE INCORPORATED in Japan and in other countries.

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(1) Japanese Bankers Association Website, http://www.zenginkyo.or.jp/en/
(2) Financial Services Agency Website, http://www.fsa.go.jp/en/index.html

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Featured Articles II

New Branch Strategies for Branch Styles that Adapt Flexibly to Customer Needs

Takeshi Shirai
Takashi Yamagishi

OVERVIEW: The environment in which financial institutions operate is undergoing major changes due to finance industry entrants from other business categories and advances in IT, creating a need to re-evaluate the channels that serve as interfaces with customers. While, among those channels, there is a need for more effective specific reforms based around cost reductions in the branch channels of banks, such core measures as branch consolidation have been fully implemented already, and further moves in this direction, such as additional branch closures, will likely hurt customer service. In response, with regard to the strategic activities of banks, Hitachi is proposing to supply services that cover the work handled by individual branches. The proposed services would support four types of branch strategies with the aim of making banks more distinctive and improving their profitability. They would also rethink banking business processes with the aim of improving costs across the banking industry in the area of non-strategic activities through selective use of bundling and unbundling.

INTRODUCTION

IN the past, bank branches have been required to accurately process large numbers of requests for different types of administrative procedures that were brought to them by visiting customers. Given that situation, banks have reduced the volume of administrative procedures handled by branches and shifted the role of staff from administration to sales by expanding the use of channels such as automated teller machines (ATMs) and Internet banking that allow customers to complete the procedures themselves. Recently, there has been an emergence of services from players other than banks that duplicate some channel functions, such as ATMs at convenience stores and mobile payments, and also changes in the population distribution in Japan as a whole and at the regional level. These environmental changes are now seen as making it difficult for banks to retain sufficient contact with their customers. In order to respond to this situation, instead of the "branch facility" of the past, which delivers identical customer services at all branches, it will become important to provide facilities that can deploy branches rapidly in accordance with the aims (strategies) of each branch and the characteristics of the region.

This article describes what Hitachi is doing with regard to bank branch strategies in response to these challenges to the branch channel.

ENVIRONMENTAL CHANGES SURROUNDING FINANCIAL INSTITUTIONS AND CHALLENGES FACING THE BRANCH CHANNEL

Environmental Changes Surrounding Financial Institutions

Japan's total population is predicted to fall below 100 million in 2048, with the working population also falling below 60 million (roughly 20% lower than in 2015). Also anticipated are a fall in demand for capital, especially from regional companies, and a lowering of the return on capital of regional financial institutions, in particular over the medium and long term, due to the negative interest rate environment. While finance remains a regulated industry in Japan that is still subject to numerous regulations under the supervision of the Financial Services Agency, the entry of new market players is anticipated due to factors such as financial technology (FinTech) and the May 2016 amendments to the Banking Act. With regard to

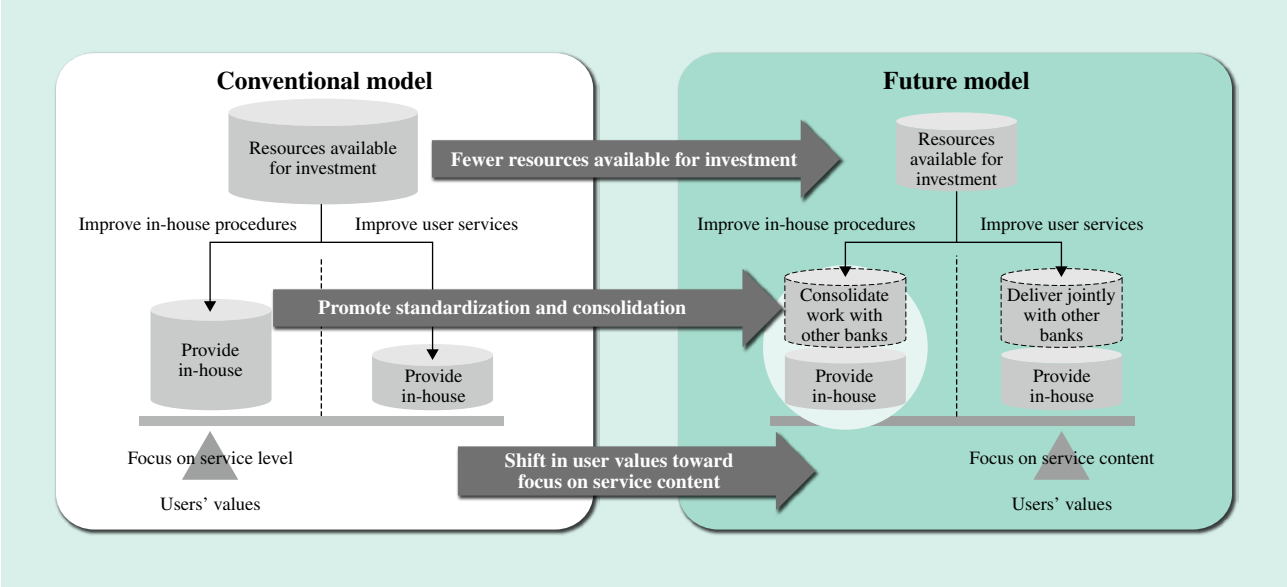

Fig. 1—Paradigm Shift in Bank Investment.
The paradigm shift in bank investment is toward delivering services that keep pace with changes in user values while remaining cognizant of competitors from other business categories in strategic areas. In non-strategic areas, meanwhile, this shift means pursuing further efficiency gains by getting rid of bank-specific procedures and standardizing and consolidating administrative procedures.

technological advances, meanwhile, smartphones have proliferated rapidly sparked by the appearance of the iPhone* (with ownership of smartphones averaging about 83% among people in their 20's and 30's) and this is anticipated to change user values with respect to services. Given these circumstances, in order to maintain banking service levels, what are needed are operational efficiency improvements made through practices such as business process re-engineering (BPR) and business process outsourcing (BPO), which utilize information technology (IT), and the development of customer-oriented services in order to thrive amid more diverse and intense competition. Unfortunately, improvements to operational efficiency and usability for customers frequently turn out to be conflicting objectives. What is needed to solve this dilemma is a paradigm shift in resource investment. Along with directing resources toward strategic services while also keeping up with changes in user values, such as those associated with FinTech, it has also become necessary for banks to make further cost reductions by pushing ahead with the standardization of non-strategic, low-margin activities, such as administrative procedures, where there is little scope for differentiation from other banks, and on consolidating such work with other banks (see Fig. 1).

* iPhone is a trademark of Apple Inc., registered in the U.S. and other countries. The iPhone trademark is used under license from Aiphone Co., Ltd.

Changes in Bank Customers

In considering future customer services, Hitachi considered channel strategies in terms of a 3C analysis of companies (banks), customers, and competitors, dividing bank customers into three segments, namely the asset-rich segment, the asset-builder segment, and the consumer segment (see Fig. 2). This section considers the consumer segment and the asset-builder segment.

The consumer segment contains those customers who are active consumers. The competitors in this context include retail-based banks and communications- and IT-based banks. A feature of these banks is that they deploy their own self-service channels that offer greater customer convenience, such as convenience store ATMs, and operate through business partnerships. The requirements for dealing with the consumer segment are to build up the brand while also installing more cash dispenser to improve customer convenience, and to improve profitability by expanding channels that provide access to consumer finance, a product that is in strong demand by people in this segment. Another requirement is to minimize investment costs as some aspects are difficult to differentiate from other banks.

The asset-builder segment refers to those customers who have a degree of savings that they are starting to increase gradually. Whereas people in this segment have a need for ways to invest their savings (portable assets) and to pass on property, the requirement for

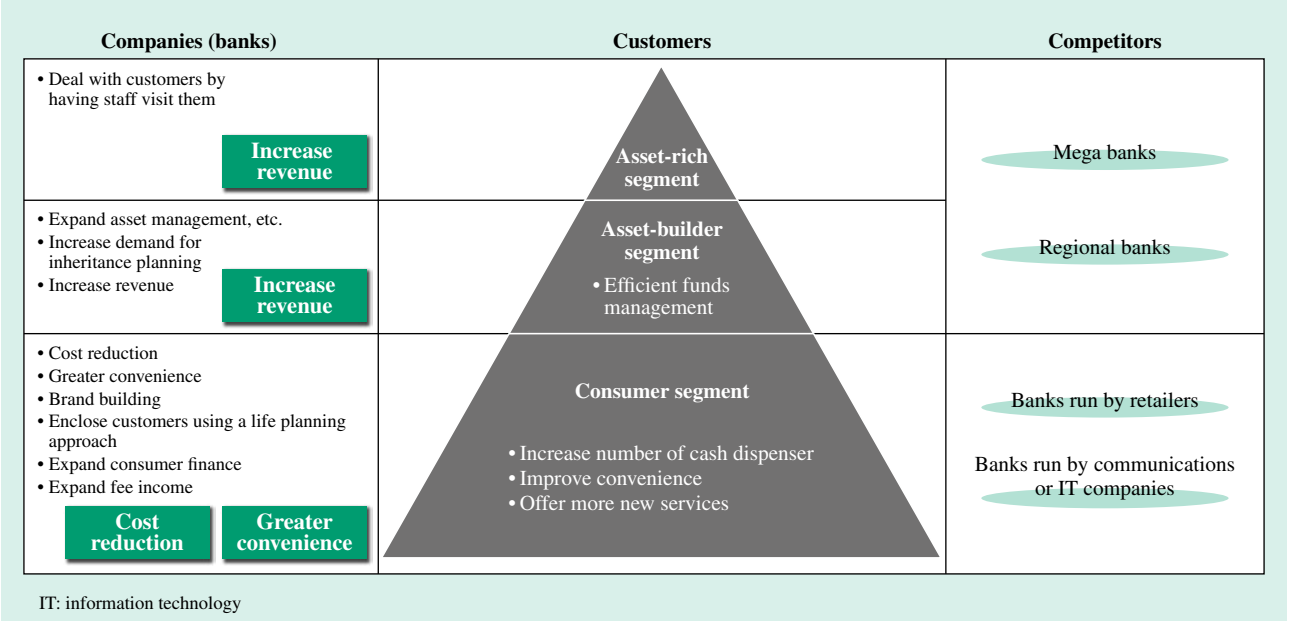

Fig. 2—Considerations Raised by 3C Analysis.
The asset-rich segment includes local people with high status or wealth. The asset-builder segment refers to those customers who have a degree of savings that they are starting to increase gradually. The consumer segment contains those customers who are active consumers.

companies (banks) is to step up their sales with the aim of generating steady income from fund management fees. The competitors for the asset-builder segment are other banks (regional and mega banks), with a key point being the banks' use of their own product services and channels as a means of differentiation.

Challenges Facing the Branch Channel and Future Branch Strategies

Next, because the branch channel is so dependent on regional characteristics, this section looks at the distribution of the population across different regions of Japan. Because this distribution is characterized by increasing polarization of the population between urban and suburban locations, it is necessary to consider urban and suburban branch designs separately. For example, regional polarization is becoming increasingly pronounced, and the urban populations of most regions are increasing while the populations in rural and other non-urban areas are steadily falling. Nevertheless, many rural locations have only ever had a single bank branch, meaning that further branch closures naturally pose a difficult problem for staff optimization.

Moreover, when considering the strategic opening of branches in locations such as new housing developments, deploying these branches with a sense of urgency is difficult in terms of cost as well as other factors when they require the same sort of heavy equipment as conventional branches, such as safes. Another difficulty with improving customer service might arise, for example, in the neighborhood of a railway station in an urban area when planning to open a new branch at the eastern exit of the station in response to a development project when there is already another branch at the western exit, in which case it is not possible to justify the cost of a conventional branch.

To deal with these challenges, Hitachi believes that new measures are needed that will improve customer convenience and cut costs by making changes to the bank branch network and branch facilities. Hitachi supports the branch strategies of banks through IT-based systems so that they can strengthen their business fundamentals and improve profitability while still maintaining ties to the community (see Fig. 3).

FOUR TYPES OF BRANCH STRATEGIES FOR FUTURE BANK BRANCHES

For future bank branches, Hitachi classifies the forms taken by bank branches into four main types with the aim of improving operational efficiency and speeding up branch deployment in accordance with the characteristics of the region and location. The four types are: unstaffed strategic branches, strategic branches designed to handle customer consultations, branches designed for efficiency, and

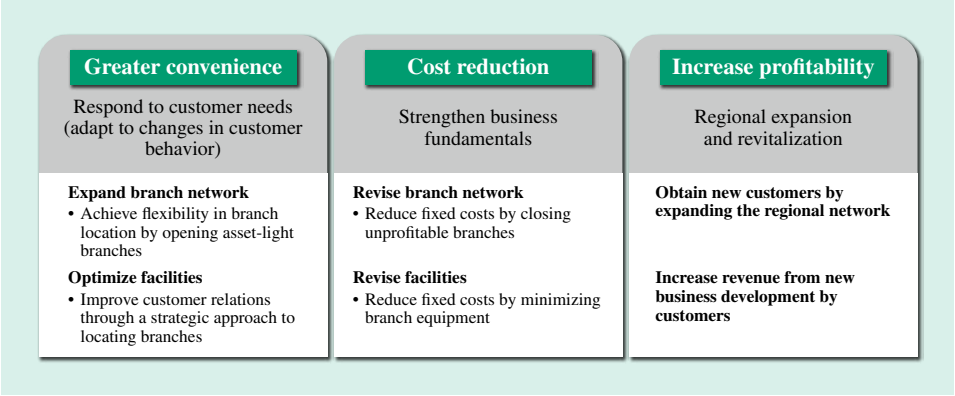

Fig. 3—Future Branch Strategies.
There is a need to proceed with measures such as increasing profitability by opening branches in places that suit the region, strengthening business fundamentals by cutting costs, and improving customer convenience by making changes to the branch network and branch facilities.

advanced branches (see Fig. 4). The characteristics of each type of branch and the relevant solutions are described below.

