Hitachi Review
Volume 64 Number 6 July 2015

HITACHI
Inspire the Next

Role of Intellectual Property in Supporting Hitachi's Social Innovation Business

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Hitachi Review
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From the Editor

This is the first time an issue of *Hitachi Review* has focused on intellectual property (IP).

"Invention is an engineer's life." Namihei Odaira, who established Hitachi in 1910 and became its first president, was involved in invention himself and actively encouraged colleagues to invent. Hitachi has identified its Mission of "contributing to society through the development of superior, original technology and products." We have continued this noble tradition by protecting inventions with patent rights and supporting our business with them.

Since 2000, Hitachi has been facing difficult financial conditions that have forced it to make major changes to its business portfolio. With electronics businesses such as semiconductors, liquid crystal displays (LCDs), hard disk drive (HDDs), and televisions (TVs) having become highly volatile, Hitachi was forced to divest or otherwise dispose of most of its operations, including the associated patents. More recently, Hitachi has been seeking to achieve more stable operations by setting out to meet the needs of the world through its Social Innovation Business, strengthening its service businesses, which undertake collaborative creation with customers by working together with them to create and deliver solutions to problems.

Along with this transformation in Hitachi's business portfolio, the Intellectual Property Division has also been through a major change in direction, moving away from managing IP with a focus on the electronics business, where the primary objective was to increase income from patent license royalties, and toward activities that contribute to the Social Innovation Business. In FY2014, Hitachi adopted "Let's make it happen with the Power of Patents" as its group-wide slogan for IP to mark a new approach to IP management in which it aims to extract maximum benefit from IP and use it as a driver for business growth.

This issue of *Hitachi Review*, entitled "Role of Intellectual Property in Supporting Hitachi's Social Innovation Business," focuses on a number of initiatives related to new business and IP at Hitachi.

SOCIAL INNOVATION - IT'S OUR FUTURE

I hope that this issue will help readers gain a deeper understanding of the IP that supports our Social Innovation Business, which is based on collaborative creation with customers, as well as of the potential of Hitachi as it seeks to build the future by working with customers to deal with management challenges and the challenges facing society (including energy and urban problems) at a global level.

Editorial Coordinator,
"Role of Intellectual Property in Supporting Hitachi's Social Innovation Business" Issue

Yuji Toda

Deputy General Manager
Intellectual Property Division
Hitachi, Ltd.

Role of Intellectual Property in Supporting Hitachi's Social Innovation Business

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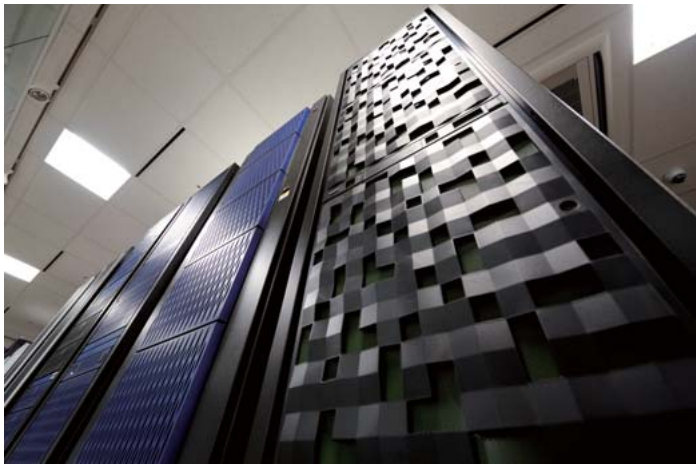
Role of Intellectual Property in Supporting Hitachi's Social Innovation Business

Intellectual property (IP) has been growing in importance in recent years as a source of business competitiveness and profitability.
Based on its Mission of “contributing to society through the development of superior, original technology and products,” which it has held since its foundation, Hitachi has built up a portfolio of IP in a wide range of businesses and put it to use as a way of maintaining competitiveness.
Currently, Hitachi is also utilizing the “power of patents” as a basis for collaborative creation with its partners in the global operations of its Social Innovation Business.
With its IP slogan of “Let’s make it happen with the Power of Patents,” Hitachi intends to continue contributing to social innovation through activities that seek to utilize IP for business growth.

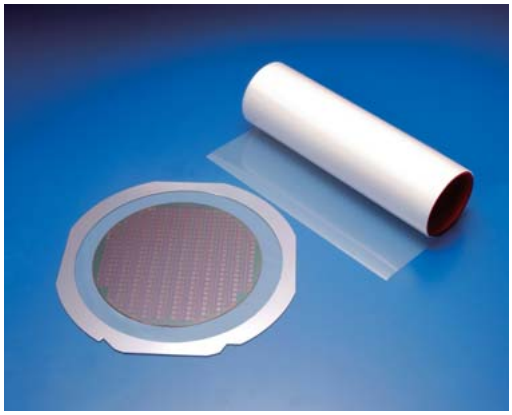
Use of intellectual property in overseas operations of Hitachi's rolling stock business



Development of ultra-high-speed elevator, and creation and use of patent portfolio in China



IT platform products underpinned by intellectual property (image)



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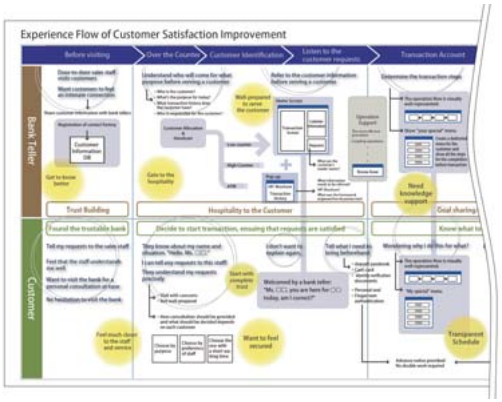

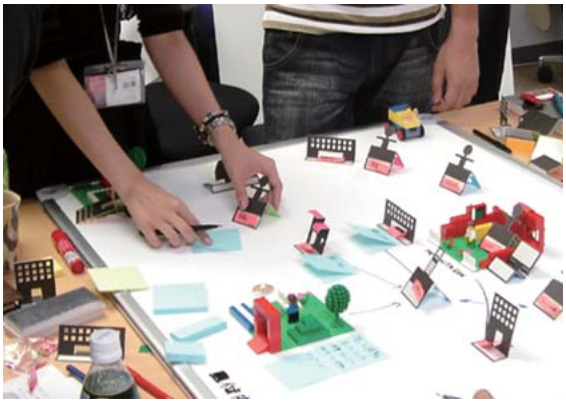

Use of design patent rights, patent rights, and trademark rights to protect equipment designs, information designs, and design methods

Participation in international standardization (IEC TC 111 meeting)

Expert Insights

Expectations for Social Innovation from Hitachi

Toshiya Watanabe, Dr. Eng.

Professor, Policy Alternatives Research Institute, The University of Tokyo

Graduated with a Master's Degree in inorganic materials engineering at the Tokyo Institute of Technology in 1984, and gained a Doctorate of Engineering from the same institute in 1994. Joined Toto Ltd. in 1984. Appointed visiting professor in information functional materials at the Research Center for Advanced Science and Technology, The University of Tokyo in 1998, and took up his current appointment in 2012.
His other appointments include visiting professor, Professional Graduate School, Tokyo University of Science; Director and Chairman, Intellectual Property Association of Japan; Director, Japan Association of Universities for Intellectual Property Education and Research; Director, Cabinet Secretariat Intellectual Property Strategy Verification and Evaluation Planning Committee (responsible for industrial property rights); member of the Research and Assessment Subcommittee of the Industrial Technology Environment Working Group, Industrial Structure Council, Ministry of Economy, Trade and Industry; and expert member of the Council for Science and Technology, Ministry of Education, Culture, Sports, Science and Technology.

When considering business strategy, the approach that involves formulating a strategy that focuses on the superiority of a company's own technologies is generally comprehensible due to its similarity to competition in sport. The basic idea of the approach is that, by fostering production capabilities for supplying high-quality products at low cost, proprietary technologies, and exclusive patents, a company would achieve a dominant position if it is better at these tasks than its competitors. Amid today's global competition, however, many companies have come to realize that success is no longer determined solely by the relative superiority of the resources possessed by the organization.

Accordingly, it is becoming important to have such innovation strategies that leverage technology and other business resources to reach out to inter-company relationships (business ecosystems) that extend across the entire world, and to make changes to them in a planned way. In many cases, such strategies utilize a variety of strategic options in the context of open innovation, among which the "open and closed strategy" that has attracted attention recently is a typical example. Rather than mere competition over your technology portfolio, they are more about taking advantage of technologies to reach out to business ecosystems, where policies to make certain business resources open are pursued, policies such as participation in standardization, intellectual property licensing, and royalty-free alliances. Since the 1990s, it has typically been European and American companies in the information technology and electronics sectors who have succeeded in pursuing this strategy. By utilizing business resources externally, these companies have pursued strategic initiatives such as expanding the market for their core businesses and enabling technology to be procured easily and at low cost. Because these strategies are frequently risky and require organizational change, implementing them is not easy. However, if you look closely at actual cases, you will also find a considerable number of successful examples among Japanese companies. The examples are not only of large companies but also of successful small-and medium-sized companies with limited resources that have incorporated the open use of technology into their business model, going beyond the idea that their own technologies are for their own use. These initiatives represent a welcome new side to Japanese companies.

Innovation strategies adopted by Japanese companies in the past have for the most part concentrated on processes and products with the objectives of producing quality products at a low price, and building products with novel performance and functions. Now, however, we have arrived at a time when, to win out amid competition on the methods of innovation in a globally competitive environment, it is difficult to rely on this approach alone. To begin with, there is a need to consider research and development from the perspectives of customers and business, and to utilize the results of this research and development in combination with new methods of innovation such as the open and closed strategy, design-driven innovation strategy, or the reverse innovation strategy coming out of emerging economies. Most of all, it is important that social innovation at Hitachi adopts an approach that takes maximum advantage of these new strategy options when dealing with complex business ecosystems that comprise customers and a large number of collaborating partners, among others.

In this respect, Hitachi will receive increasing attention for its actions aimed at achieving social innovation through collaborative creation with customers and other business partners around the world. As it seeks to build a better society, I have high expectations for Hitachi's new innovations and the intellectual property strategies that support them.

Technotalk

Contributing to Social Innovation through Global Creation and Use of Intellectual Property

Toshiya Watanabe, Dr. Eng. Professor, Policy Alternatives Research Institute, The University of Tokyo
Keiji Kojima, Dr. Eng. Vice President and Executive Officer, CTO, and General Manager of Research & Development Group, Hitachi, Ltd.
Takashi Suzuki Corporate Officer and General Manager, Intellectual Property Division, Hitachi, Ltd.

Hitachi operates its Social Innovation Business globally, providing safe and secure social infrastructure enhanced by IT. The Social Innovation Business, in which Hitachi collaborates with customers to create new value by understanding and overcoming customers' management challenges and other societal challenges, requires an entirely new strategy for creating and utilizing IP, which is the source of value. In addition to reorganizing at a global level the R&D organization that provides the impetus for its Social Innovation Business, Hitachi is also seeking to globalize the IP management that is essential to utilizing its R&D achievements. Hitachi intends to continue strengthening its customer-driven R&D and IP management, and contributing to social innovation in various parts of the world.

Creating an Organizational Structure with a Stronger Focus on Customer-driven R&D

Watanabe: Hitachi has been pursuing its Social Innovation Business since 2009. Recently, I often hear the term "collaborative creation." What is Hitachi's Social Innovation Business based on collaborative creation like?

Kojima: Our Social Innovation Business involves not merely supplying superior equipment and systems, but providing solutions as "One Hitachi" by understanding customers' challenges and societal challenges and employing the technologies, products and services that Hitachi Group possesses. This Social Innovation Business includes energy, urban development, transportation, healthcare, water and resources, logistics, manufacturing and construction, and finance. All of these sectors are characterized by having various stakeholders with complex interrelationships, and in order to understand the management challenges that customers face, it is crucial to understand from the customer's point of view what constitutes values for these stakeholders and other parts of society. I believe that, after sharing these values, working together with customers to create the solutions will lead to the growth of customers' businesses and to the resolution of societal challenges.

Watanabe: So, you are saying that "collaborative creation" not only means collaborating with customers to create value, but also includes revising organizational strategy and making various divisions within Hitachi Group cooperate with each other?

Kojima: We are working on strengthening group governance by seeking a deeper level of coordination in terms of creating customer value as well as efficiency. To go further, we use the term "collaborative creation" in a sense that includes working together not only with customers and group companies, but also with business partners and other players.

Watanabe: Does that mean a change in the role of research and development (R&D) and the approach you take to it? For example, I imagine it requires R&D teams to have contact with the customer right from the stage where you determine the challenges they are facing.

Kojima: Exactly. In the Research & Development Group where I work, we have a unique organization called the Design Division* where we have developed methodologies and tools for identifying challenges and sharing visions based on design thinking. It is also an important mission for R&D to identify challenges and to understand them along with creating new visions or concepts by utilizing these methodologies and tools in a customer-driven R&D approach. We are devoting our efforts to transforming our processes away from the conventional linear innovation model, which starts with basic research and applies the results of this research to development, design, manufacturing and sales to the new model of treating the customer's situation as the

* Department name as of March 2015.

starting point and creating solutions together through collaborative creation. To strengthen these activities, we reorganized our global R&D structure on April 1, 2015, establishing a Global Center for Social Innovation in four regions around the world. We will provide the impetus for our Social Innovation Business by, for example, using Tokyo as our headquarters for the Asia-Pacific region with network links to key R&D centers in places like India and Malaysia, and by undertaking R&D work from the perspective of collaborative creation, utilizing design thinking methodologies and tools.

Role of IP Management in Collaborative Creation Business

Watanabe: If customer-driven R&D and collaborative creation are to be undertaken at a global level, does that mean the Intellectual Property Division will be called on to play a different role from what it has played in the past?

Suzuki: That's right. In product business supplying equipment and systems, the main roles of intellectual property (IP) include preventing competitors from entering the market and helping to maintain cost-competitiveness by acquiring license fees. In a collaborative business, on the other hand, the need to encourage partnerships with customers and collaborators requires utilizing IP in ways that have advantages for customers also, rather than in ways solely for Hitachi's benefit.

In collaborative creation business, customers and Hitachi are supposed to produce new solutions as "foreground IP," after the customers and Hitachi contribute their own "background IP" while maintaining a clear demarcation regarding which IP belongs to which partner. In the business, Hitachi utilizes its IP by, for example, attracting customers with its patents as one of the advantages of engaging in collaborative creation with Hitachi, or using IP as a risk or return sharing tool when entering into a joint research or business contract with a customer.

Because IP management is more complicated in a collaborative creation business involving a large number of players compared with a product business, we need to perceive IP in broader terms than just patent rights. For example, an issue could arise of how to deal with knowledge, invention or ingenuity that requires deliberation whether to apply for patents and publish them as IP. Because these things also relate to business strategy, I expect the scope of activities will expand in the future beyond what has been thought of as IP in the past.

Watanabe: Certainly, it is important in collaborative creation businesses to adopt an open and closed strategy that includes sharing some IP with partners to encourage collaboration while also securing the source of your own competitiveness. Furthermore, it will be important to share "Intellectual Assets" that go beyond the scope of IP itself by, for example, sharing concepts and visions with partners and formulating rules and practices for allocating the business risk and return.

Suzuki: As you say, the appropriate management of know-how for which no patent application has been made, especially the customer's know-how, is particularly important in a collaborative creation business. In the case of a collaborative creation business involving big data analytics, how to handle raw data belonging to customers, the processed data, and the solutions created from it are potential issues that need to be considered.

IP contracts must follow rules for allocating risk and return based on concepts and visions shared with partners. To support collaborative creation businesses, the Intellectual Property Division intends

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Professor, Policy Alternatives Research Institute, The University of Tokyo

Graduated with a Master's Degree in inorganic materials engineering at the Tokyo Institute of Technology in 1984, and gained a Doctorate of Engineering from the same institute in 1994. After working in research and operational divisions in the private sector, he became a visiting professor in information functional materials at the Research Center for Advanced Science and Technology, The University of Tokyo in 1998, and took up his current appointment in 2012.

Keiji Kojima, Dr. Eng.

Vice President and Executive Officer, CTO, and General Manager of Research & Development Group, Hitachi, Ltd.

Joined Hitachi, Ltd. in 1982, with roles that have included General Manager of the Central Research Laboratory and Hitachi Research Laboratory prior to his current appointment in 2014.
Dr. Kojima is a member of The Institute of Electronics, Information and Communication Engineers (IEICE) and the Information Processing Society of Japan (IPSJ).

to foster human resources with the capabilities needed to act as IP project managers able to understand the business environment and strategies and offer a one-stop service for the required IP support.

Establishing an R&D Organization Able to Deal with All Aspects of Innovation

Watanabe: The open and closed strategy also relates to the idea of open innovation. After reorganizing your R&D structure at a global level, what are your views regarding R&D strategies for collaborative creation and open innovation?