Unstaffed Strategic Branches

Unstaffed strategic branches are located in areas with high foot traffic, such as railway station buildings or condominiums, and are aimed at obtaining new retail customers by serving as convenient neighborhood banks. Because these branches are equipped with self-service devices such as advanced ATMs (ATMs that can be used to process form-filling procedures) and remote tellers (which can be used to undertake procedures or consult with staff located remotely via a video link), they can operate with minimal staffing (either no staff at all or just one person). In addition to deposits and withdrawals, which can be handled by the ATMs, these branches can also be used for taxes, public funds, private funds transfers, and official procedures or specialist consultations (see Fig. 5).

Strategic Branches Designed to Handle Customer Consultations

Strategic branches designed to handle customer consultations provide a place where customers can easily communicate with the bank and are aimed at promoting services such as lending and the sale of financial products. Because these branches are

		Branch type	Installation location	Features
Existing branches	Regions with rising populations	**Advanced branches**	Locations with high foot traffic such as city centers	Branches designed to increase margins by combining the following three elements, including using self service to improve efficiency and increase sales
	Suburban areas	**Branches designed for efficiency**	Suburban and other locations where the number of customers visiting branches is declining due to a falling population	Branches designed to maintain contact with customers while also cutting costs by redeploying administrative staff to lobby duty through consolidation and greater use of self service
Outside region or in previously unserved territory	Customer catchment	**Strategic branches designed to handle customer consultations**	Good at attracting customers who are potential targets for things like cross-selling, promotion, and new loans, locations that do not currently have a branch	Branches that provide a place where customers can easily communicate with the bank, and that are intended to increase revenue by encouraging loans and the sale of financial products
		Unstaffed strategic branches	Locations that do not currently have a branch but have high foot traffic, such as condominiums, supermarkets, or near railway stations	Branches designed to attract new retail customers by serving as a convenient neighborhood bank

Fig. 4—Four Types of Branch Strategies.
Branch strategies include turning existing branches into advanced branches in urban areas with rising populations and efficient branches in suburban areas with falling populations. They also include providing branches designed to handle customer consultations and unstaffed branches so that branches can be located in a strategic manner with the aim of acquiring customers from outside the region or in previously unserved territory.

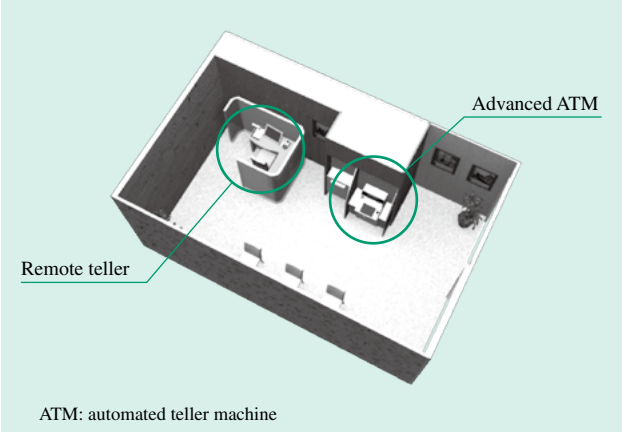

Fig. 5—Unstaffed Strategic Branches.
These branches are equipped with advanced ATMs that are fitted with a scanner or similar device to enable self service for transactions that require customers to bring documents with them, something that is a challenge for transactional services. They are also equipped with remote tellers that make it possible to operate a new type of "lightweight" bank branch in which transactions that involve account servicing and consulting with customers can be handled remotely.

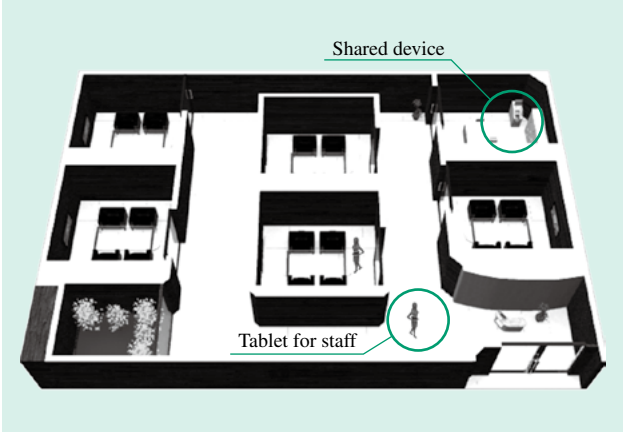

Fig. 6—Strategic Branches Designed to Handle Customer Consultations.
By using tablets loaded with Hitachi's branch system package, these branches use general-purpose devices in place of the terminal systems used in the past for branch accounting and enable staff to share the use of dedicated banking devices used for things like cash and bankbooks. This significantly reduces the cost of branch systems.

designed for consultations, they do not make much use of cashiers or banking devices such as bankbook printers. Accordingly, a small number of such devices can be shared by the entire branch and operated from the tablets used by the staff. This minimizes the quantity of special-purpose equipment that needs to be supplied to a new branch and allows a customer-oriented layout to be adopted without having to worry about where these devices are installed. This enables the low-cost, strategic deployment of branches that are primarily intended for dealing with customers (see Fig. 6).

Branches Designed for Efficiency

A feature of branches that are designed for efficiency is that they enable a certain number of lobby staff to be retained while aggressively reducing the number of administrative staff through the use of self service. The aim is to reduce staff administrative workloads by having customers undertake such procedures for themselves, while maintaining contact with customers by having lobby staff greet them. Because the tablets used by the lobby staff in these branches have access to information provided by customers when undertaking procedures on self-service devices and their progress, the staff can monitor how each customer is getting along. This function makes it possible for staff to provide assistance or advice when appropriate, improving administrative efficiency, while still maintaining communication with customers (see Fig. 7).

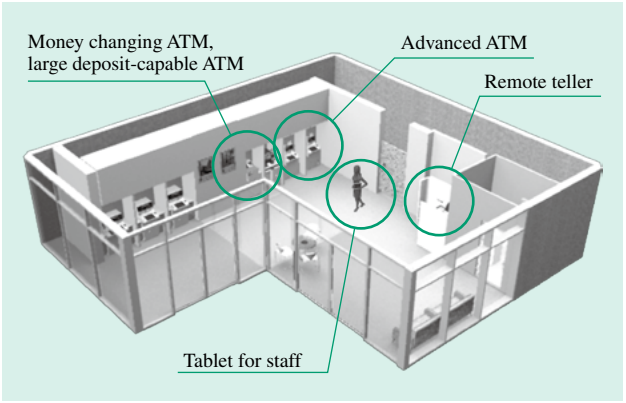

Fig. 7—Branches Designed for Efficiency.
This branch format ensures a certain number of lobby staff despite aggressively reducing the number of administrative staff through the use of self service. It is intended to significantly reduce staff administrative workloads by having customers undertake such procedures for themselves, while maintaining contact with customers by having lobby staff greet them.

Advanced Branches

Advanced branches combine all of the elements described above, including those for efficiency and sales improvement. A feature of these branches is that they are located in urban areas and have high foot traffic. They provide improvements in both efficiency and sales by having reception determine the requirements and aims of each customer's visit and then directing them to the appropriate service, making use of the information on the current status of the branch's staff and service channels. Administrative

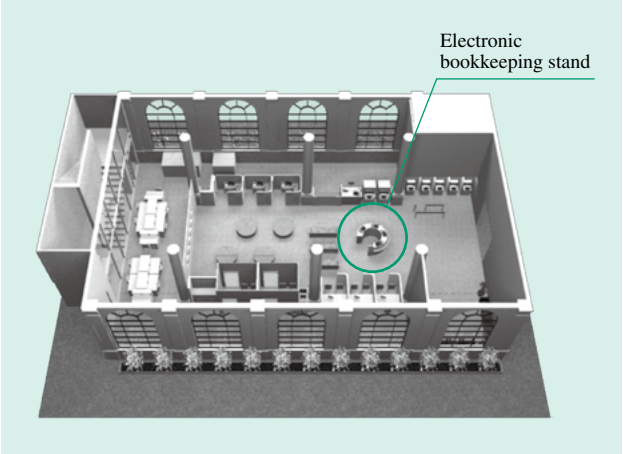

Fig. 8—Advanced Branches.
Electronic bookkeeping stands aim to improve operational efficiency further and to strengthen interaction with customers by converting conventional forms into electronic forms and by putting data entry devices online (for data sharing between branch system and accounting system).

procedures can be performed on self-service devices, freeing staff to use their tablets for sales work in the lobby or the consultation rooms (see Fig. 8).

Applying Device Solutions to Match Branch Strategy

Up to this point, the strategies for each of the four types of branch have been described. This section describes the solutions to be applied for each branch. Hitachi supplies customer-operated self-service solutions, such as electronic bookkeeping stands that facilitate appropriate pre-assessments of customers when they arrive at the branch by having them electronically input the requirements for their visit, remote tellers that can be used to complete procedures using a video link when needed with assistance from remotely located staff who are provided to handle specialist consultations or to undertake procedures outside of normal working hours, and advanced ATMs that can be used for form-filling procedures as well as normal ATM functions. By supplying these self-service solutions, Hitachi aims to improve customer convenience by making them available for afterhours use, for example. By equipping staff with devices that allow mobility, such as tablets for staff, the flow of customers in the branch can be reformed to achieve a style of customer service where staff go out among the customers. The cost of devices is reduced by sharing banking devices between multiple staff. Cost reduction can be achieved without compromising service levels by applying a combination of these solutions that suits the characteristics of the branch (see Fig. 9)

MODULARIZATION OF BANKING SERVICES

Service delivery at bank branches demands a rapid response to customers' increasingly diverse needs together with more efficient operation of the associated systems. To shift personnel toward strategic activities while still maintaining and improving branch efficiency, it is necessary to break down business processes into individual functions, to modularize

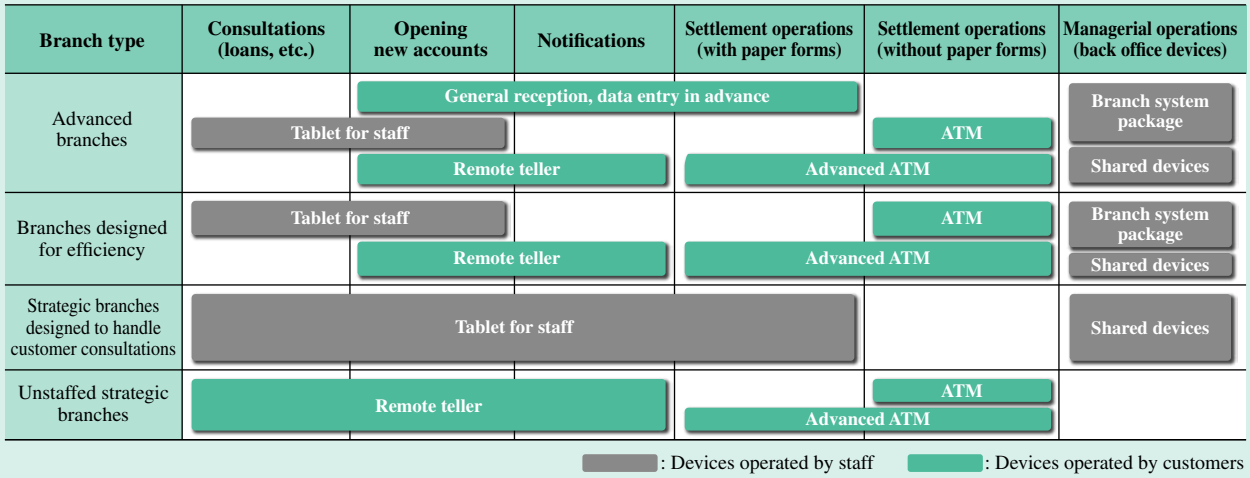

Fig. 9—Operations and Solutions for Each Type of Branch.
The establishment of new types of branches represents a shift toward greater operational efficiency and stronger sales by promoting overall optimization, including the lobby and back office, as well as by reducing teller window and middle office work.

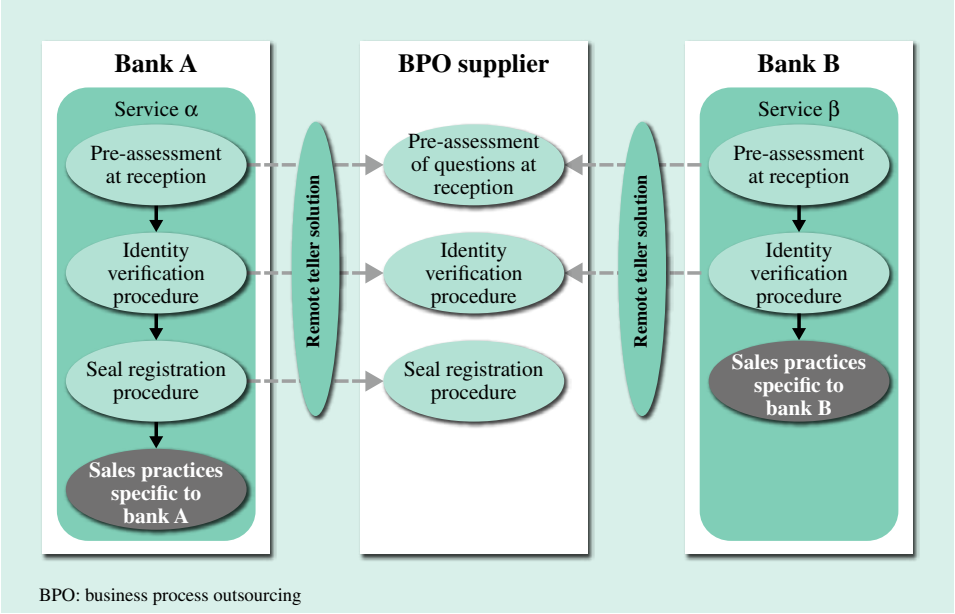

Fig. 10—Modularization of Operations for BPO. Modularizing and consolidating standard business processes makes outsourcing easier and enables further cost reductions.

the IT for each function, and to develop practices that can make effective use of this IT. The implementation of these various modules also requires measures that are resilient to change, such as ways of strengthening crisis management, overall service capabilities, and governance, and the efficiency of bank operations can be improved even further by designing the modules to have a higher degree of reusability. Hitachi believes that modularizing banking services in an appropriate manner will facilitate things like the outsourcing of procedures that are handled at the level of individual modules or the consolidation of such work with other banks, and can develop into efficiency improvements that have even greater flexibility.

Use of BPO for Banking Services

Currently, progress is being made on outsourcing at the level of bank branches and elsewhere by spinning off particular operations. However, many of these spun-off operations include requirements that are specific to the bank concerned and it is feared that this will pose an obstacle to future initiatives such as the consolidation of such operations with other banks. In order to make further cost reductions and operational improvements, an important feature of BPO in the future will be that, rather than each bank offering its own individualized services, these services will be modularized as standard business processes so that the resulting modularized processes can be shared among banks. This modularization will require processes to be divided in order to permit the rapid introduction of new services and changes to practices. The applications in Hitachi's branch system packages were designed and developed in component form to facilitate this division and reconstruction, enabling implementation in the form of components and modules at a functional level. However, BPO requires not only the division and reconstruction of applications at the system level, but also the sharing and reallocation of human resources for performing administrative procedures. To solve this problem, Hitachi has started to supply a remote teller solution that provides support for such procedures from an off-site location.

The remote teller solution provides a way for tellers with specialist skills who are based off-site to accurately perform administrative procedures for customers. If this business process, too, can be suitably divided and reconstructed, it will be possible for different banks to consolidate the work in a way that lets them share resources (see Fig. 10).

BPO Model at Branches Shared by Financial Institutions

A new way of using branches that arises when changing the format of branches to suit the region (location) and aims of the branch, as described above, is for multiple financial institutions to operate branches jointly. An example of this that is already in operation is where multiple financial institutions provide after-sales services using a BPO model based on jointly operated branches, such as handling changes of address or reissuing cash cards for the private customers of regional banks who have moved away from their region

to live in a city. It is anticipated that this approach will be adopted more widely in the future as a way of improving customer convenience in locations that have high foot traffic, such as near railway stations or in shopping malls, particularly in cities.

In rural areas, meanwhile, improving the efficiency of aging and unprofitable branches is a pressing concern for regional financial institutions, meaning there is potential for such rural branches to adopt a BPO model based on joint operation that can consolidate non-strategic after-sales services within a region by outsourcing this work to other regional financial institutions or agencies such as post offices that operate nationwide branch networks. Because mobile branches are not economically feasible in those rural areas that are even more sparsely populated, there is scope for having these operated by multiple financial institutions, or for services based on a joint BPO model involving cooperation with companies from other business categories, such as logistics. It is anticipated that BPO models like these that cross multiple industries and work through joint participation by multiple financial institutions or companies from other business categories will be adopted as a way for financial institutions to maintain service continuity. Hitachi believes that its solutions that facilitate the modularization of business processes and their division and reconstruction are suitable for implementing these BPO models in which operations are shared by multiple financial institutions.

CONCLUSIONS

This article has described the forms that Hitachi expects bank branches will take in the future and the measures for achieving these forms based on the challenges facing the branch channels operated by banks. It is anticipated that things like linking with new smartphone-based services and using ATMs as cash dispenser will play a more important role in the future as changes are made to the format of branches to suit their regions and aims. With a product range that encompasses channel services as well as the devices presented in this article, Hitachi is able to serve as a one-stop supplier of channel solutions. Hitachi can also supply services with high added value by combining these solutions with customer relationship management (CRM) information systems that incorporate new technologies such as robots, artificial intelligence (AI), and big data analytics. By sharing a vision for branches (channels) with its customers, Hitachi intends to develop new branch solutions.

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Featured Articles II

Proposal to Financial Institutions for New Contract Customer Acquisition Support Using Human Networks

—Technology for Identifying and Visualizing Introducer Models—

Yukinori Terahama, Ph.D.
Shigeru Suzuki
Kazuyuki Iida
Tomokazu Sakai

OVERVIEW: Finding customers who generate new value is an important factor in increasing revenue at companies. In the case of outcall sales in particular, how sales representatives acquire new prospective customers has a direct bearing on their performance. Unfortunately, the know-how required to acquire prospective customers is an intuitive skill that is learned by sales representatives through experience and, in many cases, it is not part of the institutional knowledge of the company. In response, Hitachi has developed a customer acquisition support service for identifying introducer models (key people), and for visualizing the human relationships between customers in the form of a network. Along with an AI technology that generates a list of existing customers who have a high likelihood of providing leads on new prospective customers, this article proposes applying this service to support sales, starting with financial institutions.

INTRODUCTION

HOW to find and acquire customers who generate new value is an important factor in increasing revenue at companies. In the case of outcall sales at financial institutions in particular, how to acquire potential customers that lead to new contracts has a direct bearing on the performance of sales representatives. Unfortunately, to acquire prospective customers in an efficient manner is, in many cases, an intuitive skill that is learned by sales representatives through experience, and is not part of the institutional knowledge of the company[1].

The customer acquisition support service described in this article is based on a business style called "referral sales"[2, 3] whereby new sales leads are acquired from existing customers in such a way that the company's institutional knowledge is utilized for efficiently identifying customers can be expected to lead to new contracts. Specifically, the relationships between customers are first visualized in the form of a human network and an introducer model is developed by identifying the types of customers that will become key people with a high likelihood of providing leads on prospective customers. Next, a list of existing customers who have a high likelihood of providing leads on new prospective customers is generated according to this introducer model. Hitachi is currently developing a sales-support-oriented artificial intelligence (AI) technology for efficiently building human networks and identifying introducer models.

The rest of this article proposes applications that utilize this technology for sales support, starting with financial institutions. Furthermore, testing has been undertaken to verify the feasibility of the ideas presented in this article, and the results of this testing are also presented here.

CURRENT SITUATION AND CHALLENGES FOR SALES ACTIVITIES WHEN ACQUIRING NEW CUSTOMERS

While acquiring new customers to increase revenue is one of the concerns faced by financial institutions, the environment of stricter compliance in recent years, personal information protection systems, and rising awareness mean it is no longer easy for outcall sales representatives to use cold calling as a way to acquire new customers. In the case of outcall sales of life insurance, in particular, while it is understood that many companies have in the past chosen to rely on the individual experience and know-how of outcall sales representatives to acquire new customers[4], for the reasons described above, they are now finding

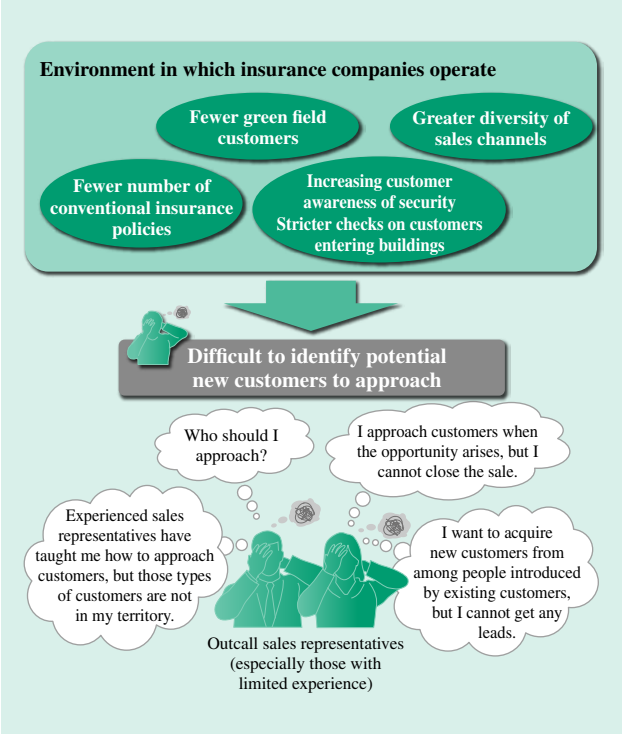

Fig. 1—Current Situation and Challenges for New Customer Acquisition by Insurance Companies.
The figure enumerates the current situation concerning the sales systems at major insurance companies and the main challenges they face in acquiring new customers.

it difficult to acquire customers that lead to new contracts. New sales representatives, in particular, who lack sales experience, are finding themselves at a loss in terms of knowing how to acquire new customers (see Fig. 1).

Moreover, it is difficult to raise the level of overall sales performance as an insurance company by simply relying on experienced sales representatives to build up sales know-how over time in the form of personal knowledge. What are needed are organizational practices for passing on the know-how of experienced sales representatives in order to improve performance across the company.

This article proposes a support service for new contract customer acquisition that can be used by outcall sales representatives in their work and that functions by focusing on customers with a high likelihood of providing leads on new customers, thereby providing a means to utilize the institutional knowledge of the company to acquire customers in an efficient manner. The aim for the future is to establish the service at financial institutions, including the development of AI technology for sales support that will enable the service to be implemented efficiently.

USING HUMAN NETWORKS TO SUPPORT CUSTOMER ACQUISITION

Overview of New Contract Customer Acquisition Support Service

To acquire new customers, the service uses a business practice called “referral sales” whereby new customer leads are acquired from existing customers. To achieve this, the relationships between customers are visualized in the form of a human network and this is used as the basis for building an introducer model by identifying the types of customers that will become key people with a high likelihood of providing leads. A service is provided that generates a list of the existing customers of each sales office who are similar to the introducer model so that those customers can be approached with a high likelihood of providing leads (see Fig. 2).

Visualizing Human Networks and Building Introducer Models

Under the hypothesis that some set of characteristics in existing customers indicates which of them can become sources of leads on new customers, and that this is derivable from the nature of past relationships between existing customers, the first step is to build a network that reflects these relationships. In the resulting human network, the nodes represent customers and the edges between the nodes represent the relationships between customers. How the nodes are connected (in other words, which customers have distinctive relationships with other customers), can be identified from the following two perspectives.

(1) From the perspective of the continuity of customer leads

Among the customers, there are those who have had their concerns about insurance resolved by sales representatives and who go on to provide leads on other customers with similar concerns. This perspective focuses on the types of customers who form chains such that, when a sales representative visits a customer who was introduced in this way and the customer is receptive to the sales pitch, that customer provides a lead on another potential customer.

(2) From the perspective of the diversity of customer relationships

This perspective focuses on those customers who provide leads on a large number of other customers and who have a wide variety of relationships with other people, including relatives, friends, and neighbors. This is based on the idea of small-world networks[5] in which connections with the sort of

people being targeted can be achieved more quickly via nodes (customers) that facilitate the propagation of information over a wide area. Accordingly, the focus is on the types of existing customers who have a wide variety of relationships.

Based on these perspectives, the service identifies customers who fit these profiles as "key people." Next, focusing on the attributes of the key people that were identified, an introducer model is built based on customers with a high likelihood of providing leads by grouping together other key people who share the same attributes (see Fig. 2).

Listing Customers with a High Likelihood of Providing Leads

Among the existing customers of each sales office, a list is generated of customers who have attributes that closely fit the introducer model described above. The sales manager then selects the customers that should be approached from this list of customers and issues instructions to the outcall sales representatives.