Kojima: The new Global Center for Social Innovation is required not only to understand and deal with both the manifest and latent needs of customers, but also to cut through accepted practices that are taken for granted, and work together with customers to achieve open innovation. Achieving this mission requires providing appropriate technical solutions to our various regional R&D organizations around the world. Because our businesses cover such a broad scope, we have diverse technical resources. To encourage the use of these capabilities and possibilities, we want to make them visible both inside and outside the company in the form of technical foundations and platforms. We are also rearranging our entire R&D operation from the following three starting points. The first is the customer-driven approach we have spoken of already. The second is to be "technology-driven," which means treating technological innovation as a starting point. The third is to be "vision-driven," meaning that we take inspiration from our vision of the future. These three elements are essential to our Social Innovation Business, which involves working with customers on the collaborative creation of value so that we can bring innovations to society.

Watanabe: This means extending the scope of R&D compared to the past to become an organization that deals with all aspects of innovation. What will be the role of IP in such an organization?

Suzuki: While there remain some areas where we are still finding our way, IP staff have embarked on knowledge-accumulating activities by working in collaborative creation business projects, identifying the issues and other areas in need of further study from an IP perspective through initiatives that include participating in meetings and other discussions with researchers, operational departments, customers, and others. We are also working to share our own knowledge with researchers and staff who deal directly with customers at operational departments in order to increase their IP and contract literacy.

Inclusion of IP Management in Globalization

Watanabe: So both broadening the footprint of IP and ingraining it at a strategic level are essential to the further expansion of the Social Innovation Business.

Suzuki: To achieve this, it will be necessary to change the mindset of the Intellectual Property Division. My personal view is that the Intellectual Property Division needs to play an IP consulting role, and not just be an in-house patent law firm. In addition to our skills related to patents, business literacy will also be essential for collaborative creation businesses. One such activity is our involvement at the frontlines of collaborative creation businesses that I have already mentioned. We are going to undertake more comprehensive activities with an organization established within the Intellectual Property Division

Takashi Suzuki

Corporate Officer and General Manager, Intellectual Property Division, Hitachi, Ltd.

Joined Hitachi, Ltd. in 1978, with roles that have included General Manager of IP Business Development Division, Intellectual Property Group, Vice President Intellectual Property at Hitachi Global Storage Technologies, Inc. (now HGST, Inc.), and Deputy General Manager, Intellectual Property Group prior to his current appointment in 2011.

that correspond to R&D's Global Center for Social Innovation.

Kojima: Given that competitive technologies and other know-how are the driving forces behind corporate growth, this current era in which we need to win out over intense global competition requires the full integration of R&D strategy, IP strategy, and management strategy. In order to work globally on collaborative creation activities with customers, we need to tie these three strategies more closely together, including not just a vision, but also such things as human resource development and the form of the organization.

Suzuki: While people have spoken about the importance of the integration of R&D strategy, IP strategy, and management strategy, there is a need to transform the progressive and consecutive relationship that these have had in the past into an organic overlay.

Watanabe: While I believe that achieving this requires a company-wide and global re-evaluation of the resource integration process, what are your views on dealing with globalization under an open and closed strategy?

Kojima: Because "local production for local consumption" is an important aspect of both our Social Innovation Business and collaborative creation businesses, a global regional strategy is very important. Increasing local autonomy (including augmenting R&D centers) to enable faster decision-making is essential. On the other hand, as we discussed earlier, it is also necessary to establish platforms for utilizing common Hitachi assets. For both R&D and IP, the challenge for the future is to create a well-balanced design that combines local autonomy and platforms.

Suzuki: IP management also needs to move away from the export model of the past of obtaining overseas patents that originate from R&D resources in Japan. However, this raises the problem that, if resources are scattered, we cannot make effective use of them at a global level. In the future, we also intend to focus on training and recruiting international staff who can support making optimal use of IP at collaborative creation businesses.

Watanabe: I can see the need for a paradigm shift in IP management as in other areas, and also globalization, so that Hitachi can make progress on its global collaborative creation activities with customers. I look forward to seeing Hitachi's extensive IP contribute to society in different parts of the world through your Social Innovation Business.

Overview

Hitachi's IP Strategy for Business Growth

Takashi Suzuki
Mina Maeda

RELATIONSHIP BETWEEN BUSINESS STRATEGY AND IP STRATEGY

INTELLECTUAL property (IP) strategy is one element of business strategy. This means that IP strategy needs to express how IP is to be exploited in achieving the company's vision and mission. Because business strategy changes in response to changes in the business environment, IP strategy, too, must adapt accordingly.

Hitachi has made major changes in its business portfolio since 2000. It has divested its electronic businesses that dealt with products such as semiconductors, liquid crystal display (LCD) panels, and hard disks, and instead expanded its Social Innovation Business[1], which combines infrastructure technology with advanced information technology (IT). Based on the slogan, "Serving the World with Our Social Innovation Business," Hitachi is building up its service business based on a model of collaborative creation with customers that involves sharing customers' management challenges and working with them to create and provide solutions.

Along with this transformation in business strategy, IP strategy has also changed due to the change in what management expect from IP. Accordingly, this article looks back at how IP strategy has adapted to this change in business portfolio, and describes the future directions for IP management.

CHANGE IN IP STRATEGY DRIVEN BY CHANGE IN BUSINESS PORTFOLIO

Hitachi has made major changes in its business portfolio since 2000 (see Fig. 1).

Back when electronics made up a considerable part of its business portfolio, the role that management asked of IP was to increase income from license royalties and reduce license payments. Accordingly, the main objectives of IP management were to

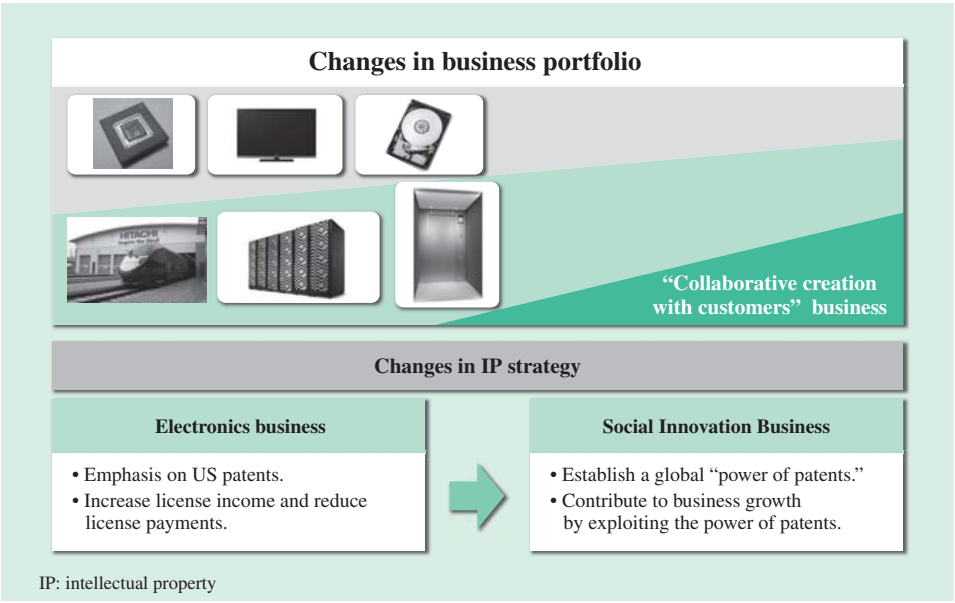

Fig. 1—Changes in IP Strategy in Response to Changes in Business Portfolio.
Hitachi has made major changes in its business portfolio since 2000. This has meant changes in IP strategy also.

establish cross-licensing with European and American companies to reduce royalty payments on the one hand, while collecting royalties from emerging Korean and Taiwanese companies on the other. One effective tactic for improving license revenue was to leverage patent lawsuits in the USA. This meant that obtaining US patents was a priority.

However, the majority of Hitachi's electronics IP was divested along with the businesses themselves. Along with redirecting its business strategy toward building up its Social Innovation Business, Hitachi also made major changes in IP strategy away from its focus on license revenue improvement. Now, Hitachi has shifted its IP management focus toward activities aimed at building the "power of patents" in the main markets for each of its businesses, and exploiting this power for business growth pursuing a business strategy that targets global business growth through entry into overseas markets.

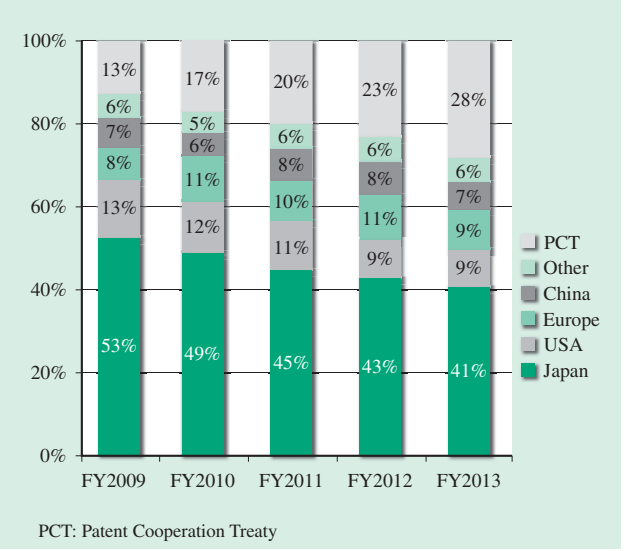

Fig. 2—Trend in Overseas Patent Application Ratio. Hitachi achieved its target of an overseas patent application ratio of more than 55% in FY2011. The overseas patent application ratio for FY2013 was 59%.

BUILDING GLOBAL "POWER OF PATENTS"

The first initiative was to build a global "power of patents." In the case of IT platforms, a sector in which both the major markets and major competitors are based in the USA, Hitachi started to work on building up its portfolio of US patents at a comparatively early stage. In the case of other businesses, however, where the focus of operations had been on the Japanese market, particularly social infrastructure, Hitachi built up a portfolio of primarily Japanese patents. Accordingly, to give root to the policy of applying for patents in key markets, and prompted by the 2012 Mid-term Management Plan target of achieving an overseas revenue ratio above 50%, Hitachi adopted a medium-term IP target for its "overseas patent application ratio[a]" of exceeding 55%. The reason for choosing a target of 55% rather than 50% was because the power of patents must be built up in target markets to protect its businesses in advance of establishing overseas operations. The target was achieved in FY2011, and the overseas patent application ratio for Hitachi Group in FY2013 was 59% (see Fig. 2).

Looking at a regional breakdown of patent applications, the proportions accounted for by Japan and the USA have fallen, whereas the proportion of applications made through the Patent Cooperation Treaty (PCT)[b] route has increased. The reasons for the increase in the proportion of PCT applications are, (1) because they are a more cost-effective option when applying in multiple countries, PCT applications are a good match for Hitachi's need to obtain patents in a number of different national markets due to the global scope of its business activities, and (2) because of the frequent instances in which Hitachi needs to take advantage of the 30-month grace period that PCT provides for choosing the country in which it tries to obtain a patent, given that global operations face a high degree of uncertainty.

To establish the global power of patents, Hitachi has also made changes in its process for deciding where to apply for patents. In the past, its practice for new inventions was to apply first in Japan, and then to take advantage of the one-year right of priority[c] granted by the Paris Convention to decide whether

(a) Overseas patent application ratio
The ratio of overseas patent applications relative to the combined total of domestic and overseas applications. PCT applications are counted as multiple applications in accordance with the number of countries in which Hitachi intends to obtain the patent.

(b) PCT
Abbreviation of "Patent Cooperation Treaty." The treaty is managed by the World Intellectual Property Organization. It enables a single application made in the applicant's own national patent office (provided the country is a treaty member) using internationally standardized application documents to be recognized as the equivalent of submitting applications in all active member countries. However, the country in which the patent is issued still depends on the examination by each national patent office. Applying for a patent under the PCT scheme is called a PCT application or international patent application.

(c) Priority right
This confers the right to have an application submitted in a second country within a specified time (priority period) after the initial application in the first country to be treated as if it were made at the same time as the initial application. In the case of a patent, the Paris Convention stipulates a priority period of one year.

applications in other countries or regions would also be necessary. That practice was based on an export-oriented patent application process. Now, however, when investigating whether to apply for a patent for a new invention, Hitachi also considers where it should initially apply for a patent. That is, the practice of first applying to patent in Japan has been superseded, and instead the initial application is made in the country that is to be the primary market, which will not necessarily be Japan. As a result, PCT is being used for an increasing number of initial applications and, while the number is still small, there are also instances of inventions for which patent applications are first made outside Japan. An example of this, in the escalator and elevator business, is the China-first strategy(d) described in one of the articles in this edition of *Hitachi Review*.

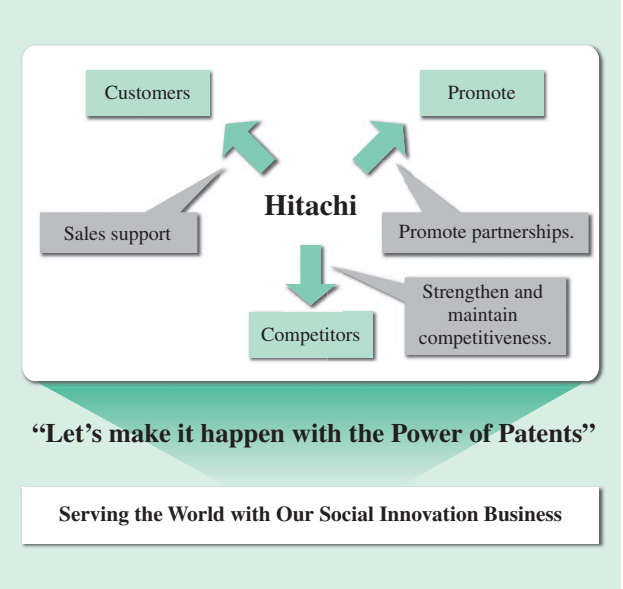

Fig. 3—Application of Power of Patents to Business.
Hitachi came up with an IP slogan with the aim of extracting value from IP (the power of patents) and exploiting it to grow its business.

HITACHI'S IP SLOGAN, "LET'S MAKE IT HAPPEN WITH THE POWER OF PATENTS," AND THE EXPLOITATION OF IP

With the aim of extracting value from IP (the power of patents) and exploiting it to grow its business, Hitachi came up with the IP slogan, "Let's make it happen with the Power of Patents" in FY2014 (see Fig. 3). The "it" that Hitachi wants to make happen is an improvement in its business position and business growth.

Because, IP, particularly IP rights, is based on exclusive rights, its likely uses are in activities directed at competitors. This means using IP as a barrier to market entry against competitors. In other words, as a way to protect and maintain Hitachi's competitiveness over other companies. Even if this ultimately results in granting a license to the competitor, by limiting the license scope, it still commonly provides a way to protect Hitachi's own markets. There have been instances at Hitachi where it has sought to protect its business by exercising its IP rights against companies that were copying its technology. An article in this issue provides an example of this involving IP management at Hitachi Chemical Co., Ltd.

Pre-emptively reducing IP risk by checking whether there is any IP owned by other companies that will act as a barrier to entry by Hitachi is also an important part of the IP strategy. Hitachi makes an effort to avoid IP right infringement in its product development, with a code of conduct that includes: "We will respect the intellectual property of other parties. We will prevent violations of other parties' intellectual property rights in advance and, for the smooth progress of business, we will investigate other parties' intellectual property rights beforehand when engaged in research, development, design, production and sales of new products or new technologies, and implement appropriate measures when any doubts arise."(2) Because IP risk is particularly high in countries where IP lawsuits are common or where Hitachi is entering for the first time, Hitachi puts a lot of effort into IP "clearance" (checking for potential IP infringement) in those countries. Examples include the USA, for the IT platform business; China, for the escalator and elevator business; and the UK, for the rolling stock business.

Furthermore, the use of IP for customers and other partners can also underpin business growth. For example, IP can be exploited to assist sales by using it as a promotional tool for marketing to customers. Examples of this are described in articles on the IT platform business, the escalator and elevator business, and finger vein authentication. In those businesses the patent portfolio is used for promotional purposes at events such as technical presentations and trade shows or in marketing material. IP can also be exploited as a currency for promoting business partnerships.

(d) China-first strategy
Hitachi's patent strategy for its escalator and elevator business. To strengthen its patent portfolio in the key market of China, Hitachi submits its first patent application for some inventions in China rather than submitting a Japanese or PCT application.

For example, in joint research and development, the background IP of its participants can be used among them for creating new technologies. In mergers and acquisitions (M&A) or in establishing a joint-venture company, contractual measures become important for enabling the new business to continue to use background IP. The article in this issue about finger vein authentication describes an example in which Hitachi partnered with another company to develop multi-modal techniques that combine fingerprint and finger vein authentication. In this case the patent rights to finger vein authentication held by Hitachi served as a foundation for building the partnership relationship.

IP STRATEGY THAT IS ALIGNED WITH BUSINESS STRATEGY

In order to use the power of patents to underpin business growth, it is important that this is done in accordance with business strategy. Because Hitachi operates such a diverse range of businesses, the role expected of IP is different in each case. Accordingly, Hitachi formulates separate IP strategies for each business (see Fig. 4).

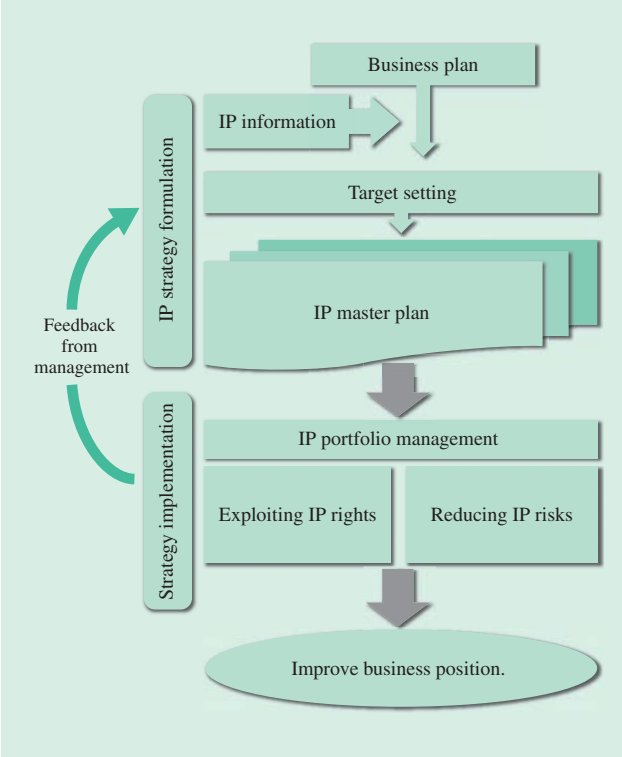

Fig. 4—Formulation and Implementation of IP Strategy. Hitachi has formulated IP master plans for each business in accordance with business strategy, and has implemented these with the help of feedback from management.

First of all, we decide on the objectives of IP management (how to exploit IP for business growth) based on the business strategy and IP information (IP rights belonging to competitors, partners, and customers, or lawsuits and other measures for IP management). The next step is to assess the gap between these objectives and the current situation, and to formulate a plan, synchronized with business milestones, for what the IP portfolio should contain; where and when the rights should be acquired; when and how the portfolio should be exploited for the benefit of the business; and the extent of risks relating to IP owned by other organizations, and how and when to reduce them. Those objectives and plans are combined into an IP master plan that also specifies the organizational structure for implementing the plan and its activity budget. At an annual IP strategy conference attended by management from the business units and the IP Division, the progress of the IP master plan is reviewed, future plans are debated, and feedback is obtained from managers.

To implement an IP strategy that is aligned with the business strategy, it is particularly important to, (1) be conversant with the business strategy during the IP strategy planning stage so that the role that IP is expected to play from a business management perspective can be set as targets for IP management, (2) set milestones for IP management that are synchronized with business milestones so that the role that IP is expected to play from a business management perspective can be fulfilled in a timely manner, and (3) have the business units (business managers) and the IP Division work through the plan, do, check, and act (PDCA) cycle for IP management together.

BUSINESS BASED ON COLLABORATIVE CREATION WITH CUSTOMERS AND FUTURE IP MANAGEMENT

With its slogan of, "Serving the World with Our Social Innovation Business," Hitachi is currently strengthening its service businesses based on collaborative creation with customers that share these customers' business challenges based on an understanding of their business environment and working with them to develop and provide solutions to these challenges.

This is bringing Hitachi's IP strategy to a new turning point (see Fig. 5).

The IP strategy required by Hitachi's product-centered businesses that deliver technically superior

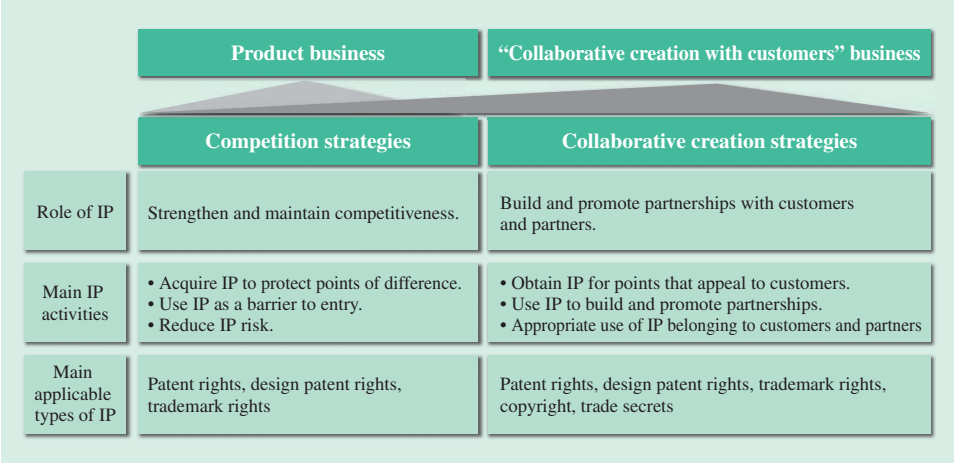

Fig. 5—Role of IP under Competition Strategies and Collaborative Creation Strategies.
To strengthen businesses based on collaborative creation with customers, IP strategy requires collaborative creation as well as competition strategies.

equipment and other systems to customers has primarily been a competition strategy aimed at strengthening and maintaining Hitachi's competitiveness. Accordingly, IP management has focused on maintaining technical points of differentiation by obtaining patents and other IP rights and utilizing them as a barrier to entry by competitors, and on reducing the business risks associated with IP rights held by other companies.

Businesses that involve collaborative creation with customers, on the other hand, require a collaborative creation strategy in addition to the competition strategy. This means a strategy that supports building and promoting partnerships with customers and partners. Accordingly, this requires not only obtaining IP that can be used for appealing to customers and utilizing it to build and promote partnerships, but also consideration of how to handle the IP obtained from customers and other partners appropriately. Examples of IP management aimed at promoting partnerships contained in articles in this issue include obtaining IP covering design tools and initiatives for converting rules that promote the effective use of technology for dealing with societal challenges into an international standard.

Note that the IP referred to here includes not only patent rights, design patent rights, and trademark rights, but also copyrights and trade secrets. In the case of big data analytics, for example, the challenges for IP include how to handle the original data that belongs to the customer (assets), the data obtained by processing (know-how), and the resulting solutions (know-how, software, or inventions). As the roles that this IP is called on to fulfill grow, so too does the associated IP.

Also needed is a "Glocal" transformation of the IP Division, meaning that the operation of the division needs to become simultaneously more local and more global. The IP-related challenges that arise in service businesses based on collaborative creation with customers need to be resolved based on understanding customers' management challenges. This is because IP-related challenges are also customers' management challenges. Accordingly, it is necessary to provide IP support for customer-facing departments to offer solutions that include an IP solution for customers. Considering the locally led deployment of collaborative creation with customers in different parts of the world, there is a need to station local IP staff at each operational site and to have greater local management of IP functions in support of customer-facing departments. In parallel with this, there is also a need for globalization involving the formulation and promulgation of a shared vision and mission for the local IP offices scattered around the world, together with the establishment of global platform functions for IP that promote the standardized adoption of best practices.

DEVELOPING "COMPETITION" AND "COLLABORATIVE CREATION" STRATEGIES

This article has described how Hitachi's IP strategy has evolved as its business portfolio has shifted from the electronics business to its Social Innovation Business.

With social innovation achieved through collaborative creation with customers as a pillar of its management strategy, Hitachi believes that "competition" and "collaborative creation" strategies are required for our IP strategy. By combining those "competition" and "collaborative creation" strategies, Hitachi intends to continue deploying measures for exploiting IP in its Social Innovation Business.

REFERENCES

(1) Hitachi website, "Hitachi's Social Innovation Business," http://www.hitachi.com/businesses/innovation/
(2) Hitachi website, "5.3 Management and Preservation of Company Assets," (2), http://www.hitachi.com/corporate/about/conduct/index.html#aid8013480

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Featured Articles

IP Management at Hitachi's Overseas Rolling Stock Business

Takateru Sato
Takashi Matsushita
Kunihiko Ito
Yasushi Yokosuka

OVERVIEW: Hitachi is actively involved in the rolling stock business, not only in Japan but also overseas, particularly in the UK, having won orders for high-speed rolling stock for the HS1 line in 2005 and the IEP in 2012. Along with the overseas operations of its rolling stock business, an increasingly large proportion of IP management at Hitachi involves activities conducted in regard to overseas business. This article describes Hitachi's overseas operations, particularly in the UK, and the associated IP management.

INTRODUCTION

HITACHI is actively involved in operating its rolling stock business overseas. In the UK in particular, it has supplied high-speed Class 395 rolling stock for the High Speed 1 (HS1) line. With the recognition of this project as a success, Hitachi has also won an order to supply rolling stock and maintenance for the upcoming Intercity Express Programme (IEP).

Along with this active involvement in overseas business, an increasingly large proportion of the intellectual property (IP) management related to the rolling stock business involves activities conducted in regard to overseas business. This article describes Hitachi's overseas operations, particularly in the UK, and the associated IP management.

HITACHI'S ROLLING STOCK BUSINESS IN UK

History of Involvement in UK

When Hitachi first became involved in the UK railway industry in 1999, the UK rolling stock market was dominated by the "big three" of Bombardier, Siemens, and Alstom. However, the expectation of strong demand for the replacement of aging rolling stock indicated there was an opportunity for a Japanese supplier to enter the market.

Table 1 lists major milestones in the history of Hitachi's rolling stock business in the UK.

Hitachi bid on rolling stock projects in 2000 and 2001 but failed to win any orders. While possible explanations for this include differences in commercial practices and contract arrangements or problems with organizational structure[1], it has been suggested that it was in a large part due to the risk of adopting Japanese railway systems that were unproven in the UK, where the infrastructure is different. Subsequently, Hitachi embarked in 2002 on the V-Train 1 project for trialing existing UK rolling stock fitted with a Hitachi traction system (inverters and motors)[1), 2]. The successful completion of these trials demonstrated the high quality of Hitachi railway systems. With the success of these initiatives, Hitachi was able to win a contract for its first UK rolling stock project, the Class 395, in 2005 (see Fig. 1).

The separation and privatization of UK railways created a vertically separated model split between companies that own the tracks, catenaries, and other

Table 1. Hitachi's Rolling Stock Business in the UK
The table lists major milestones for Hitachi's rolling stock business in the UK.

2000 to 2001	Bid on two contracts but failed to win orders.
2002	V-Train 1 project implementation
Oct. 2004	Awarded preferred bidder status for Class 395.
June 2005	Signed formal contract for Class 395.
Mar. 2007	UK Department for Transport announces IEP.
2008	V-Train 2 project implementation
Feb. 2009	Awarded preferred bidder status for IEP.
Dec. 2009	Class 395 enters commercial operation.
Feb. 2010	UK Secretary of State for Transport announces freeze on IEP negotiations.
Mar. 2011	Resumption of IEP negotiations
July 2012	Signed formal contract for IEP.
April 2013	Additional options contract for IEP
Oct. 2014	Awarded preferred bidder status for ASR.

IEP: Intercity Express Programme ASR: Abellio ScotRail

Fig. 1—Class 395 Rolling Stock.
This Class 395 train is at the Ashford depot where Hitachi operates the maintenance services it has been contracted to supply.

Fig. 2—Class 800 Rolling Stock.
The first completed rolling stock was announced at Kasado Works in November 2014.

infrastructure and train operating companies (TOC) that provide passenger services under a franchise system. The infrastructure companies have a strong desire for lighter rolling stock to reduce track damage and energy consumption. There is also a requirement to comply with UK and European railway standards, including standards for collision safety. The Class 395 are based on the A-train concept developed in Japan, featuring lightweight and robust carbodies fabricated from aluminum using friction stir welding (FSW)[3), (4)], and have been modified to comply with UK railway systems, including the requirements of infrastructure companies and standards[(5)].

Because the UK railway infrastructure still includes a considerable amount of non-electrified track, some express trains still use diesel locomotives. The IEP project is intended to provide a full replacement for these. It was initially assumed that non-electrified infrastructure would remain. Hitachi has experience with hybrid drive systems that provide superior performance (including fuel consumption) on non-electrified track, and was able to demonstrate their effectiveness through the V-Train 2 project, which involved trialing these systems in UK rolling stock[(4), (6), (7)]. Ultimately, however, use of the hybrid systems was shelved because most of the track used by the IEP will be electrified. Instead, to enable operation on the non-electrified track that will remain, Hitachi developed a new bi-mode drive system that fits locomotives with diesel generators to enable the same locomotive to run on both electrified and non-electrified track. This was part of the development of the Class 800/801 rolling stock for the IEP project[(8)] (see Fig. 2).

In this way, Hitachi has successfully proceeded with the project, by utilizing a number of key technologies to comply with the requirements of UK railways, and by conducting its own demonstration trials to gain the customer's trust.

Future of UK Rolling Stock Business

The Class 395 rolling stock have been operating successfully since they entered service in 2009. For the IEP project, the first trains have been completed and will commence trial operation in FY2015. With the aim of extending its product range to gain further overseas orders, Hitachi is also developing the semi-order-made, standard A-train for global market[(9)].

In July 2014, Hitachi presented a full-size mockup of its AT-200 rolling stock to railway industry officials in London as part of its efforts to win orders for suburban rolling stock projects, for which demand is anticipated to rise[(10)]. The AT-200 is part of a product range that includes AT-100 commuter, AT-200 suburban, and AT-300 high-speed rolling stock. In October 2014, Hitachi was awarded preferred bidder status for a suburban rolling stock project in Scotland[(11)]. It is also seeking to win orders from other parts of Europe in the future.

IP MANAGEMENT FOR ROLLING STOCK BUSINESS

UK Rolling Stock Business and IP Master Plan

When Hitachi's rolling stock business was primarily based in Japan, it formulated plans for Japanese patent applications relating to such technologies as carbodies and electrical components, and created inventions and applied for patents in accordance with these plans. To

reduce IP risk, Hitachi also reviewed patents taken out by other companies, particularly in Japan, and made an effort to develop its rolling stock in ways that respected other companies' patents.

Its practice when applying for patents overseas, in contrast, was to focus on applications that related to important developments. In the case of FSW referred to above, for example, Hitachi used technology from The Welding Institute in the UK as a base and developed it into a form suitable for rolling stock. It has built up an international portfolio of approximately 280 Japanese and 80 European patent applications relating to FSW[12]. Using this patent portfolio as a base, Hitachi has also taken steps to use FSW technology for rolling stock to help win orders by treating it as a proprietary technology that differentiates Hitachi from competitors.

However, the overseas operations of the rolling stock business require that IP management also shift from a domestic focus to include activities that take account of overseas business. In addition, it is necessary to strengthen Hitachi's portfolio of patents in the overseas markets where it operates in order to protect important technologies used in those markets. Another important consideration when entering new markets is to identify patents held by other companies and obtain clearance (confirming that Hitachi does not infringe on other companies' rights).

Accordingly, as it establishes and expands its rolling stock business in the UK, Hitachi's IP management needs to include a comprehensive review of its IP strategy and the formulation of a new IP master plan. This IP master plan is prepared by surveying patents held by Hitachi and its competitors in key markets based on its business plan for rolling stock. In the case of the rolling stock business, the two key measures are, (1) to strengthen its portfolio of UK patents, and (2) to ensure that comprehensive clearance is obtained for UK patents. An annual progress review and planning discussion is conducted for the IP master plan at an IP strategy conference attended by management from operational departments, research laboratories, and the IP department (see Fig. 3).

The following sections describe specific activities undertaken as part of this IP master plan.

Strengthening of UK Patent Portfolio in Conjunction with Establishment of Business in UK

When establishing its rolling stock business in the UK, Hitachi set up a new project for the development of rolling stock products. Fig. 4 shows the organizational structure of the project, consisting of operational departments, research laboratories, and the IP department, overseen by a project leader.

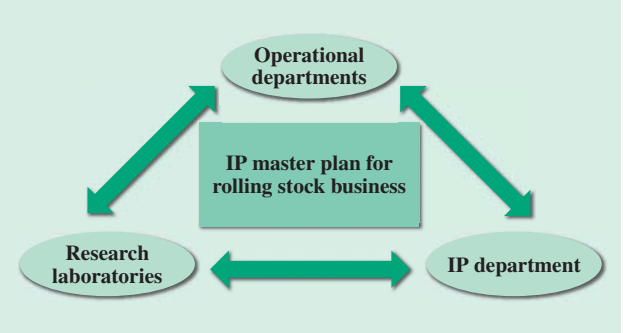

Fig. 3—Organization for Implementing IP Master Plan. Operational departments, research laboratories, and the IP department work together to implement the IP master plan for rolling stock.

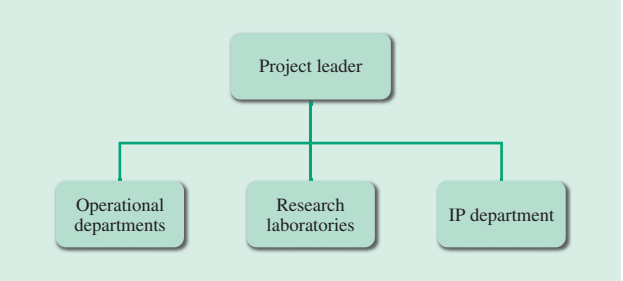

Fig. 4—Organization for Implementing Project. Operational departments, research laboratories, and the IP department work together to handle sales, development, and other tasks associated with entering the UK market.

This project included operational departments, research laboratories, and the IP department working together to facilitate Hitachi's entry into the UK market by strengthening its UK patent portfolio. It was selected as a "flagship patent activity," designating it as one of the key areas for patenting at Hitachi, with patent application plans being formulated annually and the results evaluated over a four-year period starting from 2010.