Sales activities with respect to the selected customers are actually carried out and the results (whether they provided any new leads) are used as feedback to update the human network. This enables the introducer model of customers with a high likelihood of providing leads to be refined so that support for new contract customer acquisition can be delivered with greater precision.

Development of a New Contract Customer Acquisition Support Tool

Hitachi is developing a customer acquisition support tool to provide efficient support for new contract customer acquisition. The tool includes a function that builds a human network from the relationships between a large number of customers, uses this to build an introducer model from the perspectives of the continuity of customer leads and the diversity of the relationships, and then lists the customers who are similar to the introducer model. Fig. 3 shows example screens from this tool.

Verification Testing of Customer Lists

Verification testing was conducted at an insurance company to determine whether the customer lists generated by this method really can identify customers who provide a large number of leads. When the mean number of new customer leads (1.6 people) provided by approximately 5,000 customers who had previously provided leads was compared with the mean number of leads provided by customers on the tool-generated list (2.3 people), the results showed that the mean number of leads was approximately 1.4-fold among

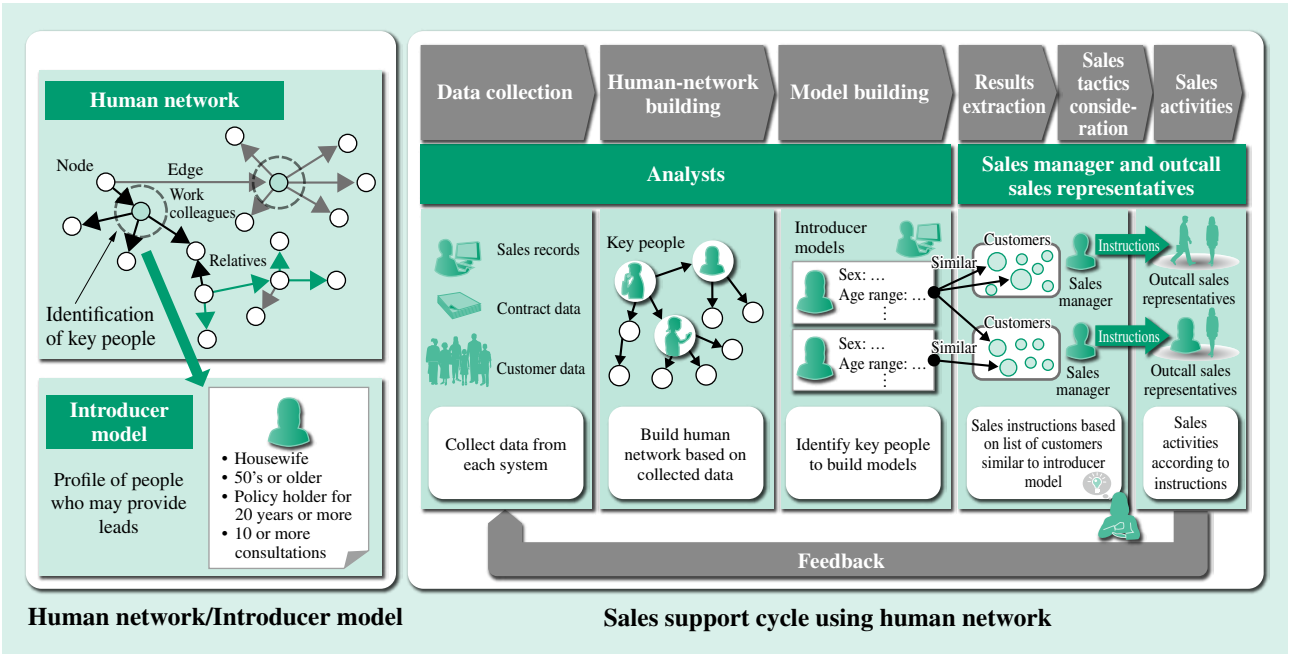

Fig. 2—Overview of Customer Acquisition Support Using a Human Network.
Outcall sales representatives use human networks in their work by representing the relationships between existing customers as a network and identifying introducer models with a high likelihood of providing leads, then using this as a basis for generating a list of the customers managed by each sales office that have a high likelihood of providing leads.

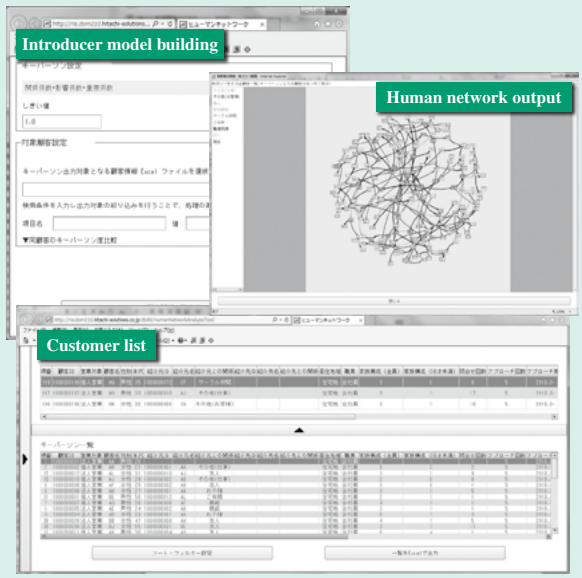

Fig. 3—Example Screenshots from the Customer Acquisition Support Tool.
The customer acquisition support tool is used to list customers with a high likelihood of providing leads by creating a human network from information about existing customers and building introducer models.

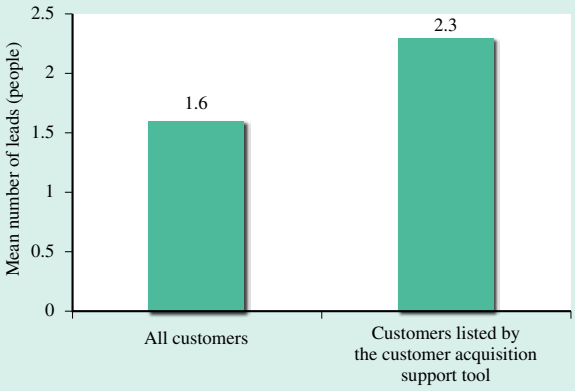

Fig. 4—Comparison of Mean Number of Customer Leads.
A comparison of the set of all customers who provided leads and the mean number of leads among customers on the list showed that the mean number of leads for customers on the list was approximately 1.4 times as much.

the customers on the list (see Fig. 4). This test result indicates that this method can be used to produce a list of customers with a high likelihood of providing leads. It is necessary to verify whether having outcall sales representatives approach customers who are listed as similar will actually result in these customers providing new leads in the case when they may not have provided many leads in the past, but match the introducer model. In the future, Hitachi intends to follow up on the results of such verification to confirm the viability of this method.

APPLICATIONS AND SERVICE FORMAT

Potential Applications

While it is anticipated that the service will initially be used to support outcall sales representatives at insurance companies and other financial institutions with new contract customer acquisition, the following applications are also anticipated for consumer and business sales in other business fields that use "referral sales" as a business model.

(1) Door-to-door sales of vehicles and cosmetics

The business practice of "referral sales" also is being used to increase sales in the case of door-to-door sales to meet customer needs, such as vehicle sales and cosmetic sales. Scope exists for such applications because it is thought that having a way to focus sales attention on existing customers with a high likelihood of providing leads will help increase sales.

(2) Door-to-door sales of real estate

Sales practices that use relationships between customers as a starting point are also used in the sale of residential and other real estate. In other words, if people can trust each other, then they can become new prospective customers if they are in a position to be introduced by a customer. Accordingly, this represents another potential use for the service.

(3) Outcall sales for companies

By extending the definition of nodes in a human network to include organizations as well as individuals, a model of the types of companies that are worth approaching can be developed by considering the relationships between companies. There is scope for banks to use this to identify potential customers for loans, for example, by generating a list of companies that fit the model and using it to select targets for outcall sales.

Service Format that Hitachi Provides

Fig. 5 shows the format of the new contract customer acquisition support service as it is actually provided by Hitachi. For the human-network analysis system, client-specific models are developed by using general-purpose introducer models that Hitachi has built-up over time as a base and customizing them to suit individual customers. It is anticipated that this will involve information delivery services such as the

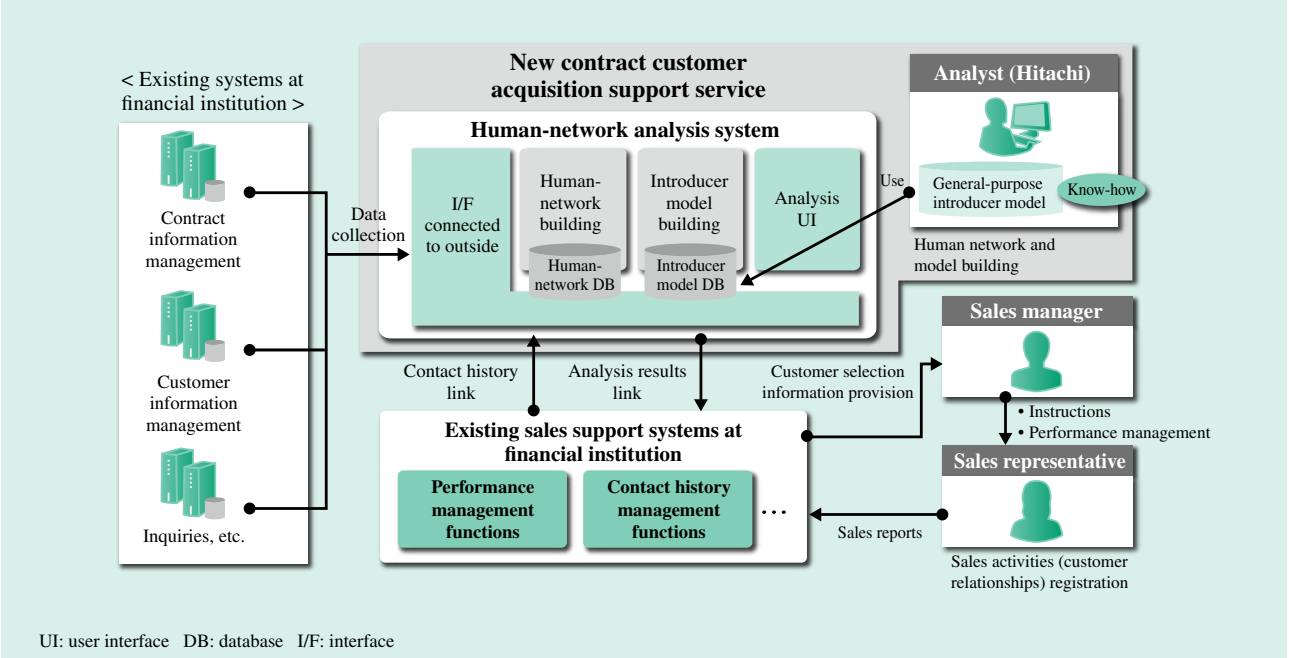

Fig. 5—Format of New Contract Customer Acquisition Support Service Provided by Hitachi.
Hitachi provides an information service that uses the introducer models it has built up over time in the form of a customer acquisition support service that uses a human-network analysis system.

generation of lists of target customers by linking the human-network analysis system with existing systems at financial institutions.

Along with specific companies, the support service for new contract customer acquisition can also be deployed horizontally across different business categories if companies deliver similar services. The applicable scope of the service can also be expanded by building up a portfolio of introducer models.

CONCLUSIONS

This article has described a support service for new contract customer acquisition that uses AI technology for sales support to enable outcall sales representatives to efficiently identify prospective customers for insurance policies or other products using the business practice of "referral sales."

Hitachi proposes that the know-how in new contract customer acquisition, which in the past has been an intuitive skill that was learned by sales representatives through their own experience, can be one means of making effective use of a company's institutional knowledge. The initial intention is to use it as a way of supporting door-to-door outcall sales by insurance companies, and subsequently to deploy it horizontally with the aim of applying it at financial institutions.

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Featured Articles III

Digital Innovation Platform and Its Application for Financial Services

Kiyoshi Takahara
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Mitsuyasu Iwata
Takeshi Yoshikawa

OVERVIEW: Social innovations achieved through the digitalization represented by IoT are bringing major changes, not only to the finance sector, but also to all areas of society. The creation of new value in ways that transcend the boundaries between companies, industries, and business categories and the adaptation to the rapidly changing business environment will require a platform that is different from the IT systems used in the past. This article summarizes the requirements for this platform and describes Hitachi's IoT Platform, Lumada, announced by Hitachi. It also presents examples of innovation in the industrial sector and mentions advances in the fusion of finance and industry through digitalization. Finally, this article looks into the opportunities for improving the accuracy of risk assessment, controlling loss costs, and creating new services in collaboration with other industries that are made possible by applying this platform in the finance sector.

INTRODUCTION

FROM their first appearance in the 2nd half of the 20th century, computers were used to process business data in offices. With the emergence of the Internet, the scope of information technology (IT) expanded to include non-routine work as it became a means to encourage connections between people through tools like e-mail and social networking services (SNSs). Recent years have also seen the marked spread of the Internet of Things (IoT) and the connected car, referring to the connection of devices and vehicles, respectively, to the Internet, with the network-connected things themselves transmitting and receiving information. As the number of target devices increases, explosive growth is taking place in the quantity and diversity of the information they produce (see Fig. 1).