Specifically, these "flagship patent activities" involved, (1) surveying patent applications filed by Hitachi and its competitors (particularly applications filed in the UK and Europe) that included both macro and micro analyses (respectively, the analysis of trends and of specific technical issues), (2) preparing a map of development work and technical issues, creating inventions that resolve issues from a medium- to long-term perspective, and applying for patents throughout the world, starting in the UK, and (3) designing and

reviewing design documents and specifications for projects in the UK to identify whether they contained any practical inventions that could be applied to actual products, and issuing patent applications for them prior to commercialization.

This work led to patent applications for key technologies such as the bi-mode drive system used in the Class 800/801.

Hitachi also plans to undertake similar activities for its AT-100 commuter, AT-200 suburban, and AT-300 high-speed rolling stock, for which it anticipates future orders.

Achieving Comprehensive Clearance

The project described above included "clearance" of UK patents.

In contrast to Japan where it has traditionally operated its rolling stock business, being a new entrant to the UK market means that Hitachi faces greater IP risks. Accordingly, the IP department, in consultation with operational departments and research laboratories, takes the lead in prioritizing which technologies, competitors, and other factors need to be reviewed, assesses competitors' patents in tandem with the development schedule for the project described above, and implements countermeasures.

Furthermore, protection of rights in the rolling stock business includes not only technologies, but also rights to the designs of carbodies and train interiors that play an important part in appealing to customers. Accordingly, in addition to patents, Hitachi also verifies that it is not infringing on other companies' design rights.

CONCLUSIONS

This article has described Hitachi's rolling stock business based in the UK and the associated IP management.

Hitachi moved the overseas headquarters and strategy formulation function of its railway systems business to London in April 2014. Furthermore, with its plan to establish facilities for the production of rolling stock in the UK, it is likely that the number of inventions coming out of the UK will increase in the future. While Hitachi currently has Japanese IP staff seconded to Hitachi Rail Europe, its UK railway industry subsidiary, to handle patent applications, acquisition of rights, and other IP management, it will be necessary in the future to adopt an IP strategy that is more closely integrated with its overseas headquarters.

Hitachi is also working actively to extend its rolling stock business to other overseas markets beyond the UK. Its intention is to make use of IP rights in its business by also formulating and implementing IP master plans for countries other than the UK.

REFERENCES

(1) "Innovative Express—UK Intercity Express Programme—," Hitachi Hyoron **95**, pp. 6–15 (Jan. 2013) in Japanese.
(2) Y. Kono, M. Shimada, and H. Okawara, "Power Electronics Products for Railway Application—Environmental Technologies for Global Railway Market—," Hitachi Hyoron **90**, pp. 1010–1013 (Dec. 2008) in Japanese.
(3) T. Kawasaki, T. Yamaguchi, and T. Mochida, "Railway-vehicle Technologies for European Railways," Hitachi Review **57**, pp. 61–65 (Mar. 2008).
(4) Y. Yokosuka et al., "Development and Global Deployment of Environmentally Conscious Railway Systems," Hitachi Review **59**, pp. 165–170 (Oct. 2010).
(5) T. Mochida et al., "Development and Maintenance of Class 395 High-speed Train for UK High Speed 1," Hitachi Review **59**, pp. 39–46 (Apr. 2010).
(6) K. Tokuyama et al., "Practical Application of a Hybrid Drive System for Reducing Environmental Load," Hitachi Review **57**, pp. 23–27 (Mar. 2008).
(7) M. Shimada et al., "Energy-saving Technology for Railway Traction Systems Using Onboard Storage Batteries," Hitachi Review **61**, pp. 312–318 (Dec. 2012).
(8) A. Rogers et al., "Development of Class 800/801 High-speed Rolling Stock for UK Intercity Express Programme," Hitachi Review **63**, pp. 646–654 (Mar. 2015).
(9) M. Iwasaki et al., "Advanced Train Technology and New Development for Global Markets," Hitachi Review **61**, pp. 296–300 (Dec. 2012).
(10) "Hitachi Rail Europe Launches New Train Design Heralding the Future of Commuter Travel," Hitachi News Release (Jul. 2014), http://www.hitachi.co.uk/about/press/pdfs/20140721-Hitachi_Rail_EuropeAT200_launch_press_release_FINAL.pdf
(11) "Hitachi Rail Europe to Provide New Trains for Abellio Franchise in Scotland," Hitachi News Release (Oct. 2014), http://www.hitachi.co.uk/about/press/pdfs/20141009-HRE-EGIP%20contract%20win_FINAL.pdf
(12) T. Mizumura and M. Ezumi, "Hitachi's Use of Friction Stir Welding (FSW) for Rolling Stock and its IP Strategy," Tokugikon 258, pp. 41–46 (Aug. 2010) in Japanese.

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Featured Articles

Development of Ultra-high-speed Elevator and Establishment and Use of Patent Portfolio in China

Atsuya Fujino
Hideka Matsuoka
Masamichi Tomita
Atsushi Matsuura
Daisuke Mizumoto
Michiyuki Inoue

OVERVIEW: The market for elevators and escalators continues to expand in China and other Asian nations based on a background of economic development and steadily rising urban populations. The Urban Planning and Development Systems Company of Hitachi, Ltd. has entered the Chinese market with an ultra-high-speed elevator it developed with the world's fastest speed of 1,200 m/min. In addition to strengthening its patent portfolio in China by using patents to protect the technology developed for the elevator, Hitachi is also including patents in its development of a technology brand, using them as a tool for marketing products to customers in its external promotions.

INTRODUCTION

THE Urban Planning and Development Systems Company of Hitachi, Ltd. is responsible for expanding its elevator and escalator business providing vertical mobility infrastructure to cities as part of a move to strengthen the global operations of Hitachi's Social Innovation Business.

The G1TOWER[(1)], the world's tallest[*1] (213 m) elevator research tower, commenced operation in 2010 at Mito Works, Hitachi's manufacturing and development base in Japan. Since then, it has been used for experimentation and testing in the development of technology for products that are designed for safety, comfort, and environmental performance in order to meet the rising global demand for elevators with high speed and large capacity. One outcome from the work at the G1TOWER is the supply by the Urban Planning and Development Systems Company and Hitachi Elevator (China) Co., Ltd. of ultra-high-speed elevators (with the world's fastest[*2] speed of 1,200 m/min or 72 km/h) to the Guangzhou CTF Finance Centre (height 530 m), a high-rise building complex currently under construction in Guangzhou, China that is scheduled to fully open in 2016[(2)].

As part of the global operations of its elevator and escalator business, the Urban Planning and Development Systems Company is establishing a portfolio of patents covering development work in conjunction with its Intellectual Property Division, and is taking steps to utilize the portfolio in its business. This article describes market trends in the elevator and escalator business, the development of the ultra-high-speed elevator for the Chinese market, and the use of the intellectual property that supports the business.

*1 As of April 21, 2014, based on research by Hitachi.
*2 As of April 21, 2014, based on research by Hitachi.

MARKET TRENDS AND DEVELOPMENT OF AN ULTRA-HIGH-SPEED ELEVATOR

Role of China in Market for New Elevators and Escalators

The market for new elevators and escalators continues to demonstrate steady growth due to expanding demand for buildings in China and other nations in Asia and elsewhere that are experiencing economic development and rising urban populations. Total global demand is expected to rise from approximately 759,000 units in 2013 to approximately 905,000 units in 2015, with approximately 78% of this demand coming from the Asian Belt region (Japan, China, Southeast Asia, India, and the Middle East). The Urban Planning and Development Systems Company of Hitachi, Ltd. is focusing on business growth in this region (see Fig. 1).

In particular, China alone accounts for approximately 60% of global demand, making it the most important market, with considerable activity in the construction not only of office buildings and high-rise apartments, but also of high-rise buildings of 300 m or more.

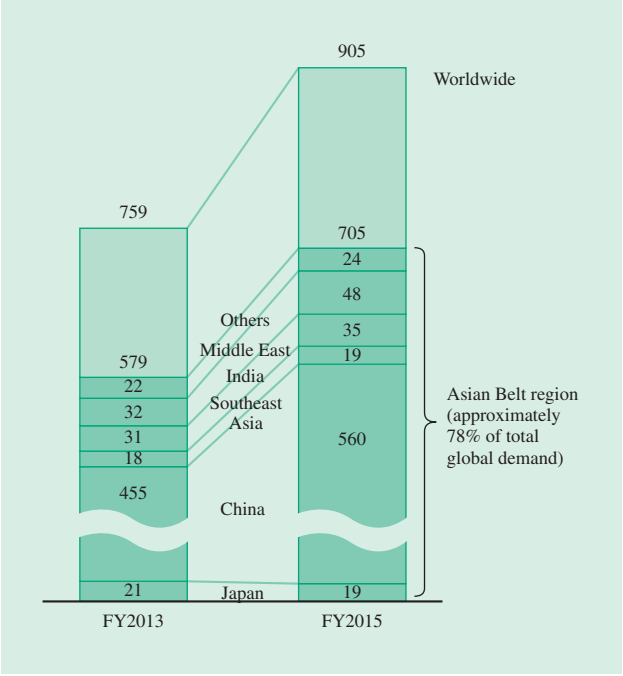

Fig. 1—Trends in Market for New Elevators and Escalators (×1,000 Units, Based on Hitachi Research).
The market for elevators and escalators is expected to grow from approximately 759,000 units in FY2013 to approximately 905,000 units in FY2015. The Asian Belt region (Japan, China, Southeast Asia, India, and the Middle East) accounts for approximately 78% of this demand.

As its most important market, Hitachi Elevator (China) is seeking to increase sales of new equipment and extend its network of sales and service centers in China in its role as regional coordinator. In FY2013, it won orders for 67,000 new units (a 15% share of the Chinese market). To meet this demand, it is increasing its production capacity, having opened its fourth manufacturing plant in Chengdu in the west of China, adding to its existing plants in Guangzhou, Tianjin, and Shanghai.

Major examples of the company's elevators operating in China include the double-decker elevators at the Shanghai World Financial Center, with a speed of 480 m/min in 2008 and the ultra-high-speed elevators at the Long Wish Hotel International of Huaxi, with a speed of 600 m/min in 2010. It will also supply ultra-high-speed elevators with the world's fastest speed of 1,200 m/min in 2016. Hitachi's strategy for the elevator and escalator business is to enhance its brand value in the Chinese market by developing and commercializing the world's fastest elevators, and by technological differentiation through the wider deployment of the ultra-high-speed technology, and to use this as a way to expand its business.

Development of Ultra-high-speed Elevator

The 1,200-m/min elevators to be supplied to the Guangzhou CTF Finance Centre, which can travel the 440 m from level 1 to level 95 (the "up-down stroke") in approximately 43 s, are being built based on a combination of technologies and equipment development work[3].

The traction system that delivers the world-leading speed incorporates a 330-kW permanent magnet (PM) motor traction machine, the largest class ever used in an elevator; a brake with brake pad material that has a high tolerance for heat; and a high-strength rope with a strength-to-weight ratio approximately 30% higher than before.

Hitachi has developed a 2,200-kVA control unit consisting of two inverters in parallel, each of which has four parallel-connected insulated-gate bipolar transistors (IGBTs), and is using it as the control system that supplies the power to the traction machine (see Fig. 2).

Hitachi has also used the G1TOWER elevator research tower for structural and vibration design to achieve a high level of ride comfort with low levels of vibration and noise when traveling at ultra-high speed. This included the development of a fluid commutating cover that reduces wind noise at ultra-high speeds and an active guide unit that significantly reduces elevator car vibration due to rail curvature.

Traveling on the 440 m up-down stroke at ultra-high speed has a tendency to induce ear blockage and other passenger discomfort caused by air pressure

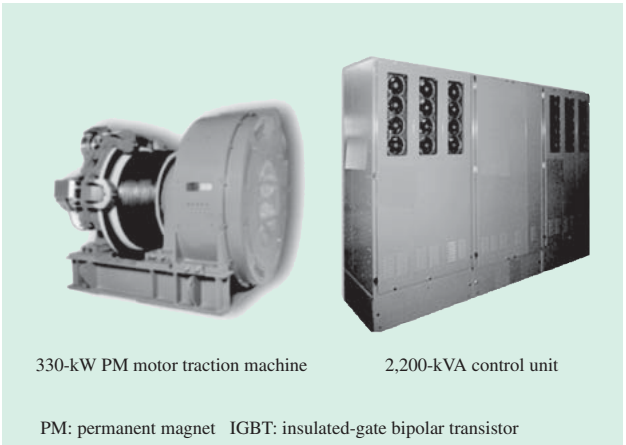

Fig. 2—Traction Machine and Control Unit for 1,200-m/min Ultra-high-speed Elevator.
Hitachi has developed a 330-kW PM motor traction machine, the largest class ever used in an elevator, and a 2,200-kVA control unit consisting of two inverters in parallel, each of which has four parallel-connected IGBTs.

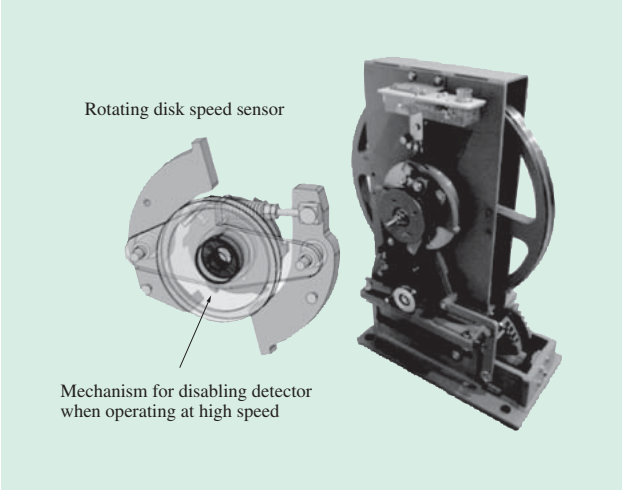

Fig. 3—Governor with Different Speed Limits for Ascending and Descending.
The governor incorporates a mechanism for disabling the overspeed limit for descending when the elevator is ascending so that it can detect abnormal overspeed at the respective ascending and descending speed limits.

differences due to altitude. Accordingly, whereas the ultra-high-speed elevators to be supplied to the Guangzhou CTF Finance Centre will travel at 1,200 m/min when ascending, they are speed-limited to 600 m/min when descending, which is the speed above which passengers are most likely to be affected, and are also fitted with devices for controlling the air pressure in the elevator cars. As a consequence, the safety devices need to detect abnormal overspeed at the respective ascending and descending speed limits. To achieve this, Hitachi developed a governor with different speed limits for ascending and descending so as not to treat the ascending speed as exceeding the overspeed limit for descending (see Fig. 3).

USE OF INTELLECTUAL PROPERTY TO SUPPORT ELEVATOR AND ESCALATOR BUSINESS

Hitachi activities relating to intellectual property include the formulation of an intellectual property master plan for the elevator and escalator business to underpin the growth of the business in China. The following sections describe some of these activities.

Establishment of Patent Portfolio for Ultra-high-speed Elevators

As described above, the technology for ultra-high-speed elevators can be broadly divided into the traction system, control system, structural and vibration design, and safety device categories. These technologies enable the high speed, safety, and comfort that are used as promotional features for the elevators. To ensure the comprehensive protection of the key ideas involved in each of these four technical categories, Hitachi's Urban Planning and Development Systems Company, Research & Development Group, and Intellectual Property Division set up a project to apply for patents. In particular, this work was selected in FY2013 as a "flagship patent activity," which designates it as one of the key areas for patenting at Hitachi. This involved identifying technologies from the above four technical categories that are seen as strengths and as providing differentiation, and taking a prioritized approach to defining discoveries in parallel with the progress of research and development. As a result, Hitachi has been able to build up a portfolio of approximately 80 patent applications relating to ultra-high-speed elevators in the key Chinese market.

Strengthening the Patent Portfolio in China

In addition to all the major elevator and escalator suppliers from Europe, America, and Japan, there are also a very large number of domestic Chinese suppliers operating in the Chinese market. The operation of end-product manufacturers is also complimented by parts manufacturers that specialize in the supply of elevator and escalator parts. China is continuing to grow in importance not only as a market but also as a base for manufacturing. This makes it very important for the elevator and escalator business to build up a patent portfolio in China.

The Urban Planning and Development Systems Company and Hitachi Elevator (China) have been working together to strengthen their patent applications in China (see Fig. 4). As a result, the number of patent applications made by Hitachi in China has grown from about 20 in 2004 to about 140, making Hitachi the leading publisher of patents in China among elevator and escalator manufacturers in 2013 (see Table 1).

In strengthening its patent applications in China, Hitachi has made changes to its application processes. Whereas past practice was to apply for a patent in Japan first, and then to consider whether pursuing a patent application in China was necessary, Hitachi now considers in which countries to apply for patents at the time an invention is created. As a result, Hitachi has also adopted a "China-first strategy" for some patent applications whereby it first applies for a patent in China.

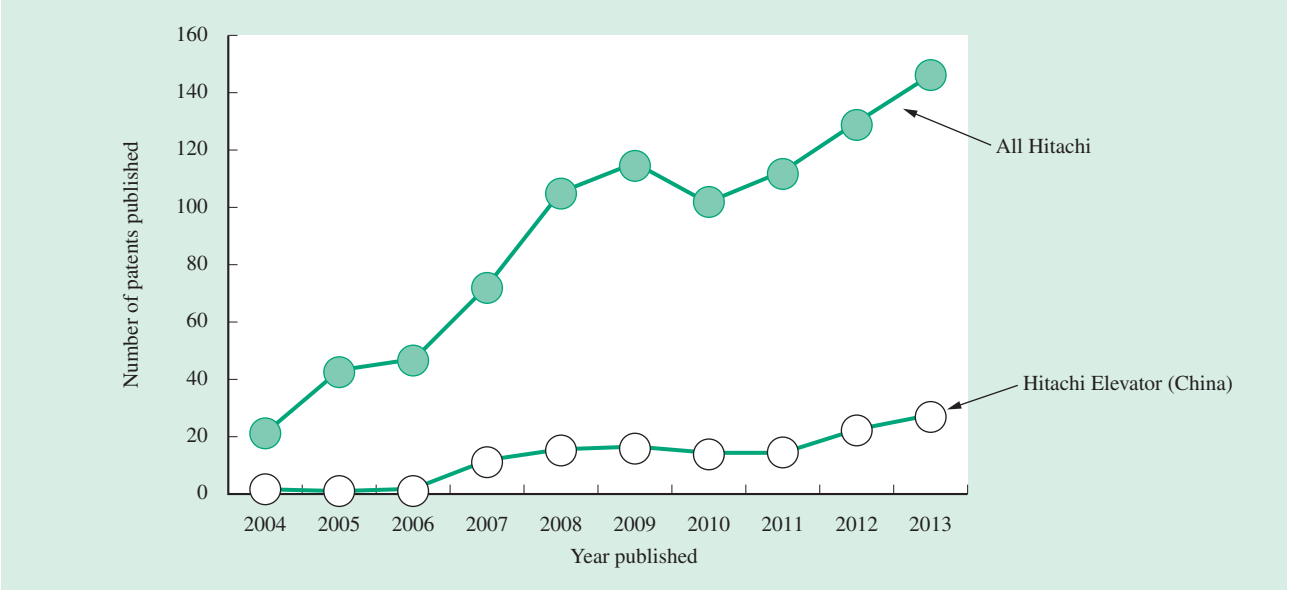

Fig. 4—Trend in Numbers of Patents Published in China (Elevators and Escalators).
Hitachi has strengthened its patent applications in response to the expansion of the Chinese market (based on research by Hitachi using figures from Shareresearch).

TABLE 1. Number of Elevator and Escalator Patents Published in China during 2013 by Equipment Suppliers
Hitachi published more patents in China during 2013 than any other elevator and escalator supplier (based on research by Hitachi using figures from Shareresearch).

Corporate group	Hitachi	Group A	Group B
Number of patents published in China	146	109	90

Intellectual Property Management at Hitachi Elevator (China)

Management of intellectual property by Hitachi Elevator (China) is essential to the elevator and escalator business.

Hitachi Elevator (China) established its Asia Research & Development Center in 2004 to strengthen development in China. Staff from Japan and China work together at the center to develop technologies and products for expanding the Chinese market.

The intellectual property staff of Hitachi Elevator (China) have been assisting center engineers in undertaking the work required for patent applications, including idea formulation, prior art searches, and application document preparation. This has led to a steady increase in the number of patent applications (see Fig. 4) and is part of the work involved in building a portfolio of patents in China.

Patent applications by Chinese suppliers have also been increasing in recent years, making it important to assess and analyze these patents to avoid the risk of infringement. Because the language barrier makes it difficult to perform this patent assessment and analysis in Japan, this is another activity that is handled by the Chinese staff at Hitachi Elevator (China). Specifically, Hitachi Elevator (China) identifies and analyzes patents that relate in particular to products it is developing in China. In the case of particularly important patents, it shares information about the products and patents with Japan so that they can jointly conduct a detailed analysis and decide how to proceed.

In this way, Hitachi Elevator (China) plays a vital role both in building a portfolio of patents and in avoiding the risk of infringing other companies' patents. Each year, the Urban Planning and Development Systems Company, Hitachi Elevator (China), and Intellectual Property Division hold an intellectual property strategy conference to share and communicate their intellectual property strategies and facilitate the management of intellectual property.

Use of Patents in Public Relations

Using the patents that cover a product as a way of promoting that product to customers is sometimes an effective way to foster an appreciation of Hitachi's technical capabilities and differentiate it from other suppliers.

Accordingly, the Urban Planning and Development Systems Company sometimes publishes its patents at public relations events such as technical announcements. For example, Hitachi presented a

technical seminar on the world's fastest 1,200-m/min elevator at the World Elevator & Escalator Expo 2014 (May 2014), the world's leading trade show for elevators and escalators, and included the relevant patent numbers on the presentation slides. This is a case of patents also being used to support the business strategy of building a technology brand by promoting the world's-fastest elevator.

CONCLUSIONS

This article has described the development of an ultra-high-speed elevator and summarized the associated intellectual property management.

It is anticipated that the demand for elevators and escalators, in their role as vertical mobility infrastructure, will continue to grow in the future due to economic development and rising urban populations all around the world. Hitachi intends to continue utilizing patents to grow its business by acquiring them to protect its development work in key markets, and by using the acquired patents to enhance awareness of its technology brand.

REFERENCES

(1) A. Omiya and Y. Tashima, "World-leading Elevator Research Tower and New Elevator Technology for Next Generation of Urban Vertical Mobility Infrastructure," Hitachi Review **60**, pp. 106–111 (Apr. 2011).
(2) "Hitachi to Deliver the World's Fastest Ultra-high-speed Elevators with a Speed of 1,200 m/min for a Mixed-use Skyscraper in Guangzhou, China in 2016," Hitachi News Release, http://www.hitachi.com/New/cnews/month/2014/04/140421.html (Apr. 2014).
(3) "Elevators," Hitachi Technology 2015, Hitachi Review **64**, pp. 81–82 (Mar. 2015).

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Featured Articles

Aggressive Intellectual Property Management to Protect Business Activities

Koichi Wakayama
Yasuyuki Seki

OVERVIEW: Companies are seeking to identify the best strategies and tactics for obtaining intellectual property rights to the results of their research and development and using those rights to protect and promote the business, and are implementing policies accordingly. Hitachi Chemical Co., Ltd. is a B-to-B business, meaning it supplies corporate customers, and it operates its business based on a mission of contributing to society through the timely development and supply of materials and components that deliver new functions, processes, and value to customers. The support of patents and other IP rights is essential to achieving and maintaining the superiority of its materials and components so that it can expand its business. Accordingly, it obtains patents and other rights and makes active use of them. This article introduces examples of the company's efforts including dicing-die attach film (DDF).

INTRODUCTION

WHAT is meant by strong intellectual property (IP), and IP that is useful to business? This is a question commonly put to people who work with IP. Hitachi Chemical Co., Ltd. places particular emphasis on IP that is useful to business and has created a virtuous cycle for enhancing IP that is useful to its business and for making use of IP in its activities by establishing an IP strategy for using IP to support the business, discussing the tactics needed to execute the strategy, and working through a process of trial (execution) and experience (successful and unsuccessful initiatives) that is then used as feedback for subsequent IP management. Through these activities, the company has fostered a culture of actively investigating IP use in its operational departments so that the operational and IP departments are able to work more closely together.

IP STRATEGY

What is the best way to get operational departments to appreciate how IP rights have benefitted their business activities? While obtaining patents and other rights covering the company's own products is important, this alone is not enough to gain recognition for their benefits. At Hitachi Chemical, it is in many cases only when the exclusive rights (right to prevent patent infringement) conferred by patents or other rights are exercised with respect to competitors to maintain the superiority of Hitachi's products and technologies that people appreciate how IP rights have benefitted their business activities.

Specifically, this first means increasing, if only by a small amount, the number of patents relating to the superiority of the company's products and technologies, namely those that cover features that provide competitive superiority over competitors' products (i.e., patents that prevent competitors from copying those features).

Furthermore, Hitachi Chemical uses the patents it has acquired for promotional purposes in its public relations. This is a way to promote the superiority of the company's products to customers in order to encourage purchases. It is also possible to ensure that competitors are aware of and respect the company's patents. That is, to prevent copying by competitors. Although the act of filing a patent makes it public, it is difficult for third parties to identify which patents are important from among the large number of patents that are published. Accordingly, it is important to actively promulgate information about patents that relate to the superiority of the company's products and technologies to inform people of the patents' existence and have them acknowledged by customers and competitors.

In the case of Hitachi Chemical, the company sometimes issues a written notification of a patent's existence to competitors that copy the company's patented technology without authorization. Hitachi Chemical also takes a firm stance against rights infringers who fail to respect its patents, making its willingness to sue clear, and taking legal action as needed such when using the infringement of rights as a basis for applying for an injunction.

Being persistent about its pursuit of these actions not only raises the presence of Hitachi Chemical's patents and other IP rights, it also makes it clear to customers and competitors that Hitachi Chemical expects its IP to be respected. As a result, ultimately, the ideal outcome is to create an environment in which it is possible to win without fighting. That is, to create a business environment in which competitors respect Hitachi Chemical's IP rights and instances of copying do not occur, without Hitachi Chemical itself exercising the exclusive rights conferred by its IP.

Amid the current ongoing trend toward globalization, competitors are increasingly overseas companies rather than Japanese companies. In emerging nations in particular, the current situation is that many companies only start thinking seriously about IP rights when they are taken to court, and it is increasingly necessary to take an active approach to enforcing company rights.

Meanwhile, to demonstrate to competitors a willingness to sue, it is necessary to have patents that will stand up in court. Primarily, this means identifying which inventions support the superiority of the company's products and technologies and are at high risk of being copied by competitors, coming up with patent claims based on the most likely ways in which copying by competitors might occur, and taking a determined approach to acquiring rights so as to obtain patents that will stand up in court with regard to things like patentability and ability to prove an infringement. It is important to take an active approach to dealing with patent examiners at the patent office based on a policy of obtaining patents that provide the desired range of rights rather than obtaining patents for the scope within which rights can be acquired, and to issue challenges when necessary to have patentability recognized even if it means going to court to dispute a judgment or decision.

There is also the question of how to identify which inventions support the superiority of the company's products and technologies and are at high risk of being copied by competitors. Hitachi Chemical operates on a business-to-business (B-to-B) model. That is, its business model involves offering customers new materials and components (or ways of using them) that solve their operational troubles (problems) based on their requirements[*1]. There are numerous cases in which inventions that support the superiority of the company's products and technologies and that are at high risk of being copied by competitors are present in their marketing to customers and the associated lead-up processes, but which are not recognized as inventions and therefore get overlooked. Getting the research and development staff to identify these inventions is an important task for the IP staff whose job it is to apply for patents and acquire rights. The activities of the IP staff at Hitachi Chemical are not limited only to inventions relating to materials and components marketed by the company, they are also working hard to establish an all-encompassing network of patents by striving to identify a broad scope of inventions, from raw materials to the ways in which materials and components are used, and the products in which they are used.

There is frequent talk in the IP world about a shift from patent quantity to patent quality and about improving invention quality. Instead of judging the quality of an invention by such criteria as how technically advanced the invention is or the thickness of the patent application documents, Hitachi Chemical assesses quality based on the extent to which a patent covers the superiority of the company's products and technologies, the risk of copying by competitors, and the extent to which it serves as an obstacle to the copying of those superior features by competitors. This type of assessment is only possible by having an understanding of the developments being undertaken by competitors and of the details of their products. Furthermore, assessments change over time. The IP staff in charge of applying for patents and acquiring rights at Hitachi Chemical communicate closely with the operational and research and development departments to obtain information about the development trends and products of competitors, etc., and use this information as a basis for continuously revising their assessment of inventions and adjusting the level (priority) of efforts put into acquiring rights.

*1 Since 2000, Hitachi Chemical has adopted its Material System Solution (MSS) business model for the marketing and supplying to customers of the best possible materials, services, and solutions to meet their needs in the form of a series of systems. Hitachi Chemical has also, since mid-2000, adopted the Working On Wonders business model whereby it has delivered "wonders" that exceed society's and customers' expectations by taking on the challenge of venturing into unknown territory and creating new value that goes beyond chemistry.

AGGRESSIVE TACTICS

Patent rights are based on exclusivity, and monopoly rights are not conferred automatically. Accordingly, using patents to protect a business requires that active steps be taken to obtain patents that will stand up in court and to make use of those patents. This section describes the associated tactics.

Obtaining Patents that will Stand up in Court

Training

The rights that patents confer are not entirely reliable in the sense that they can still be rendered invalid by the presentation of new evidence of prior art, even after they have been registered. Accordingly, the need to prepare specification documents carefully and to counter any basis on which the patent might be rejected or decreed invalid means that the skills of the IP staff responsible for preparing specifications and acquiring rights play an important role in obtaining patents that will stand up in court. This means it is essential that IP staff hone their skills by undergoing training to improve their capabilities.

To this end, Hitachi Chemical is proceeding with the following four initiatives.

(1) Conduct working group activities within the IP department to collate a manual aimed at improving the quality of specification documents and make it available for use.

(2) Review and improve the skills of IP staff by having a committee of three examiners conduct half-yearly performance reviews to assess their ability to prepare specification documents.

(3) Share experiences by holding half-yearly case study review meetings at which IP staff give presentations on successful and unsuccessful cases.

(4) When exercising patent rights, have IP staff sit in on patent negotiations with other parties to get first-hand experience of the other party's counter-arguments in response to presentations by Hitachi Chemical asserting patent infringements, patent validity, and so on, so that staff can benefit from this experience in their subsequent work when preparing specification documents or acquiring rights.

In addition to IP staff, Hitachi Chemical also provides IP training to research and development departments and sales and operations departments to prevent IP-related problems and to share knowledge about how to make use of IP in business. This consists of the following five training programs.

(1) IP training for new recruits

This training is given to new recruits when they are first hired and after they have been with the company for one year, and focuses on teaching them about the advantages and risks of IP.

(2) Patent courses

Separate courses cover fundamentals and practice, focusing on teaching participants about the preparation of specification documents, procedures for acquiring rights, and how to exercise rights.

(3) Patent search course

This course focuses on improving knowledge of database searching so that people can conduct their own patent searches.

(4) Business course

Targeted at research and development staff who visit customers, this course focuses on encouraging understanding of the points to keep in mind regarding IP and what to do about them.

(5) Training for sales and operational departments

This course focuses on encouraging understanding of IP problems in sales and marketing, and what to do about them.

Patenting in Accordance with Business Phases

IP staff are assigned to specific technologies and products, and they go about patenting work in their respective areas depending on the business phase.

(1) The early development of new technologies and products is called "flare/flair activity" and involves holding invention review meetings and making applications in a consolidated manner. To ensure that the publication of initial patent applications by Hitachi Chemical does not obstruct the subsequent acquisition of rights for applications relating to improvements, an effort is made to make a consolidated application prior to the initial application being published. It is up to the knowledge of the IP staff to determine which inventions to select as "flare/flair" themes, with reviews being conducted every six months.

(2) When plans for commercialization are formulated, work starts on patent portfolio management (PPM) by collating previous applications that relate to the same field. An effort is made to avoid omissions when issuing applications for patents that cover improvements, and, in the case of overseas patents, to create a network of patents in which the claims made in each country are the same. An emphasis is also placed on establishing substantive claims and acquiring rights.

(3) The need to exercise rights becomes evident when competitors start to release products. As the company with respect to which the rights are to be exercised also

becomes clear, the "five fighting patents" (5FP) phase is initiated. This phase involves identifying which patents, among those for which applications have been made, are able to be exercised with respect to the competitor, and finding at least five actionable patents.

Use of IP to Protect Superiority of Hitachi Chemical Products and Technologies

News Releases and Informing Customers about Patents

Hitachi Chemical uses news releases to announce the acquisition of core patents, the establishment of patent networks, suing for patent infringement, and other such developments that relate to important products. Hitachi Chemical does this to inform customers and the wider industry about its patents and its stance on IP, with the expectation that it will help prevent IP disputes while also promoting the technical capabilities of its products.

Issuing Warnings and Lawsuits when Necessary

Hitachi Chemical issues written notices (including warning notices) of the existence of patents to competitors that copy its patented technology. However, because this has little effect on its own, it is important to undertake patent negotiations regarding patent validity and infringements in consultation with the other party, and this frequently involves working with the other party to find ways to resolve the issue.

In cases where there is no hope of holding discussions to resolve the issue, Hitachi Chemical believes that a decision needs to be made to proceed with a lawsuit without hesitation. Winning a case that seeks to invalidate Hitachi Chemical patents makes customers and competitors aware of the patents. And, because this highlights to customers that choosing to use products that infringe on IP rights carries a genuine risk of supply interruptions, it helps to enhance Hitachi Chemical's IP brand.

An additional benefit is that the experience gained from seeing how the other party defends a lawsuit enhances the ability to respond when Hitachi Chemical itself is the subject of an exercise of rights by another company.