The digital innovations brought about by this digitalization of the whole society have been characterized, among other things, as representing a fourth industrial revolution (Industrie 4.0[*1]) and a new type of society (Society 5.0[*2]).

*1 A strategic project run primarily by the German government for improving manufacturing. http://www.plattform-i40.de/

*2 A concept proposed in the 5th Science and Technology Basic Plan (2015) of the Cabinet Office of Japan. The plan stipulates, "through an initiative merging the physical space (real world) and cyberspace by leveraging information and communication technology to its fullest, we are proposing an ideal form of our future society: a 'super smart society' that will bring wealth to the people." http://www8.cao.go.jp/cstp/kihonkeikaku/index5.html

CHALLENGES FOR DIGITAL INNOVATION

The finance sector has been quick to make use of IT in business, including by shifting accounting systems online. Financial institutions have developed over time by continually adopting sophisticated IT innovations, such as Internet banking, risk calculations for complex financial products driven by financial engineering, and high-frequency trading (HFT).

With the arrival of this new era of digital innovation, financial institutions with involvement in the IT industry faced the following new challenges to the continued provision of sophisticated services in the future.

(1) Agility

The changes driven by digital innovation are coming at a faster pace than occurred with IT in the past. Examples include technologies introduced by venture businesses that have spread rapidly, such as highly convenient smartphone applications and virtual currencies. The blockchain technology that serves as the basis of virtual currencies is recognized as an innovative technology common to not only financial institutions, but also to a wide variety of industries.

It is essential that innovative businesses be established quickly by putting these powerful new technologies to practical use.

(2) Openness

Digitalization is advancing in all industries, with all sorts of different economic and social activities being

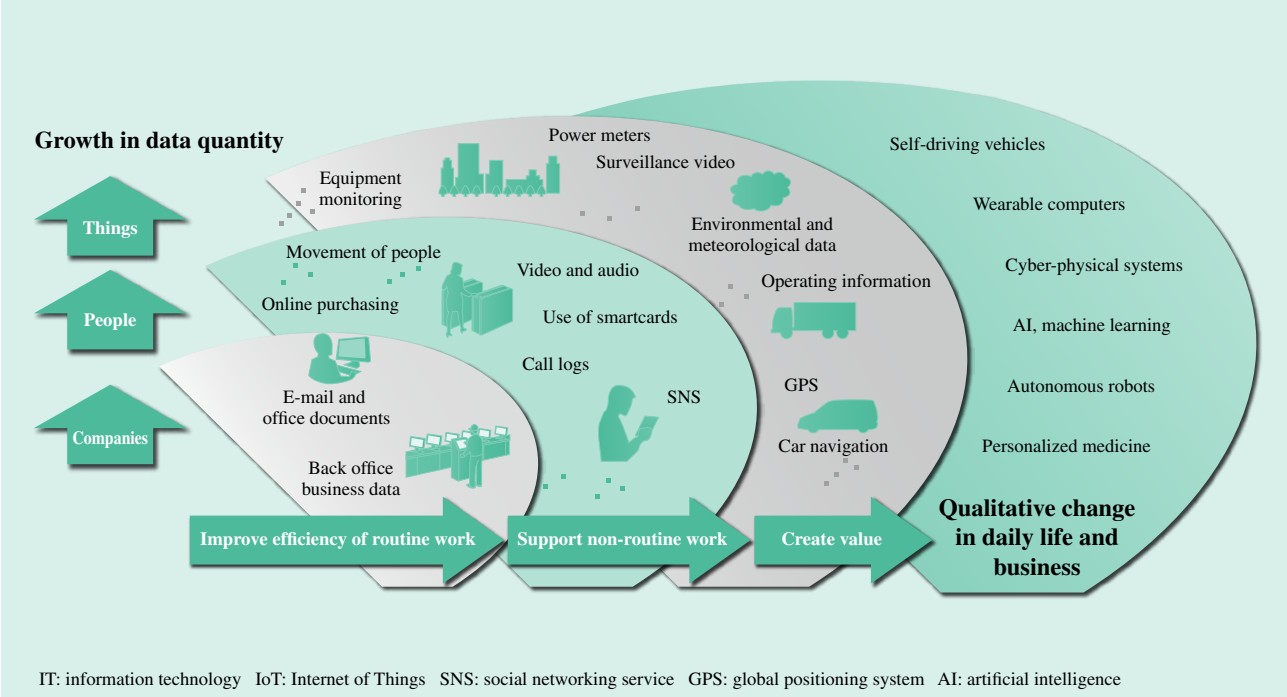


Fig. 1—Expansion in Applications for IT and Growth in Data.
The quantity of data to be processed is increasing rapidly due to the growth in quantity and diversity of data generated by devices as a result of the IoT and the expanding scope of IT.

converted to digital data, including the production, tracking, and distribution of goods; traffic conditions; the dissemination of news on the Internet; and the posting of SNS messages. To capture this data and deliver sophisticated services, financial institutions will be required to flexibly coordinate with companies in other industries and business categories that generate this data to create a connected world.

It goes without saying that these arrangements need to be both open and secure. It is essential that the interfaces that make financial services available to other industries and business categories are provided in a secure manner.

NEW WAYS AND PLATFORMS FOR DELIVERING IT

The format of IT is also progressively changing in response to the wave of innovation created by digital technology.

Originally, the most common model used by financial institutions for providing services was to retain their own IT. Under this model, IT vendors participated in the system development of financial institutions as system integrators.

Subsequently, a new approach to using IT has emerged wherein a number of financial institutions develop and operate systems jointly with the aim of reducing costs as systems become larger and practices become more complex. Accordingly, the idea of shared economy, where a number of businesses share an IT platform to reduce the cost of development and maintenance, has been incorporated into system platforms.

Cloud computing has transformed IT by taking this idea further and making applications and platforms available as services. The jointly operated data centers of regional banks were among the early adoptions of this model.

Future digital innovation will involve a frequent exchange of data and services across different industries and business categories. Rather than the past practice of sharing services and other resources across a limited range of industries, a requirement of new platforms will be the establishment of ecosystems that span multiple industries and business categories (see Fig. 2).

HITACHI'S IOT PLATFORM, LUMADA

Based on the above considerations, in May 2016 Hitachi announced its IoT platform, "Lumada" as a new platform to overcome these challenges.

Hitachi has a product range that includes power generation, railway, and medical devices, and an

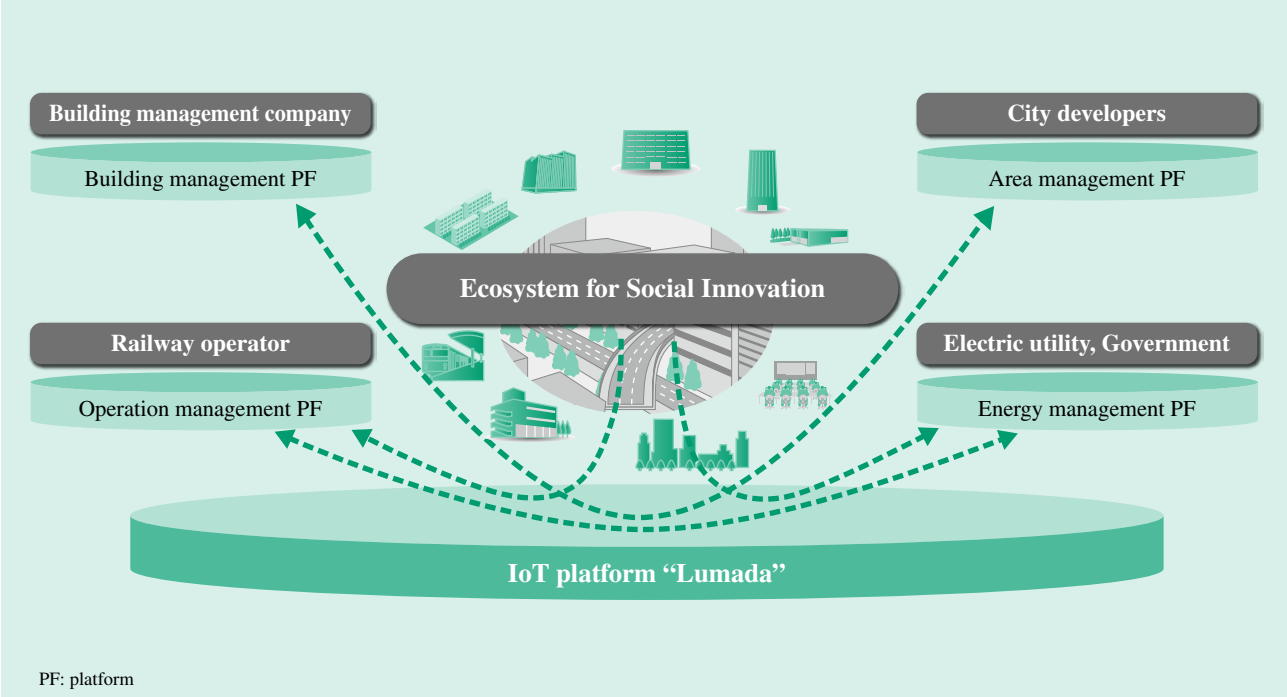


Fig. 2—Platform that Provides an Ecosystem for Innovation.
Progress in digital innovation is enabling the exchange of data and services across different industries and business categories, creating a need for platforms that can provide an ecosystem for innovation.

extensive portfolio of operational technologies (OT) for controlling and operating these products. It also has extensive experience from its participation in the IT industry, dating back to the early days of computing. Lumada consolidates Hitachi's advantage of possessing both OT and IT. The Lumada platform supports not only the IoT, but also all aspects of digital innovation.

(1) Platform for agility and collaborative creation

Digital innovation is the use of digital techhnologies to resolve management challenges or to create new business.

In the past, the mainstream practice for building IT systems was to have an IT system user, who has knowledge of the business, specify requirements and specifications, and then contract an IT vendor to deliver the system. In the case of digital innovation, in which IT is one source of innovation, a closer relationship between customer and IT vendor is required.

The first step in digital innovation is for the company and IT vendor to work together to come up with potential new innovations and to start by conducting a feasibility study. Once the feasibility has been demonstrated, the next step is front end engineering design (FEED), which includes consideration of the technical issues and tentative costs. This also requires easier system operation and management, with faster development, configuration, and modification compared to the past.

Lumada facilitates these processes and provides the required functions and components as a platform (see Fig. 3).

(2) Achieving openness

Because digital innovations that originate through collaborative creation involve greater coordination between the customer and the IT vendor, and more frequent interaction with other industries and business categories than in the past, they call for open practices that are not dependent on any specific type of IT.

There has been a rapid spread in the use of open source software (OSS), meaning software for which the source code and intellectual property rights are publically available and that is developed jointly based around a community. Many new technologies on the Internet are provided through OSS, and such software is becoming a de facto standard in various areas.

For Lumada, the benefits of using OSS for its individual components include enabling quick adaptation to new fields of IT and the availability of engineers.

The platform also accelerates collaborative creation by providing its interfaces and functions in open formats that make interconnection and shared use with other companies easier.

LUMADA AND OT SYSTEMS, EXISTING IT SYSTEMS

(1) Coordination with OT Systems

The emergence of the IoT, with the connection of a wide variety of devices to the Internet, has been a major factor behind digital innovation. A variety of protocols and standards have been proposed for communicating with these devices since the time when the term "machine to machine" (M2M) was coined. OT systems take various forms depending on the nature of the devices and how they are connected to the Internet.

Lumada coordinates with these diverse OT systems.