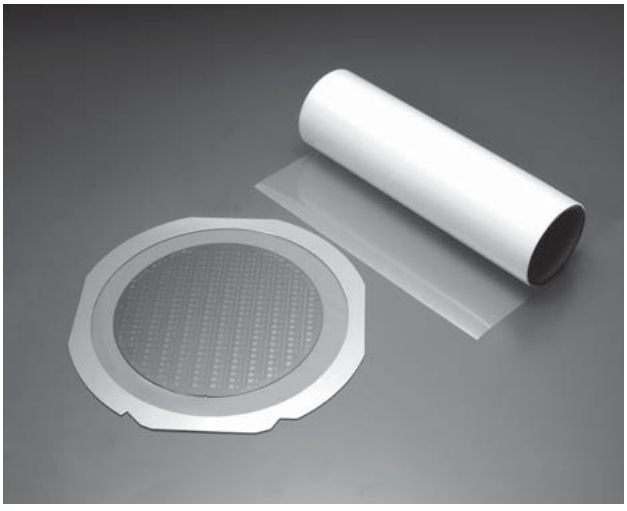
Even in cases where negotiations with the other party leads to seeking a resolution based on licensing, rather than offering comprehensive licensing, it is important to protect the superiority of Hitachi Chemical products to a certain extent by, for example, stipulating the specific patents to which license is being granted, the specific applications where they may be used, and the scope of composition or structure. Furthermore, it is not necessary to reject a settlement when taking on a lawsuit, and a settlement is desirable if it is beneficial to Hitachi Chemical. It is also common for internal dissent to be raised when halting legal proceedings that are already in progress. However, because the timing and content of a settlement are important, persuading others in the company to avoid missing the right timing is another important task for the IP department.

CONTRIBUTION OF IP TO BUSINESS

This section uses an example involving dicing-die attach film (DDF) to explain the contribution that IP management makes to business.

DDF

DDF is made by successively laminating die attach film (DAF) and dicing film (DCF) on a release liner, and is precut into a circular shape the same size as a silicon wafer (see Fig. 1). When used, the precut DDF is first peeled off of the release liner and the DAF side is affixed to the underside of the silicon wafer on which the semiconductor circuit has been formed. Next, after using a dicer on the silicon wafer side to dice it into semiconductor chips, the DCF side is expanded through exposure to ultraviolet (UV) light, and the semiconductor chips are picked up and mounted on the semiconductor package substrate (see Fig. 2).



DDF: dicing-die attach film DAF: die attach film DCF: dicing film

Fig. 1—DDF.
DDF is made by successively laminating DAF and DCF on a release liner, and is precut into a circular shape the same size as a silicon wafer.

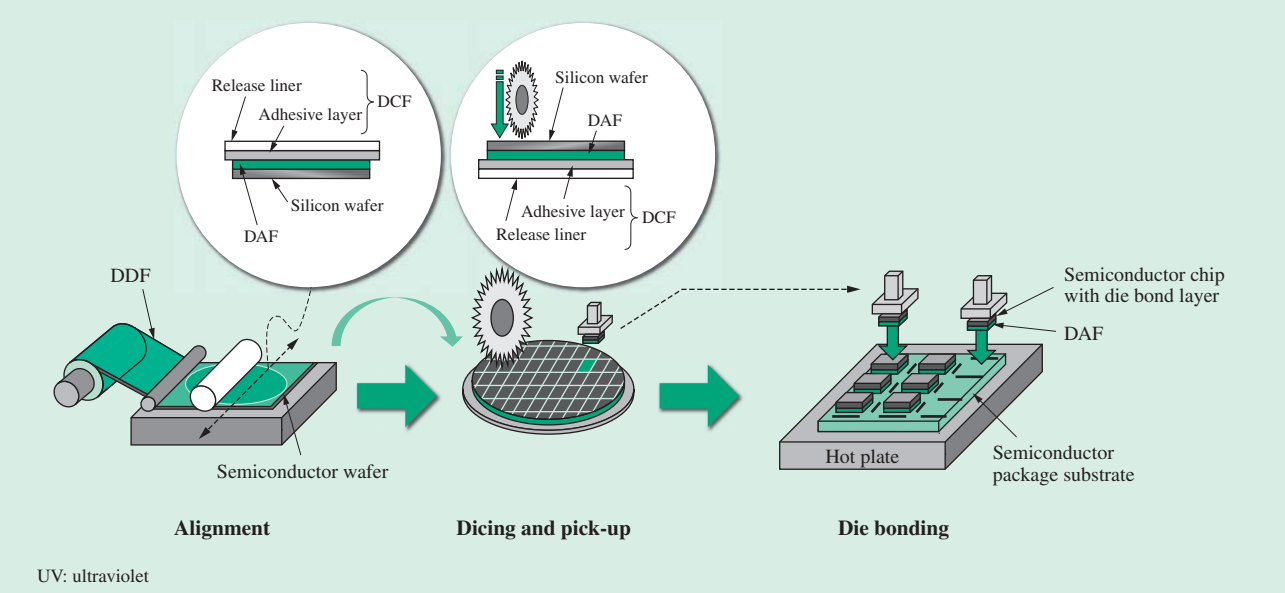


Fig. 2—Process for Using DDF.
Precut DDF is peeled off from the release liner and the DAF side is affixed to the underside of the silicon wafer on which the semiconductor circuit has been formed. Next, after the dicer is used on the silicon wafer side to dice it into semiconductor chips, the DCF side is expanded through exposure to UV light, and the semiconductor chips are picked up and mounted on the semiconductor package substrate.

In this way, DAF is used between the semiconductor chip and semiconductor package substrate, and also between semiconductor chips. The semiconductor device is then completed by performing wire bonding (whereby gold wire is used to connect the semiconductor chip circuits to the terminals on the semiconductor package substrate) and sealing in encapsulating mold compounds (see Fig. 3).

The method used in the past was to affix DCF to the underside of the silicon wafer and use the dicer from the wafer side to dice it into semiconductor chips, after which the DCF side was expanded through exposure to UV light and the semiconductor chips picked up and mounted on a semiconductor package substrate coated with adhesive and adhesive film (see Fig. 4).

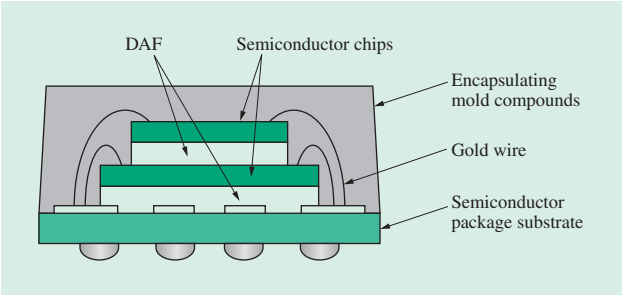


Fig. 3—Cross-section of Semiconductor Device.
DAF is used between the semiconductor chip and semiconductor package substrate and also between semiconductor chips. Wire bonding is then performed to connect the semiconductor chip circuits to the terminals on the semiconductor package substrate and the package is sealed in encapsulating mold compounds.

IP Activity for DDF

Because DDF is supplied and stored with the DAF and DCF in contact with each other, a method is needed to prevent the resins in the DAF and DCF from mixing during the time between manufacture and use. Also, DDF is a functional product in the sense that it needs to demonstrate the appropriate functions at the appropriate times. That is, while it is necessary to prevent delamination of the DAF and DCF when peeling the DDF off of the release liner, the DAF and DCF are peeled apart when picking up chips after dicing and the DAF must retain its function as an adhesive film.

The approach that Hitachi Chemical has adopted for DDF has been to supply total solutions that extend from upstream to downstream processes, and it has obtained patents that cover its materials and all stages of the manufacturing process, encompassing film formation, precutting, affixing to silicon wafers, dicing, and pickup and mounting on the semiconductor package substrate (see Fig. 5).

In particular, improvements and modifications intended to enhance convenience and boost productivity when the product is used by the

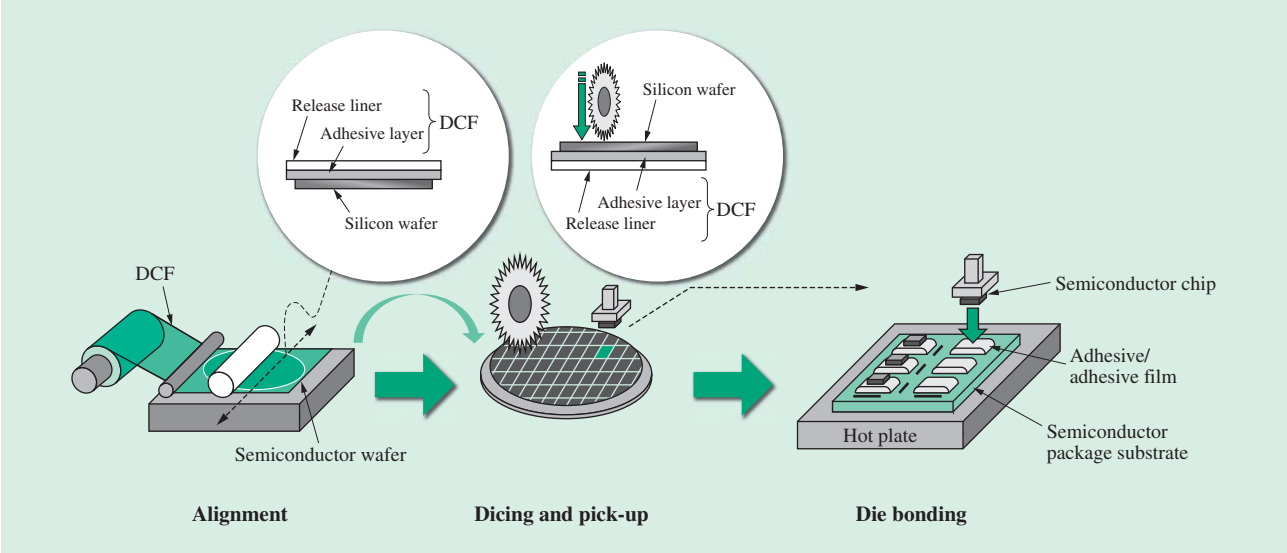


Fig. 4—Previous Method.
DCF was affixed to the underside of the silicon wafer and the dicer was used from the wafer side to dice it into semiconductor chips, after which the DCF side was expanded through exposure to UV light and the semiconductor chips picked up and mounted on a semiconductor package substrate coated with adhesive and adhesive film.

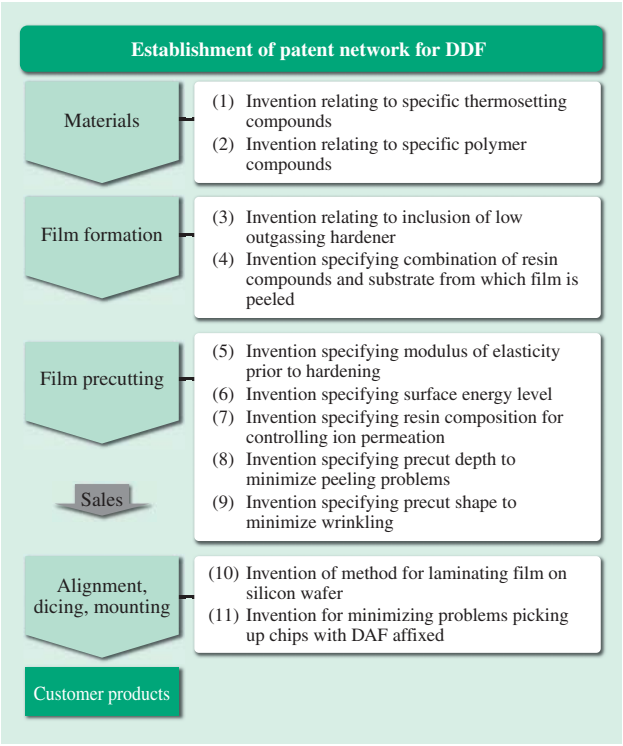


Fig. 5—Technical Flowchart of Invention Identification.
Patent applications are made for inventions at each stage, primarily in Japan, USA, South Korea, China, and Taiwan to acquire rights in each country or region.

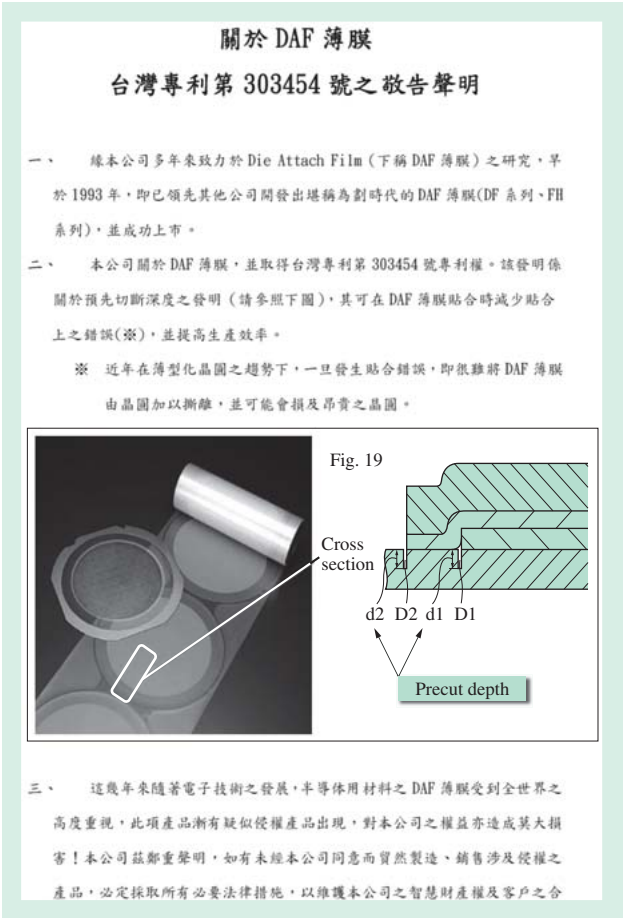
customer serve as prompts for patent applications by identifying at an early stage the needs (problems) of the customer, including any troubles they have, and undertaking various investigations into optimal solutions to these problems based on the company's accumulated technical know-how. Furthermore, Hitachi Chemical has sought to expand its patent network by undertaking invention identification, including by considering which inventions are at the greatest risk of being copied by competitors, and by making a variety of patent applications.

Also, IP staff have been building up a network of patents to use against competitors by visiting sales and development departments to obtain information about competitors' development trends and product details, and through measures such as augmenting or splitting applications based on this information.

Hitachi Chemical dose not just hold the patent network acquired through this activity as a defensive measure or use it as a means of collecting royalties from overseas subsidiaries, it also adopts aggressive tactics to make active use of it.

Specifically, when a customer was deciding who to purchase its DDF from, Hitachi Chemical supplied them with a list of its patents that relate to the product. This was done to make the customer aware of the patents and to get the customer to query the other companies participating in the DDF product selection process about Hitachi Chemical's patents. Because it forced competitors to respond in some way, such as by conducting an investigation or making design changes, this inquiry from the customer prevented competitors from copying and gave Hitachi Chemical a lead time advantage.

Next, Hitachi Chemical issued a news release describing the DDF patents. This was done because it anticipated that the news release would attract the attention of management at the customer's and competitors' companies. For the customer in particular, a word from its management has more effect than someone from Hitachi Chemical explaining the situation to the staff at its company. That is, it was anticipated that management at the customer's company would query Hitachi Chemical's competitors about its patents. Specifically, Hitachi Chemical purchased space in a Taiwanese trade newspaper to make sure that the customer in that country was aware of Hitachi Chemical's Taiwanese patents. In this case, the day of the week on which the notice was published was chosen by checking with the newspaper as to when there would be a high probability that management personal working in the industry would see it. A Taiwanese patent for DDF, which has a characteristic shape, was chosen to ensure that management would be able to understand the characteristics of Hitachi Chemical's patent, and a notice regarding this patent was published in the newspaper (see Fig. 6).


關於 DAF 薄膜

台灣專利第 303454 號之敬告聲明

一、 緣本公司多年來致力於 Die Attach Film（下稱 DAF 薄膜）之研究，早於 1993 年，即已領先其他公司開發出堪稱為劃時代的 DAF 薄膜(DF 系列、FH 系列)，並成功上市。

二、 本公司關於 DAF 薄膜，並取得台灣專利第 303454 號專利權。該發明係關於預先切斷深度之發明（請參照下圖），其可在 DAF 薄膜貼合時減少貼合上之錯誤(弊)，並提高生產效率。

※ 近年在薄型化晶圓之趨勢下，一旦發生貼合錯誤，即很難將 DAF 薄膜由晶圓加以撕離，並可能會損及昂貴之晶圓。

三、 這幾年來隨著電子技術之發展，半導体用材料之 DAF 薄膜受到全世界之高度重視，此項產品漸有疑似侵權產品出現，對本公司之權益亦造成莫大損害！本公司茲鄭重聲明，如有未經本公司同意而貿然製造、銷售涉及侵權之產品，必定採取所有必要法律措施，以維護本公司之智慧財產權及客戶之合

Fig. 6—Notice of Hitachi Chemical Patent in Taiwanese Newspaper.
Hitachi Chemical published a notice about its patent in a newspaper to ensure that the management at the customer's company would understand the nature of its patent.

The effectiveness of this tactic was subsequently demonstrated when a negotiation inquiry regarding this Taiwanese patent was received from a company, leading to an agreement on terms and the signing of a licensing contract. After the contract was signed, the company concerned issued a news release stating that the patent issue had been resolved.

Furthermore, studies were also conducted to analyze a competitor's product that had appeared on the market and to assess whether the company had been copying. In cases where it is identified that a competitor's product lies within the technical scope of a Hitachi Chemical patent, a warning notice or similar is issued to inform it of the patent and discussions are held to request that it be respected. While in some cases it has been possible to reach a resolution through measures such as licensing, Hitachi Chemical has taken a firm stand in cases where a negotiated settlement is unlikely and has not hesitated to seek a legal resolution in order to prevent those companies that do have a licensing arrangement from being put at a disadvantage. For example, Hitachi Chemical filed a lawsuit based on the Taiwanese patent for DDF against a South Korean company in an IP court in Taipei, seeking a halt to sales in Taiwan and compensation for losses[*2].