(2) Coordination with existing IT

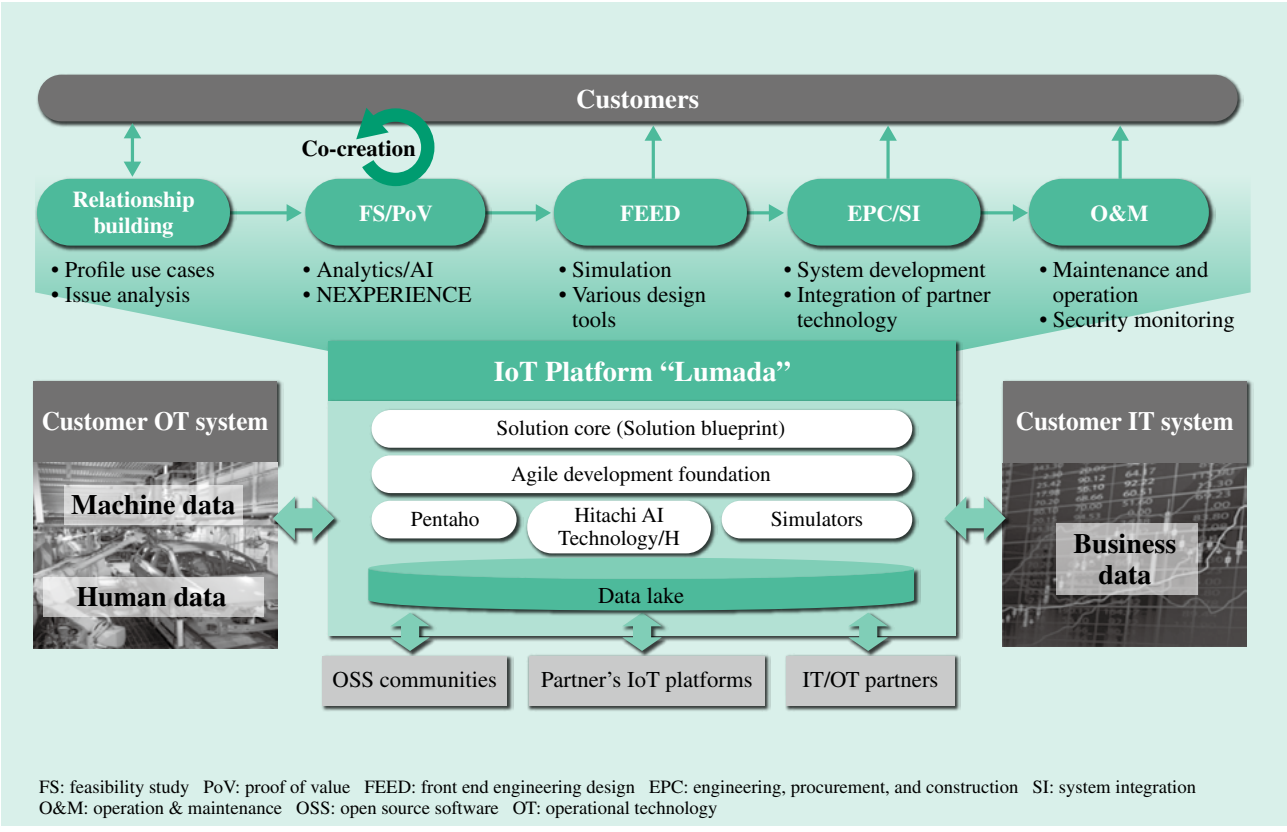
New businesses created through digital innovation do not mean a complete break with the IT of the past. Coordination with existing systems such as customer databases and payment systems remains essential. However, because these existing systems were built using the IT of the past, they have not been designed to work with new applications.

Among the other areas where it is involved in accelerating innovation, Hitachi is working on establishing the capabilities to assist customers with the modernization of existing applications and the development and management of interfaces that provide access from other applications.

APPLICATIONS FOR LUMADA (PROVIDING SERVICES TO MANUFACTURERS)

Hitachi uses Lumada, which has these features, as a basis for supplying solutions that improve energy efficiency, productivity, asset utilization, and the convenience of data exchange to a variety of business sectors, including industry, social infrastructure, and healthcare. In the case of industry, for example, the trend toward digital innovations as represented by Industrie 4.0 is bringing significant changes to the competitive requirements of manufacturers. Hitachi is combining OT and IT in the manufacturing industry to organize and enhance platforms that can coordinate different companies across multiple sectors, in what it calls the "optimized factory."

There is a strong requirement for manufacturing companies to transcend the boundaries between industries and to optimize value chains globally by



FS: feasibility study PoV: proof of value FEED: front end engineering design EPC: engineering, procurement, and construction SI: system integration
O&M: operation & maintenance OSS: open source software OT: operational technology

Fig. 3—Processes and Components for Agile Collaborative Creation using Lumada.
Lumada provides agility from early verification of potential innovations to implementation.

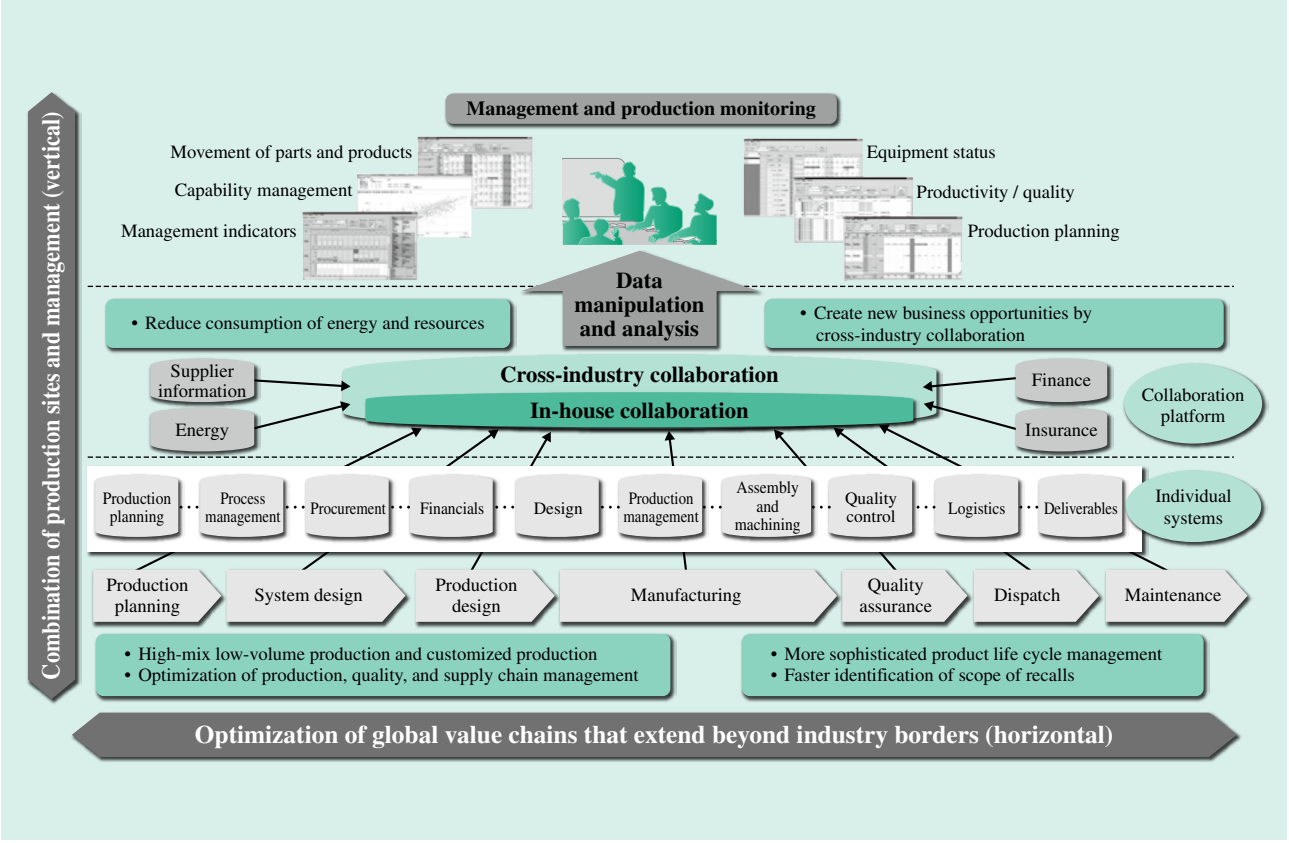


Fig. 4—Collaborative Creation Platform that Optimizes Manufacturer Value Chains.
The diagram shows the architecture of a service for optimizing manufacturer value chains through the coordination of data both inside and outside the company.

combining production sites and management (see Fig. 4).

For manufacturers that operate a number of sites around the world to perform accurate planning at a global level, they must be able to make accurate and timely assessments of information about production, sales, and inventory that is maintained individually at each site. This involves using IoT, big data, artificial intelligence (AI), and other forms of IT to collate and analyze workplace data on the activities of people, goods, and equipment, including procurement (of materials and parts), assembly (of semi-finished and finished products), quality control, and equipment operation, and to make immediate use of it in the workplace. It also involves analyzing the collected data and using it to make ongoing operational improvements.

Furthermore, Hitachi believes that the development of optimized manufacturing and management across the entire value chain [including procurement, assembly, logistics, and improving the cash conversion cycle (CCC) in coordination with financial institutions] is the next stage in improving business relations. Also transcending the boundaries between individual organizations to coordinate activities of those companies that make up a value chain and utilizing the big data this generates mean we can respond quickly to fluctuating demands and changes in the supply of materials.

INNOVATION IN FINANCE USING SERVICE PLATFORMS

How will financial institutions use this digital innovation platform to achieve financial innovation?

In the finance sector, digitalization has been adopted for many product services, such as deposits, transfers, securities, and financial markets, and also for the prerequisites of these services. While there remain cases that involve handling physical items such as cash, there is no need for “things” in product development and production.

While there are limited opportunities for the finance industry to adopt IoT for their business innovation, various innovations in financial products and services will be possible once the targets of financial service are digitalized, and data from the targets is collected

and available to financial firms to make the status of their targets visible.

(1) Improving accuracy of risk assessment

More accurate and detailed risk assessments can be made by collecting and analyzing the latest information such as life and economic activities, status, attributes of financial service customers (companies or individual customers), and entities involved (such as collateral). This has the potential to make assessing the advisability of granting credit or accepting a contract deal, pricing financial products, and evaluating the value of underlying assets, etc. with accuracy and criteria that are very different from those of the past.

(2) Creating opportunities to provide financial services

There is scope for using technologies such as AI and blockchain to automate transactions, policies, and the provision of financial services based on the circumstances of policy holders. This will create new opportunities by making financial services more customized, available on-demand, and timely.

(3) Control of loss costs

It will become possible to provide services to reduce potential losses by applying knowledge in the finance sector to customer data. This can both improve customer satisfaction and reduce loss costs for the financial institution.

Such services have already appeared in the field of vehicle insurance (called "telematics insurance"), and it is anticipated that these can evolve much further through the real-time collection and use of more detailed driving data in large quantities by taking advantage of advances in connected cars, for example.

While this has the potential to lead to more competition, driving down premiums for insurance companies, it can also provide a business advantage through the development of products and services based on the company's own know-how.

CONCLUSIONS

It is anticipated that the ability to collect and use big data to provide financial services through the adoption of the IoT will open up significant possibilities for innovation in those services. This means that financial institutions will need to form partnerships with the companies that use their services. Moreover, this will likely lead to financial institutions working on the platform and becoming part of business ecosystems, to develop and deliver appropriate and attractive financial services. Also important will be timely compliance with legal frameworks, regulations, and commercial practices.

In addition to making extensive use of its IoT platform "Lumada" in the industrial and public sectors, Hitachi will also strive to rapidly develop and deliver better services by utilizing the big data collected as a result of this and the associated know-how.

Based on the extensive technologies and knowledge of big data analytics that Hitachi has acquired in industry, it will engage in collaborative creation with financial institutions to determine how different sorts of data can be used in the development of financial products and services.

Hitachi also intends to work with financial institutions on creating the business ecosystems for achieving this.

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Featured Articles III

Development of New Enterprise Applications to Achieve Financial Innovation

Gaku Saito
Hideki Sakurazawa
Tomonori Nakamura
Kunihiro Muto

OVERVIEW: The market for the development of large enterprise applications like those used in the finance industry demands robust architectures that combine long-term stability and quality to ensure system availability, and also improvements in productivity and development speed (ultra-rapid development) to ensure a timely response to the hectic pace of change in business requirements. This changing environment and other challenges facing financial institutions have reinforced the need for an application development platform that can satisfy new requirements. In response, Hitachi, Ltd. is supplying a new application development platform service for achieving financial innovation using the latest Java EE 7 technology.