When suing overseas companies, the decision on where to file the suit involves a broad consideration of factors such as where the competitor's manufacturing and sales operations are located, which countries have a greater or a lesser tendency to rule patents invalid, trends in court judgments, ease of third-party expert testimony, and ease of demonstrating proof. Filing a lawsuit in a country other than the defendant's home country (an "away suit") is also a consideration. This is because filing in a different country places pressure on the defendant in terms of both the progress and cost of the case.

DDF from Hitachi Chemical has established a strong presence in the market and has maintained its competitiveness thanks to this aggressive business support on the patent front coinciding in a timely manner with other factors, including developments to improve the company's products and the fall in the yen.

*2 By mutual agreement between the two parties, Hitachi Chemical subsequently withdrew its patent infringement lawsuit and the South Korean company withdrew its motions to have Hitachi Chemical patents ruled invalid.

CONCLUSIONS

Hitachi Chemical started working on its IP strategy in 2000 and has since built up a record of modest successes one step at a time through a process of trial and error. As a result, this has led to active management of IP, with research and development departments and sales and operational departments being among those who have gained an appreciation of the impact of IP on business and an understanding of the use of IP in business. While Hitachi Chemical is still working to create a business environment in which customers and competitors respect its IP, this takes a long time, and it is important to continue persistently in the future with measures for increasing awareness.

While the IP strategy and tactics described in this article and the example of a B-to-B business model relate to the specific business conditions of Hitachi Chemical, which involves investing in research and development to supply materials and components that will invoke wonder in customers, the authors hope they will also be of some use to IP management at companies in other industries.

REFERENCES

(1) A. Hisano, "Patent Strategy—Theory and Know-how of Practical Patent Strategy—," Parade Inc. (Oct. 2006) in Japanese.
(2) K. Hasegawa, "Why Your Company's Patent Strategy is Unsuccessful," Chukei Publishing (Mar. 2010) in Japanese.
(3) S. Tamai, "Introduction to Intellectual Property Strategy Management—Textbook for Survival in the Knowledge Economy—," Nikkan Kogyo Shimbun Ltd. (Feb. 2011) in Japanese.
(4) G. Marushima, "Intellectual Property Strategy—How to Strengthen Your Business with Technology," Diamond (Oct. 2011) in Japanese.
(5) H. Koda, "Why Isn't the Japanese Intellectual Property Business Profitable?—The Secret Intellectual Property Strategies of America, Patent Superpower," LexisNexis Japan (Nov. 2013) in Japanese.
(6) K. Ogawa, "Open & Closed Strategy—Requirements for Rebuilding the Japanese Corporation," Shoeisha (Feb. 2014) in Japanese.

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Featured Articles

Cross-industry Deployment of Core Technology and Associated IP Management Support

—Finger Vein Authentication Technology—

Takafumi Miyatake, Dr. Eng.
Akio Nagasaka, Ph.D.
Kenji Kumakiri

OVERVIEW: Approximately 400,000 of Hitachi's finger vein authentication devices, which verify people's identity by reading and checking their finger vein patterns, are currently in operation. The technology is being adopted in Japan and overseas in the form of solutions that provide customers with safety and security in applications such as access control, banking, and IT. Hitachi leads the world in its research into finger vein authentication technology, and has published numerous papers on the subject and filed for more than 600 patent applications. Hitachi is a leader in this field of research, with total paper citations numbering more than 700. Hitachi's patents have been recognized for their quality as well as their quantity, including winning the Prize of the Minister of Education, Culture, Sports, Science and Technology at the 2007 National Commendation for Invention awards ceremony in Japan.

INTRODUCTION

BIOMETRICS technology, which identifies people from their physical characteristics, has attracted attention in recent years as an important technology for creating a safe and secure society that can provide a more reliable means of personal identification. However, past technologies based on fingerprints, irises, or faces have suffered from security problems because they worked by sensing surface features of the body, making them too easy to forge. This created a need for a new form of biometrics technology that would be difficult to forge and could be used with confidence.

Hitachi became interested in finger veins as a new form of biometric identification in 1997 and proceeded with the research and development of its own biometrics technology. This attracted attention as a new form of biometric authentication that was resistant to forgery because it uses finger vein patterns under the skin that are not visible to the naked eye. Within just a few years of the technology being commercialized, it was adopted for use in access control, banking, and information technology (IT), with a total of approximately 400,000 units currently in operation. This Japanese technology is also being deployed globally, including its adoption as an identification device for Internet banking by a major UK bank.

This article describes the research and development of finger vein authentication technology, its deployment in different industries, and Hitachi's unique initiatives for creating and exercising the associated intellectual property (IP).

HISTORY OF FINGER VEIN AUTHENTICATION TECHNOLOGY DEVELOPMENT

Hitachi first embarked on research into this field based on the expectation that the primary means of making payments would shift from the automated teller machine (ATM) to Internet banking. Discussions on this subject concluded that Internet banking would require a safe and reliable form of personal identification, and Hitachi therefore embarked on basic research into finger veins as a new biometric marker that could be used for authentication. The interest in fingers for this purpose was prompted by the expectation that the technology would be used in offices or on the personal desktop. It was anticipated that using fingers would enable future authentication devices to be made smaller and easier to use.

Research and development commenced in 1997 and proceeded through the four stages of basic research,

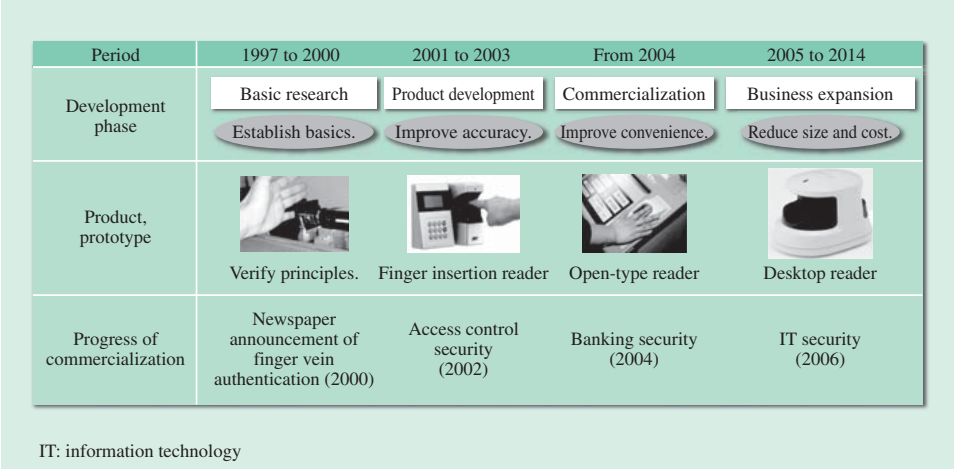

Fig. 1—Development History of Finger Vein Authentication Technology.
Research and development into the use of finger veins as a new form of biometric identification commenced in 1997 and proceeded through the four stages of basic research, product development, commercialization, and business expansion. The core technology has since been utilized in various businesses, including access control, banking, and IT.

product development, commercialization, and business expansion. As it worked through each phase, Hitachi encountered new problems and encouraged the growth of the business by preemptively solving them. Commercialization commenced in 2002 with access control applications, followed by deployment in the banking and information technology (IT) sectors. The sequence of deployment was also the sequence in which societal needs arose. Use in Internet banking, the objective of initial research, came in 2014 when the technology was adopted in the UK, with a plan to roll it out progressively to corporate customers from 2015 onward[(1)]. This sequence can be understood by thinking of this as an application that arises out of the fusion of banking and IT (see Fig. 1).

This deployment across multiple industries requires robust core technology[*1] that supports a broad range of businesses. The solutions to specific problems that arose during the product development, commercialization, or other phases for particular business sectors have been incorporated into the core technology for Hitachi's finger vein authentication technology. In this way, Hitachi is able to provide cross-industry support to a wide variety of businesses extending from access control to banking and IT by making ongoing enhancements to the core technology, not just in the basic research phase.

Basic Principles

Finger vein authentication technology identifies individuals by utilizing the fact that the patterns formed by the large number of veins that run through people's fingers vary from person to person. To achieve this, Hitachi proposed using a finger vein imaging technology that can obtain clear images of finger veins by passing near-infrared light through the finger in an appropriate way to obtain reliable images of subcutaneous finger veins that are not visible to the naked eye. While near-infrared light with wavelengths of between 700 and 1,200 nm can pass easily through biological tissue, it is strongly absorbed by the hemoglobin in the blood that flows in veins. Hitachi developed an imaging technology that takes advantage of this difference in properties to clearly highlight veins as dark lines.

Next, to ensure that the imaged veins could be compared with precision, despite variations in blood vessel width or the angle of placement of the finger, Hitachi devised a high-performance pattern matching technique that could extract the central shape features

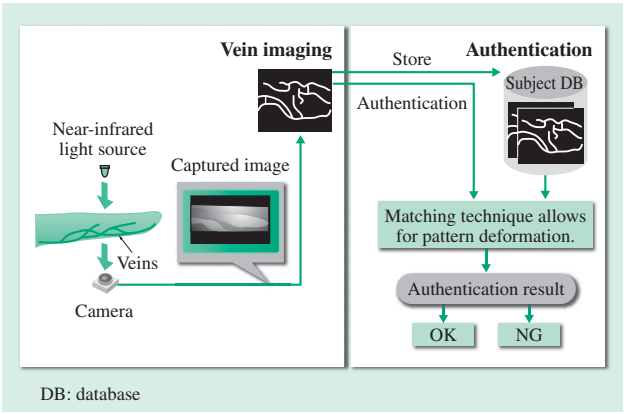

Fig. 2—Basic Principles of Finger Vein Authentication.
Finger vein authentication works by shining near-infrared light through a subject's finger to obtain an image of the internal vein pattern, and then matching this pattern against their pattern on file to confirm their identity. Because it uses a biological characteristic that is not visible to the naked eye, forgery is extremely difficult.

*1 Technology that provides the basis for a variety of applications.

of the veins and allow for deformations in their shape, and thereby achieved world-leading authentication accuracy (see Fig. 2).

The technology is being adopted for applications such as access control to important facilities and IT security that protects important information.

Open-type Authentication Method

This research included not only achieving a high level of accuracy but also the development of a technique that would be easy for anyone to use. The transmitted-light imaging technology for veins described above plays an important part in acquiring clear vein patterns with high contrast[(2)] to achieve highly accurate authentication. Transmitted-light imaging is typically performed by placing the object to be imaged between a light source and a camera, with the result that the light source obscures the space above the finger. To reduce psychological aversion and smooth the process of the user placing their finger in the authentication device, the light source is positioned on the left and right sides of the finger leaving the top open. Transmitted-light imaging can still be performed with this configuration because the light shone on the finger is scattered in all directions and therefore reaches the camera. However, because this arrangement of light sources results in the light being brighter closer to the light source, making it difficult to acquire vein images, the system alternately captures two images each illuminated from one side only and then combines the two halves where the light level is appropriate to obtain the image to use for authentication. In this way, the system achieves both the accuracy of the transmitted-light method and the ease of use that comes from having the user simply place their finger on the reader (see Fig. 3).

For financial institutions that demand high security and the ability to work with a wide variety of customers, the technology is being adopted as a key technique for personal bank deposit protection, and it has become the de facto standard in Japan with finger vein authentication being the choice of approximately 80% of financial institutions that use biometric authentication.

Benefits of Research and Development

In 2006, Hitachi contracted the International Biometric Group (IBG) to assess its authentication accuracy. IBG is a third-party assessment agency for biometric authentication in the USA. The assessment gave the finger vein authentication technology a level 3 rating, at that time the highest rank for any biometric authentication technology anywhere in the world. In addition to low levels for false rejection rate[*2] and false acceptance rate[*3], the failure to enroll rate[*4] in particular is an order of magnitude lower than fingerprint and iris technologies[(3)].

Hitachi has published a large number of papers on finger vein authentication technology in Japan and overseas since 2000[(2), (4)–(15)]. A review of data using Google Scholar[*5], an academic search service provided by Google Inc., found more than 700 citations for the papers. The most commonly cited paper[(7)] had 323 citations, placing it at the head of its field (see Fig. 4).

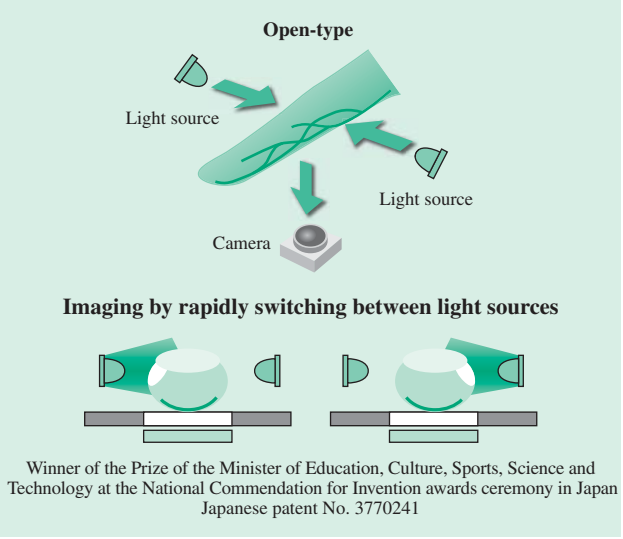

Fig. 3—Open-type Authentication Method.
While transmitted light imaging has in the past required the finger to be placed between the light source and camera, the open-type authentication method positions light sources on the left and right of the finger and captures two images by illuminating each side in turn. This enables a sharp finger vein image to be obtained by merging these two images, meaning that authentication can be performed simply by having the subject place their finger on the reader.

CROSS-INDUSTRY DEPLOYMENT OF FINGER VEIN AUTHENTICATION TECHNOLOGY

Cross-industry Deployment Based on Societal Needs

Hitachi's security business is expanding in accordance with the sequence in which societal needs emerge. The

*2 Proportion of instances in which the system erroneously rejects a person.
*3 Proportion of instances in which the system erroneously accepts a person.
*4 Proportion of people whose biometric information is not accepted by the system.
*5 Google and Google Scholar are trademarks or registered trademarks of Google Inc.

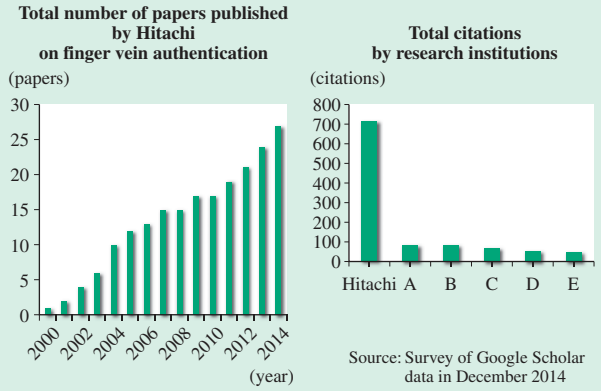

Fig. 4—Number of Papers Published and Total Number of Citations.
Hitachi has published more than 25 papers on finger vein authentication technology since 2000. Hitachi leads this field of research, with top place in the total number of citations for each research institution for the top 10 ranking most-cited papers (more than 700 citations).

Year	Application		Year	Application	
2002		Access control	2010		Multi-function printers
2004		ATM	2012		Mobile devices
2006		PC	2014		Internet banking
2008		Access control	(research currently in progress)		Gates

ATM: automated teller machine PC: personal computer

Fig. 5—Product Development History.
Hitachi has contributed to the cross-industry deployment of core technologies, commencing product development in 2002, and having developed more than 30 products to date in the fields of access control, banking, and IT.

development of its business is proceeding as it strives to be the fastest to provide solutions when societal problems arise.

(1) Access control security

The 9/11 terrorist attacks in the USA in 2001 have led to greater concern about preventing unauthorized access to important facilities such as airports. Hitachi responded to this by releasing an access control product in 2002.

(2) Bank security

In 2003, increased incidents of forged cash cards being used for unauthorized withdrawals from ATMs had created a need for ways to prevent this activity. In response, Hitachi announced an ATM with biometric authentication in 2004 and commenced shipments in the following year.

(3) IT security

In 2005, an increasing frequency of data leaks had raised concerns about companies' internal controls. In response, Hitachi released a small, low-cost device in 2006 suitable for personal desktop use.

As these examples show, products were developed separately by specialist business divisions to offer rapid solutions for businesses that specialize in different areas.

Product Development

The applications used by customers in security businesses such as access control, banking, and IT vary widely. They each differ in terms of things like size, speed, accuracy, ease-of-use, cost, and interfaces. This diversity extends from requirements that can be handled by design changes to those that require new research and development.

As a result, Hitachi developed more than 30 products from 2002 to 2014. These included devices for access control, ATMs, personal computers (PCs), multi-function printers, mobile devices, and Internet banking. For the future, research and development is currently in progress on a high-throughput gate system that can authenticate people as they walk through (see Fig. 5).