INTRODUCTION

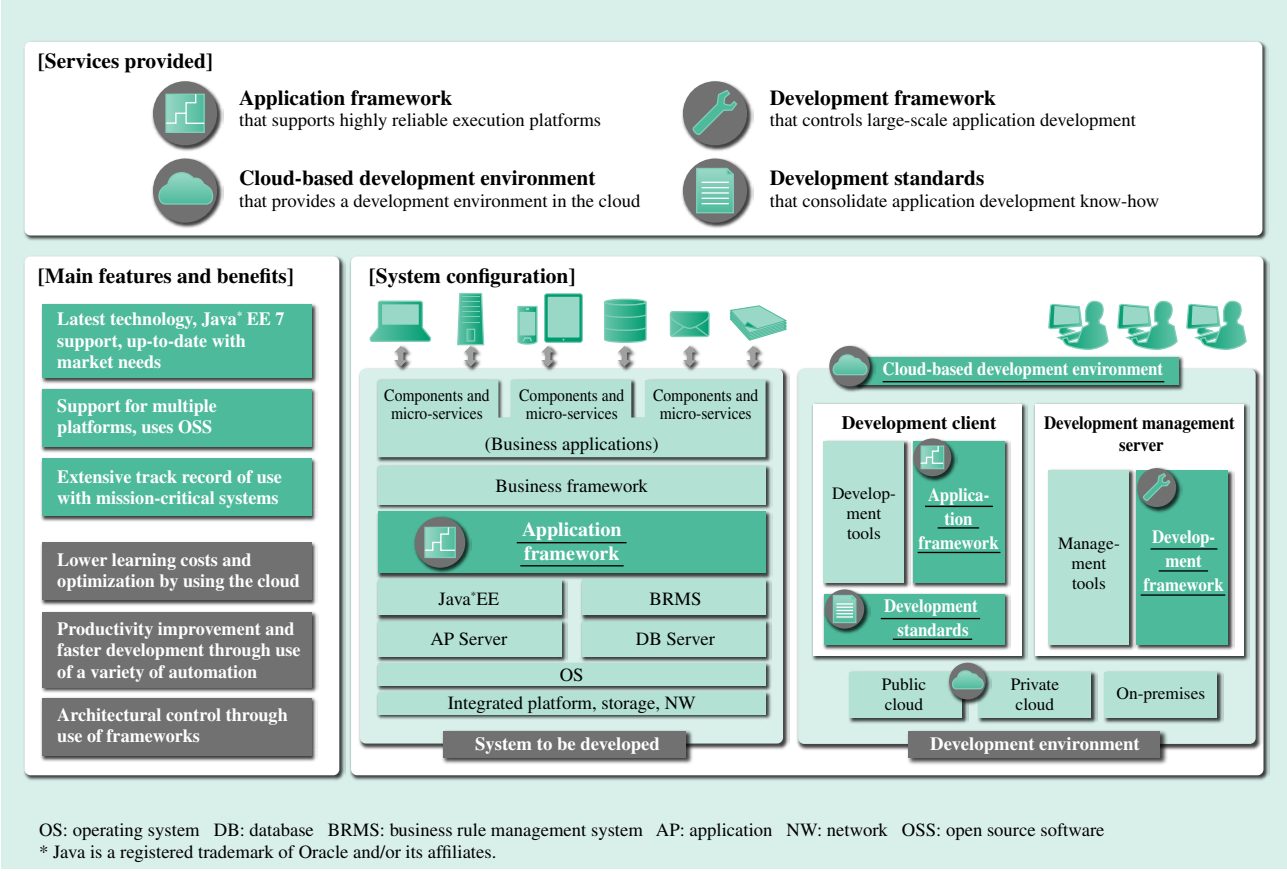
AMID a rapidly changing world economy and an upsurge in the pace of change associated with globalization, it remains necessary to deal with the challenges of responding quickly to business requirements, revitalizing business through the optimization of information technology (IT) costs, and delivering secure and high-quality systems. The period since the crisis triggered by the Lehman Brothers collapse has seen the rise of new players, including the financial technology (FinTech) startups that are appearing in the USA in particular, and who are developing services in areas not covered by existing financial institutions, such as payment services based on the Internet of Things (IoT), which has caught the eyes of general consumers, and also the emergence of advanced marketing services that make use of large quantities of credit card or other transaction data. Given these factors, how to deal with financial innovation has also become an important question.

Together with the improvement in business sentiment following an extended period of stagnation in the wake of the global financial crisis and the Great East Japan Earthquake, this means that there is growing sense among financial institutions that now is the time to upgrade their existing core business systems to a new generation of systems. Hitachi believes that the following new requirements need to be taken into account in the development of next-generation systems.
(1) Build systems that reduce total cost of ownership (TCO) by switching from mainframes to open systems and that can provide the best possible return on investment
(2) Avoid proprietary products and seek to use technologies based on open standards
(3) Take advantage of advances in open source software (OSS) and its use
(4) Use third-generation platforms, and development and operations (DevOps)
(5) Use new services that take account of systems of engagement (SoE), systems of record (SoR), and the IoT
(6) Shorten development times

OVERVIEW OF HITACHI APPLICATION FRAMEWORK'S APPLICATION DEVELOPMENT PLATFORM FOR ENTERPRISES

Hitachi has announced the Hitachi Application Framework, as an application development platform service that can satisfy the new requirements of financial institutions described above.

Providing four services (an application framework, a development framework, a cloud-based development environment, and development standards), Hitachi Application Framework is designed to overcome challenges by providing solution services in collaboration with customers that can develop in tandem with system growth and enhancements over time, while still maintaining the same "mission critical" standard of uninterrupted operation that has always been expected of core business systems.



OS: operating system DB: database BRMS: business rule management system AP: application NW: network OSS: open source software
* Java is a registered trademark of Oracle and/or its affiliates.

Fig. 1—Overview of Services Provided by Hitachi Application Framework.
Hitachi Application Framework deploys services with respect to two main areas: the system to be developed and the development environment. They provide an application framework, a development framework, a cloud-based development environment, and development standards.

FEATURES OF HITACHI APPLICATION FRAMEWORK'S APPLICATION DEVELOPMENT PLATFORM FOR ENTERPRISES

Fig. 1 shows how the four services provided by Hitachi Application Framework relate to one another and gives an overview of its main features and benefits.

Hitachi Application Framework provides an application framework for use in systems being developed in the SoR and SoE areas, and a development framework, cloud-based development environment, and development standards that are used to provide the development environment.

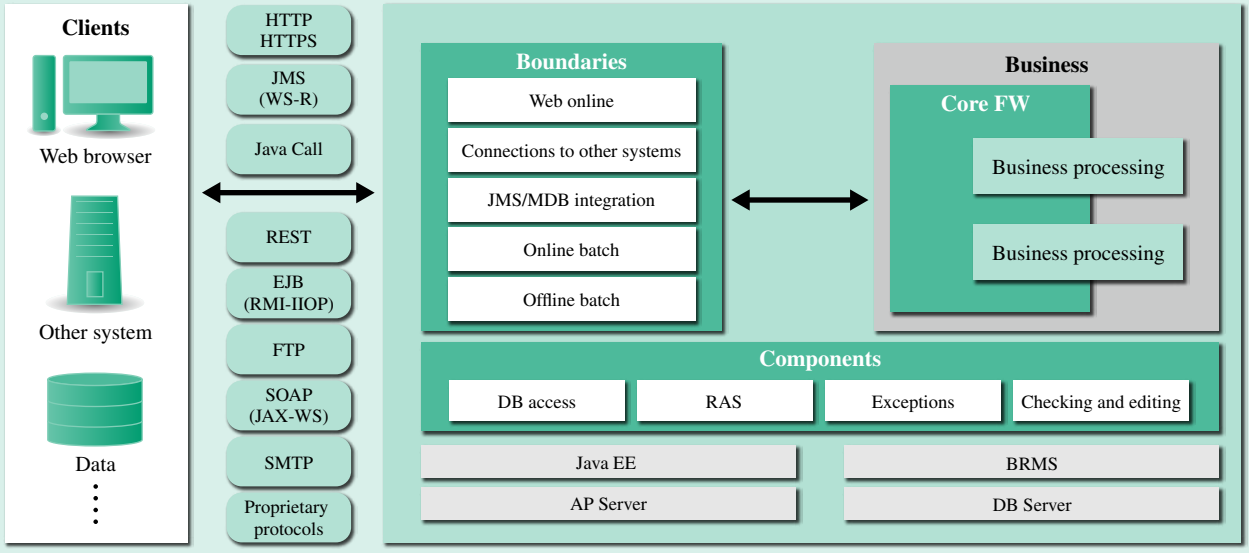
The Hitachi Application Framework application model provides a loose coupling between these four services so that they can be used as needed based on the requirements of the core business systems being developed.

Application Framework

The core service provided by Hitachi Application Framework is the application framework. The role of the framework is to sit between the application (AP) server and a framework called the "business framework," which is used to provide common processing functions for business processing. It is made up of the frameworks used for transaction patterns (boundaries) required to implement mission-critical systems and the components required for application development (logging, checking and editing, database management, and other components), and has the following features (see Fig. 2).

(1) Support for Java Platform, Enterprise Edition 7 (EE 7)

The Hitachi Application Framework supports the latest version of Java EE. Java EE has evolved as a platform that provides standard technology and stable technology for Java-based enterprise applications. Having evolved from the initial Java 2 Platform, Enterprise Edition (J2EE) through augmentation by OSS (including Struts and Spring) and the transition to Java EE, Java EE 7 continues to provide the stability, high quality, and support for new technology required by enterprise applications. With the aim of building on



HTTP: hypertext transfer protocol HTTPS: HTTP Secure JMS: Java Message Service WS-R: web services reliability REST: representational state transfer
EJB: Enterprise JavaBeans* RMI-IIOP: remote method invocation - Internet inter-ORB protocol FTP: file transfer protocol
JAX-WS: Java application programming interface for extensible-markup-language-based web services SMTP: simple mail transfer protocol
MDB: message-driven bean RAS: remote access service FW: framework
* Enterprise JavaBeans is a registered trademark of Oracle and/or its affiliates.

Fig. 2—Overview of the Application Framework.
The Hitachi Application Framework is made up of a number of frameworks provided as boundaries and core areas that perform business processing. The framework includes various components required for application development.

Java EE to provide a framework for mission-critical systems that are used over long periods of time, Hitachi Application Framework provides the functions of an application framework in the form of extensions and augmentations that cover things that cannot be achieved with Java EE 7 on its own.

(2) Multi-platform

Another reason for supporting Java EE 7 was to be able to work on multiple platforms. By basing the framework on Java EE 7 (and taking note of the trend among customers away from proprietary technology), Hitachi ensured that it could support a wide range of commercial and OSS-based AP servers that are able to host Java EE 7, and thereby support a wide variety of system configurations. Another advantage is that technical support for Java EE is available for commercial application servers (see Table 1).

TABLE 1. Support for Multiple Platforms
Hitachi Application Framework enables systems to be implemented by combining solutions from various vendors using Java, BRMS, AP Server, and DB Server, which can be thought of as platform areas.

Platform	Supported products (*TBD: Under consideration)
Java	• Java SE 8/Java EE 7
BRMS	• [Red Hat*1] JBoss*1 BRMS • [InnoRules] InnoRules*2, *TBD • [Pegasystems*3] Pega*3, *TBD
AP Server	• [Hitachi] Hitachi Application Server • [Red Hat*1] JBoss*1 EAP • [Red Hat*1] WildFly*1, *TBD • [IBM*4] WebSphere*4 • [Oracle*5] Oracle WebLogic*5 Server*TBD
DB Server	• [Hitachi] HiRDB • [IBM*4] DB2*4 • [Oracle*5] Oracle*5 • [OSS] MySQL*6, PostgreSQL*7, *TBD

HiRDB: highly scalable relational database EAP: enterprise application platform
*1 Red Hat, JBoss and WildFly are trademarks of Red Hat, Inc., registered in the U.S. and other countries.
*2 InnoRules is a registered trademark of InnoRules Co., Ltd.
*3 Pegasystems and PEGA are registered trademarks of Pegasystems Inc.
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ULTRA-RAPID DEVELOPMENT USING THE HITACHI APPLICATION FRAMEWORK'S APPLICATION DEVELOPMENT PLATFORM FOR ENTERPRISES

Today's financial institutions have a very strong requirement for shorter development times to enable the rapid rollout of new loan products, changes to insurance premiums, compliance with regulatory reforms, and so on. While the term "ultra-rapid

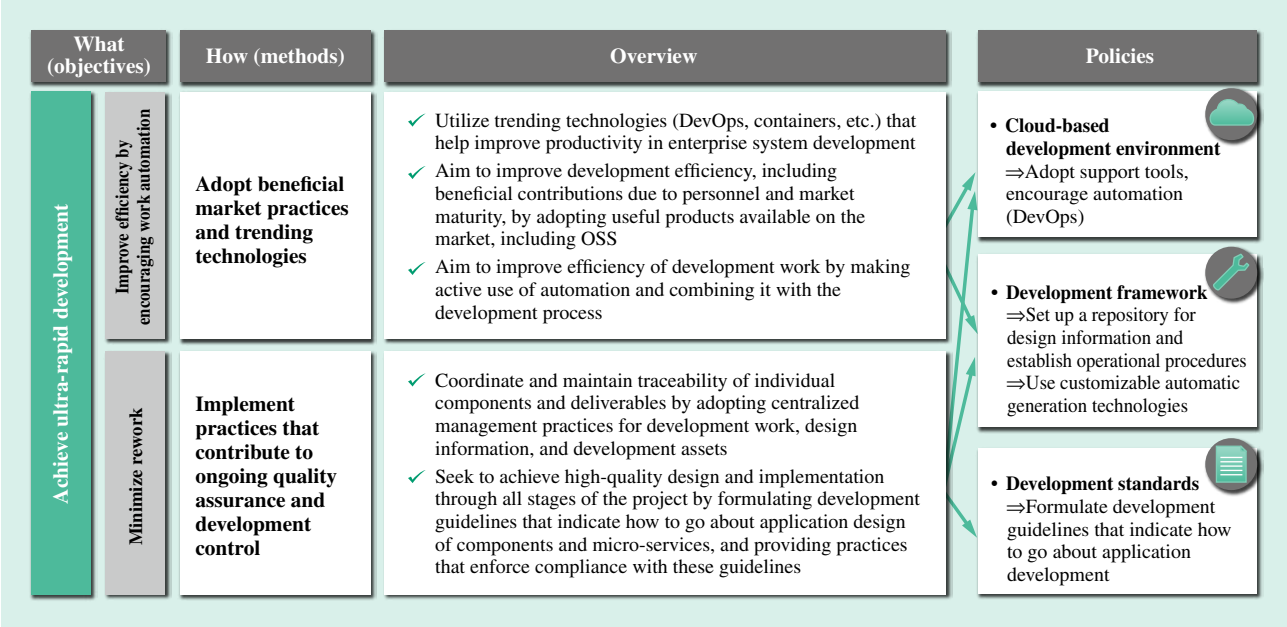


Fig. 3—Achievement of Ultra-rapid Development.
To achieve ultra-rapid development, implementation methods are considered on the basis of ways of thinking that have been collated with the two objectives of improving efficiency by encouraging the automation of work and minimizing rework.

development" has a variety of definitions within the IT industry, it is used in Hitachi Application Framework with the following meaning.

"Development that improves productivity and provides ongoing controls and quality improvement throughout the life cycle of an enterprise application, which extends from design through to operation and maintenance"

To shorten development times (improve productivity and development speed), Hitachi places

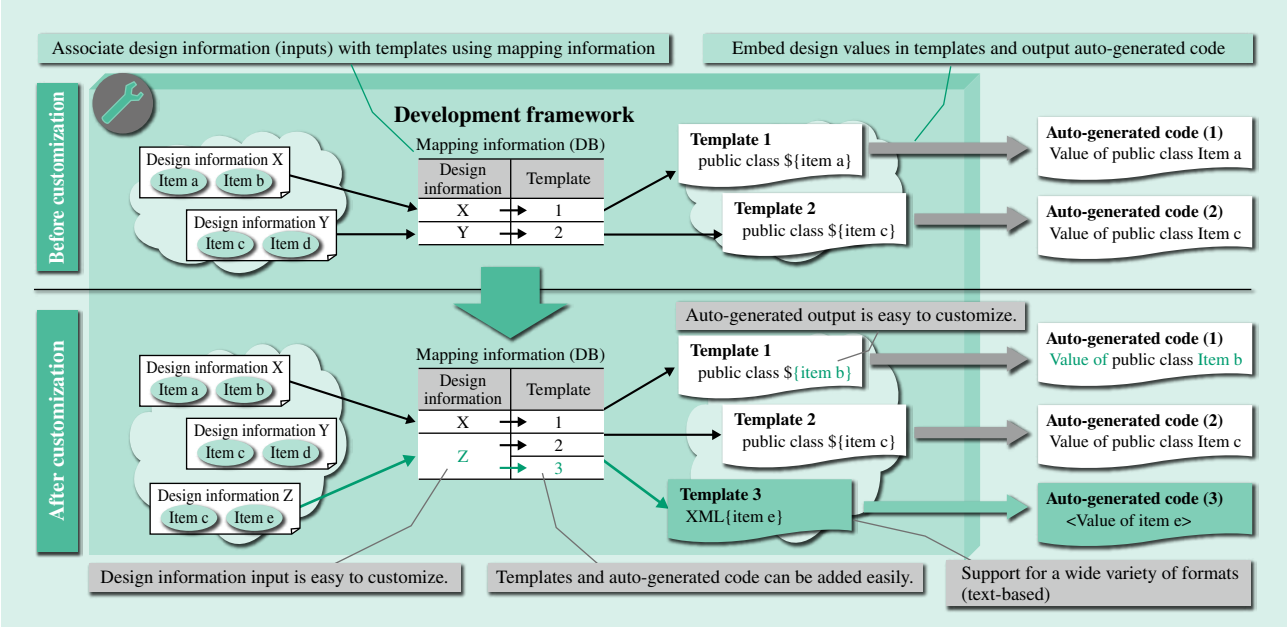
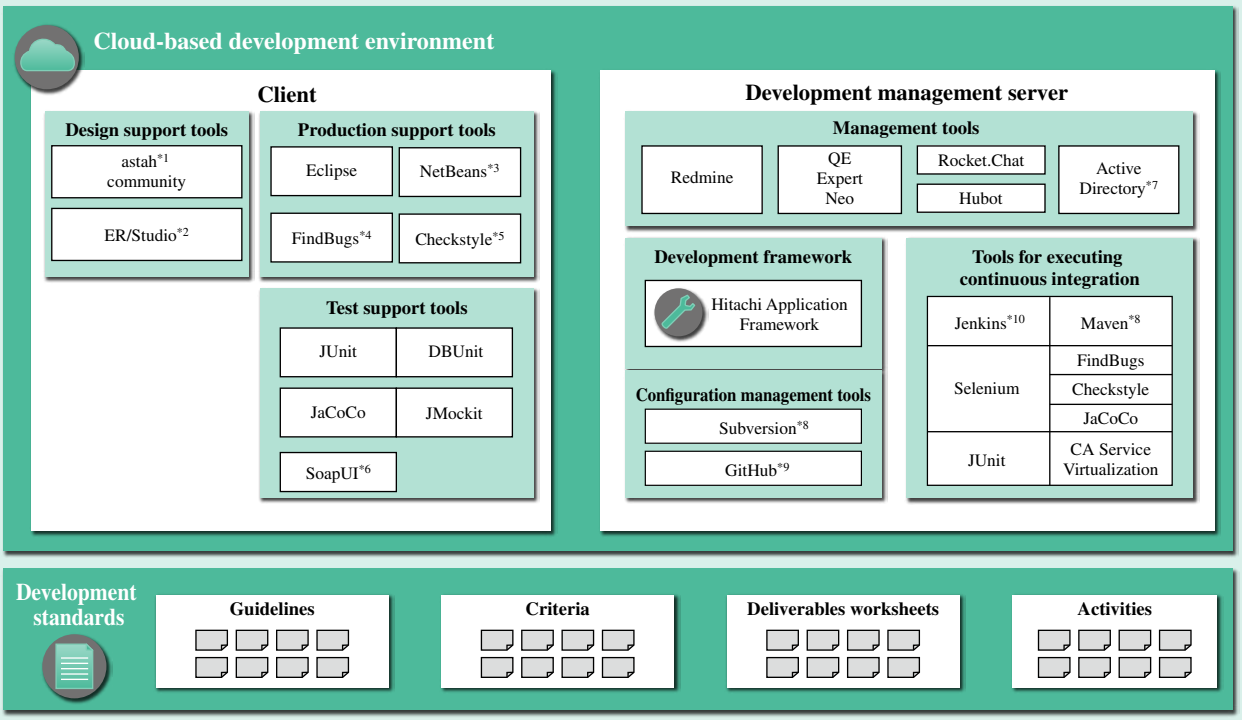


Fig. 4—Customization and Extension of the Development Framework.
The approach adopted by Hitachi Application Framework gets the maximum benefit from productivity improvement measures based on the customer and system being developed, with the ability to customize both the design information that serves as input to the development framework and the auto-generated source code output.



UI: user interface
*1 astah is a registered trademark of Change Vision, Inc.
*2 ER/Studio is a trademark or registered trademark of Embarcadero Technologies, Inc.
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*9 GitHub is an exclusive trademark registered in the United States by GitHub, Inc.
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Fig. 5—Overview of the Development Environment.
The diagram shows the positioning of the development framework, cloud-based development environment, and development standards in one example of the development environments provided by Hitachi Application Framework.

a priority on encouraging the automation of work to improve efficiency and on minimizing rework, and achieves this by adopting beneficial market practices and trending technologies and by implementing practices that contribute to ongoing quality assurance and control of development (see Fig. 3).

Hitachi offers an approach to developing the latest mission-critical systems that incorporates new elements in hybrid form while also utilizing the know-how and experience in enterprise application development it has built up over time since the era of mainframes.

Development Framework

The main functions of the developer support framework, which enables the rapid development of high-quality enterprise applications, are listed below.
(1) Data item control function
(2) Design information consistency checking function
(3) Impact analysis and traceability functions
(4) Automatic program generation function

It also enables the greatest possible improvements in development speed to be pursued, with control handled by mapping information (which contains design data) and templates (automatic generation engines), and functions for flexible customization and expansion to satisfy the business requirements of next-generation systems (see Fig. 4).

Cloud-based Development Environment

The maintenance and operation of the application development environments used for enterprise applications face the following challenges.

- Cost: Optimization of TCO by building and maintaining hardware and software in accordance with peak developer workloads
- Control: Control of development practices and governance that covers all developers involved in large development projects

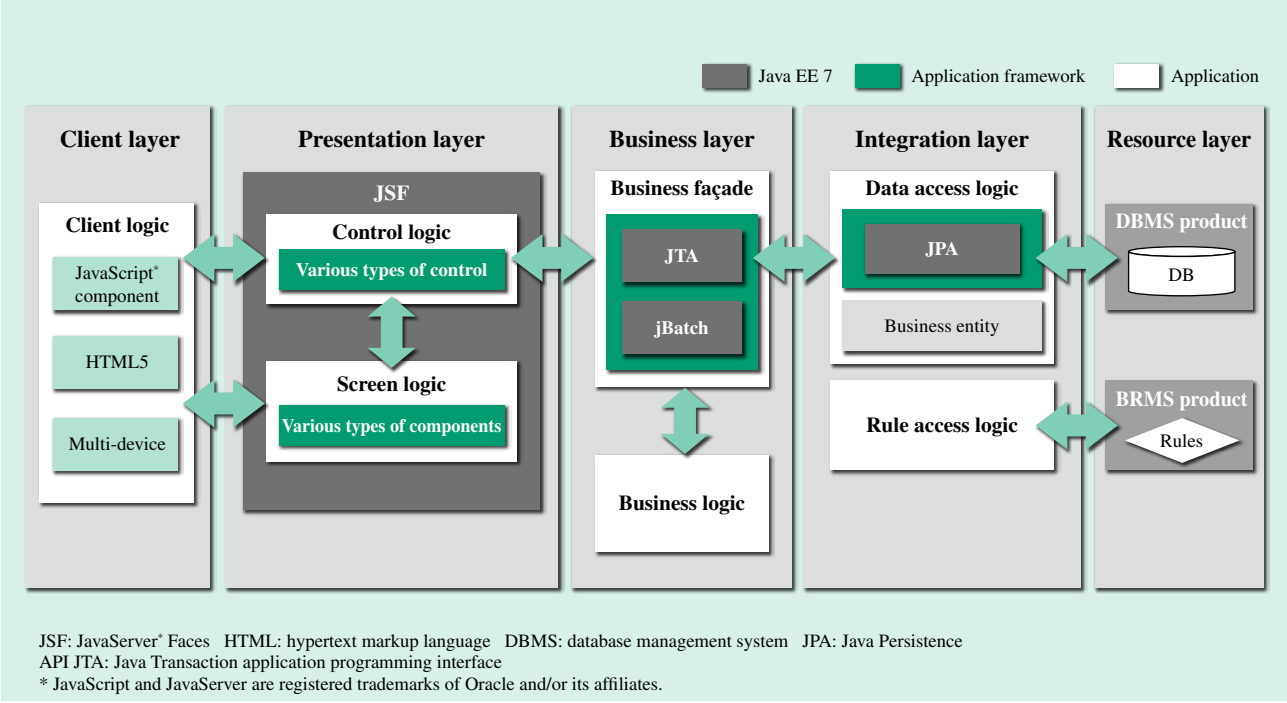

Fig. 6—Overview of the Five-layer Architecture.
Using a five-layer architecture, Hitachi Application Framework provides transparency for the technical components and logic configuration, and facilitates architectural control and loose coupling of the technical component dependencies.

- Flexibility: Control of lead times for everything from hardware and software procurement to the establishment of infrastructure based on project progress

To overcome these challenges, Hitachi supports an approach to development that provides the development environment in the cloud, thereby reducing TCO, ensuring control of governance by using a common software stack, and achieving faster provision of the development environment (see Fig. 5).

Hitachi also goes out of its way to use OSS in the development environment, enabling it to increase development speed through continuous integration (CI), undertake quality assurance, and maintain portability by using containers.

Development Standards

Hitachi Application Framework stipulates a five-layer architecture adapted for enterprise applications (see Fig. 6) and stipulates design items based on these layers, using this as the basis for specifying how to go about component separation and micro-service design, standards, worksheets, work breakdown structure (WBS), and deliverables in the form of development standards (see Fig. 5).

Undertaking development in accordance with these standardized development practices enables quality assurance of the entire application, reducing issues like overlooked work and work stagnation time. Hitachi also provides knowledge of design methodologies used in early-stage design based on experience from previous large development projects in the finance industry.

CONCLUSIONS

This article has given an overview of the Hitachi Application Framework, which supports enterprise application development for next-generation systems, and described its features.

Hitachi, Ltd., intends to remain up to date with the latest technologies, such as Java EE, hypertext markup language 5 (HTML 5), multi-device, OSS, and the cloud, and is increasing the pace of open innovation with a view to providing feedback to the standard technologies of the IT market. Hitachi believes it can participate from the planning stage and help with proof-of-concept (PoC) in conjunction with customers by enhancing enterprise application development platforms that can satisfy customer and market requirements, and by providing excellent application development solutions and consulting based on its know-how and practical knowledge from large numbers of large-scale application development projects.

Through these efforts, Hitachi intends to help establish new financial innovation businesses by serving in the finance industry as a partner in collaborative creation with customers.

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