MEASURES FOR CREATING AND USING IP

Building a Strong Patent Portfolio

Patent applications for finger vein authentication have been made with respect to underlying core technologies by Hitachi, Ltd., to which the research laboratories belong, and, with respect to the distinctive technologies for specific products, by the companies to which the business divisions that developed the technologies belong (including both Hitachi, Ltd. and other group companies) as part of its research and development. During the basic research and product development phases in which the research laboratories played a central role, a large number of basic patents were created by preemptively identifying requirements, including but not limited to technical challenges, through actions such as having researchers visit customers to obtain information about their diverse requirements by demonstrating prototypes. Since around 2004 when firm orders were obtained, technologies developed in-house by business divisions

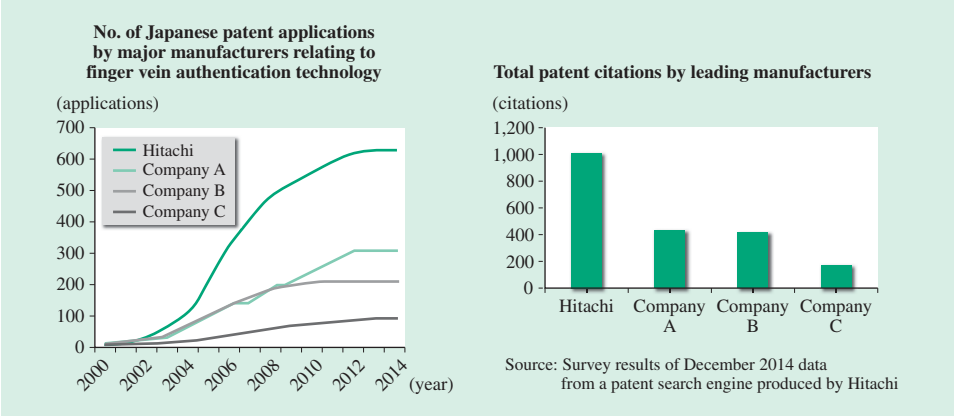

Fig. 6—Japanese Patent Applications and Total Number of Citations.
Hitachi has filed more than 600 patent applications for finger vein authentication, the most of any major manufacturer. It is building a high-impact patent portfolio, and is at the top of the total number of patent citations (more than 1,000).

as well as research laboratories began to emerge and patent applications started to be filed. In particular, a project to create finger vein patents was undertaken in 2005 by the research laboratories, business divisions, and Intellectual Property Division to build a robust patent portfolio by expanding the range of peripheral patents covering not only core technology but also applied technologies. This project exceeded its target by creating more than its target of 40 peripheral patents.

Through these activities, Hitachi has filed more than 600 Japanese patent applications to date. According to a survey by patent search engine produced by Hitachi, the total number of citations of Hitachi patents exceeds 1,000 (see Fig. 6).

The number of citations for a patent indicates how many times it has been cited in a notice of rejection. Accordingly, the high number of citations indicates that closely related inventions continue to be created, and that it is a fundamental and high-impact patent. Patents with a high number of citations tend to be created during the basic research and product development phases.

The most-cited patent, that for the "open-type authentication method" (Japanese patent No. 3770241)[16], has been cited 42 times. It received the 2007 Prize of the Minister of Education, Culture, Sports, Science and Technology at the National Commendation for Invention awards ceremony, hosted by the Japan Institute of Invention and Innovation (JIII).

As this demonstrates, Hitachi has built up a strong patent portfolio that surpasses that of other companies by conducting research and development ahead of them and by pursuing strategic patent activities.

Establishment of Hitachi Group Patent Pool System

As explained above, the patent portfolio for finger vein authentication technology was built up through patent applications relating to the core technologies developed primarily by the research laboratories in addition to applications relating to the distinctive technologies that differ between products developed primarily by each business division. Accordingly, what is needed is a centralized way of managing patents relating to finger vein authentication technology that utilizes them as "One Hitachi."

To achieve this objective, Hitachi established the "Hitachi Group patent pool system" for finger vein authentication technology in 2007. This patent pool system has a large membership made up of the Hitachi research laboratories and business divisions that develop and use finger vein authentication technology.

This Hitachi Group patent pool system provides mechanisms for the collation and centralized management of important patents held by its members, which it designates as "pool patents" (see Fig. 7). Hitachi has also established a framework for holding regular meetings of pool system members to share information on new developments relating to such things as the status of pool patents and business within Hitachi.

Furthermore, a secondary function of the Hitachi Group patent pool system is to provide a forum for the sharing of information about core technologies. This enhances management efficiency by minimizing the duplication of activities such as research or development by business divisions that operate in different industries.

Use of Hitachi Group Patent Pool System for Patent Management

This section describes examples of how the Hitachi Group patent pool system is used to utilize patents relating to finger vein authentication as "One Hitachi."

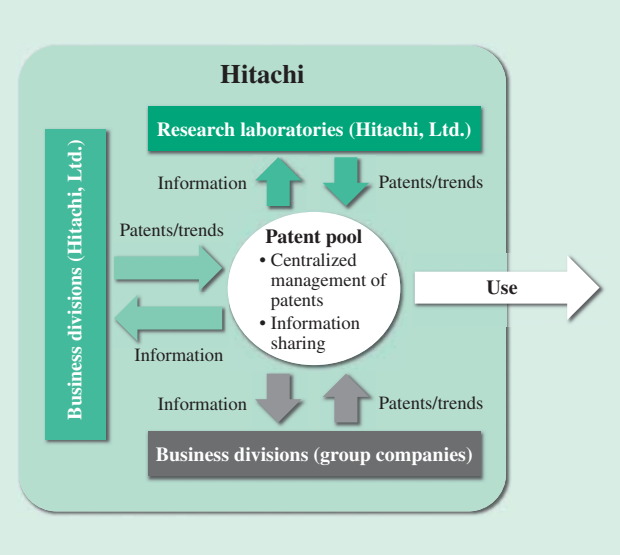

Fig. 7—Overview of Patent Pool System.
This is Hitachi's own scheme for the centralized management of the finger vein authentication patents belonging to research laboratories and business divisions and their use as "One Hitachi."

Aid to Establishing Collaborations with Partners

In October 2009, Sagem Sécurité of France (since renamed Morpho SAS) and Hitachi jointly developed a multi-modal biometric authentication device that combines fingerprint and finger vein authentication[17]. Hitachi had been considering multi-modal biometric authentication devices that incorporate other forms of biometric authentication since its initial research and development, and had already filed patent applications[18]. Those patents became the underlying support for the realization of this joint development. The collaboration targeted a wide variety of applications, such as access control, ATMs, and mobile devices, using IPs belonging to a number of business divisions, and produced joint research outcomes that were relevant to the businesses of a number of departments. Accordingly, the members of the patent pool system played a central role in gathering the views of the relevant business divisions, setting out the best possible joint research plan from a "One Hitachi" perspective, and proceeding with the collaboration with Sagem.

Informing Customers and Competitors about Patents

Utilizing the advantages provided by Hitachi's patent portfolio for finger vein authentication technology, Hitachi posted material that actively promoted the patent portfolio on a website with the aim of assisting its business activities[19].

The primary aim of this material was to promote Hitachi's technical capabilities to customers by presenting its patent technology in a form that would be easy to understand.

This involved first selecting five promotional features for enhancing the brand image of Hitachi's finger vein authentication technology, namely its, (1) accuracy, (2) easy-to-use design, (3) reliability, (4) speed and safety, and (5) ability to accommodate a variety of fingers.

In making the selection, Hitachi first asked customers for their views and collated the in-house development concepts it deemed important. Next, Hitachi analyzed patent information for trends in research and development by other companies to identify which development concepts were deemed important by competitors. These two sets of development concepts were then compared and those that appeared in both lists were deemed to have strong appeal and were selected as the five promotional features listed above.

Next, based on information obtained from consultations with customers and sales staff from the relevant business divisions, those patents that were expected to appeal most to customers were selected from among the patents that underpinned the promotional features. The patent numbers were included in promotional material and the patent technology descriptions were worked on to make them easy for customers to understand.

The selected patents were all fundamental and high-impact patents that placed high in the rankings for number of citations. Accordingly, it was anticipated that the promotional material would also be highly effective as a restraint on competitors.

In keeping with the global operation of the business, the promotional material was also translated into English and Chinese and utilized in sales.

CONCLUSIONS

This article has described the research and development of finger vein authentication technology, the deployment of core technologies in different industries, and Hitachi's initiatives for creating and exercising the associated IP.

The Hitachi Group patent pool system played an essential role in deploying core technologies in different industries. Although it was adopted as a centralized way of managing the invention of core technologies, it also proved effective at encouraging

information sharing among research laboratories and business divisions, and helped improve management efficiency through such benefits as preventing the duplication of research and development and sharing promotional material.

In the future, Hitachi intends to proceed with research and development to supply security solutions that contribute to the safety and security of society.

REFERENCES

(1) "Barclays First in UK to Launch New Biometric Reader for Customers, Hitachi's Finger Vein Authentication Technology Set to Revolutionise Account Security in UK Banking," Hitachi News Release (Sep. 2014), http://www.hitachi.com/New/cnews/month/2014/09/140905.html

(2) T. Miyatake, "Personal Identification Using Vein Pattern," Kogaku **33**, pp. 23–27 (2004) in Japanese.

(3) IBG, "Comparative Biometric Testing Round 6 Public Report," (Sep. 2006), http://www.nws-sa.com/biometrics/CBT6_public_report.pdf

(4) M. Kono and S. Umemura, "Use of Finger Vein Patterns for Personal Identification," The Society of Instrument and Control Engineers (Oct. 2000) in Japanese.

(5) N. Miura, A. Nagasaka, and T. Miyatake, "An Extraction of Finger Vein Patterns Based on Multipoint Iterative Line Tracing," The Institute of Electronics, Information and Communication Engineers (Mar. 2001) in Japanese.

(6) M. Kono, H. Ueki, and S. Umemura, "Near-infrared Finger Vein Patterns for Personal Identification," Applied Optics (Dec. 2002).

(7) N. Miura, A. Nagasaka, and T. Miyatake, "Feature Extraction of Finger-vein Patterns Based on Repeated Line Tracking and its Application to Personal Identification," Machine Vision and Applications (Jul. 2004).

(8) T. Miyatake and A. Nagasaka, "Finger Vein Authentication Technology," Jidosha Gijutsu **59**, pp. 33–38 (2005) in Japanese.

(9) J. Hashimoto, "Finger Vein Authentication Technology and Its Future," VLSI Circuits (June 2006).

(10) N. Miura, A. Nagasaka, and T. Miyatake, "Extraction of Finger-vein Patterns Using Maximum Curvature Points in Image Profiles," The Institute of Electronics, Information and Communication Engineers (Aug. 2007).

(11) M. Akabane et al., "Latest Trend of Finger Vein Authentication Solutions," Hitachi Hyoron **91**, pp. 912–917 (Dec. 2009) in Japanese.

(12) N. Miura and Y. Sato, "Removal of Blurring from Vein Images and Estimation of Vein Depth Using Near-infrared Images Obtained with Dual-wavelength Light Source," MIRU2011 (July 2011) in Japanese.

(13) Y. Matsuda et al., "Feature Extraction from Finger Vein Images Using Brightness Curvature," MIRU2011 (July 2011) in Japanese.

(14) H. Kiyomizu et al., "Method for Assessing Finger Identification Reliability in Finger Vein Authentication," DICOMO2012 (Jul. 2012) in Japanese.

(15) N. Miura et al., "Multi-layer Biometric Authentication Based on Use of Multiple-wavelength Light to Measure Skin Layers," The Institute of Electronics, Information and Communication Engineers (Nov. 2014) in Japanese.

(16) A. Nagasaka et al., "Personal Identification Apparatus and Personal Identification Method," Japanese Patent No. 3770241 in Japanese.

(17) "Sagem Sécurité and Hitachi Unveil Multi-modal Finger Vein and Fingerprint Device," Hitachi News Release (Oct. 2009), http://www.hitachi.com/New/cnews/091019a.html

(18) N. Miura et al., "Personal Identification System and Apparatus," Japanese Patent No. 4555561 in Japanese.

(19) "Hitachi's Finger Vein Authentication Technology," http://www.hitachi.co.jp/products/it/veinid/tec/pdf/fv_patent2012.pdf in Japanese.

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Featured Articles

Changing Nature of IP Management for IT Platform Business

Akinobu Shimada
Akira Yamamoto, Dr. Eng.
Shigeyuki Sudo
Naoki Takahashi
Haruka Suzuki

OVERVIEW: Hitachi's IT platform business has been based on an export business model in which storage equipment was developed in Japan and exported. To support this business, it has pursued an IP strategy involving rigorous patent portfolio management based on patent benchmarking against competing American companies. Subsequently, however, with the ongoing globalization of IT platform research and development, and with Hitachi pursuing its Social Innovation Business globally in the future, the need has arisen to operate the business as "One Hitachi" in a way that transcends departmental and national borders, and to develop new strategies in IP management as well.

INTRODUCTION

THE information technology (IT) platform business, which focuses on servers and storage, started out with an export-based business model of exporting products that were developed in Japan. The subsequent establishment of overseas research and development centers led to an increasing number of products being developed overseas. The business is now part of Hitachi's Social Innovation Business, where it is proceeding with the utilization of such IT technologies as big data analytics.

Along with this shift in business strategy, the intellectual property (IP) strategy has also undergone major changes. This article describes how the IP strategy that supports the export-based business model arose and how it has been implemented, as well as how this IP strategy has changed in tandem with subsequent changes in business strategy.

HISTORY OF IT PLATFORM BUSINESS

Establishment of Export-based Business Model

The starting point for Hitachi's IT platform business was the establishment in 1937 of Totsuka Works for the manufacture of telephones and switching equipment. Kanagawa Works opened in 1962 to manufacture mainframes and, in 1989, together with the Electronic Data Systems Corporation, Hitachi Data Systems Corporation was established in the USA to provide overseas sales offices for the overseas expansion of the mainframes business. Production of redundant array of inexpensive disks (RAID) storage products commenced in 1995, and Hitachi completed a full buyout of Hitachi Data Systems stock in 1999 to encourage storage sales in North America (see Fig. 1)[1].

With the USA becoming its key market, the storage business succeeded with the export-based business model of exporting products developed in Japan, including reaching fourth place internationally by market share in 2001 (see Fig. 2)[2].

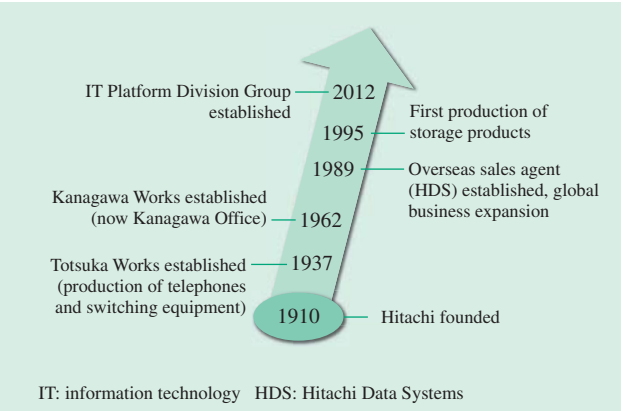


Fig. 1—History of IT Platform Business.
Hitachi's IT platform business started in 1937 with the opening of Totsuka Works. The business now focuses on the sale of storage products.

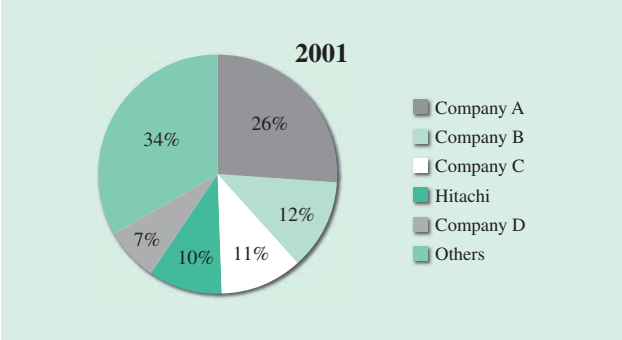


Fig. 2—Market Share of External RAID Vendors (Worldwide). Hitachi expanded its market share, reaching number four in market share in 2001.

Emergence of IP Risk

While Hitachi's sales grew from 2000 to 2001, sales at the largest company in the storage market fell, shrinking from approximately five times to approximately double Hitachi's sales, as shown in Fig. 3. However, whereas the number of storage-related US patents filed by this company grew year on year, the number of Hitachi patent filings fell to approximately one-sixth of its competitor's, creating an imbalance between the two companies' patent positions in terms of patent quantity (see Fig. 3).

This led the competitor, in 2002, to file a lawsuit with the United States International Trade Commission and U.S. District Court alleging six patent infringements by Hitachi. Although a settlement was ultimately reached, the lawsuit demonstrated the storage business's exposure to IP risk in the USA and led to a fundamental reappraisal by Hitachi of its IP strategy.

IP Management in Support of Export Business

A special project was launched in 2003 to ensure business continuity by reducing IP risk. Through this special project, business divisions, research laboratories, and the IP department worked together to implement both an aggressive strategy of building up a patent portfolio that could outdo other companies in terms of both quantity and quality, and a defensive strategy of rigorous "patent clearance" (confirming that products do not infringe on other companies' patents).

The aggressive strategy involved setting a target of 300 patent applications annually in the USA in order to increase the number of US patent registrations relating to storage to 1.5 times the number estimated to be held by Hitachi's largest competitor in the storage market at that time. It also involved improving patent quality by ranking each application by the quality of the invention and using this as a basis for selecting the countries in which to file patent applications and how to go about acquiring rights.

To acquire a larger number of US patents in a short time, Hitachi also looked at ways of shortening the time taken from filing an application until acquiring the rights.

First, the capability was established to manage each patent application individually and to provide thorough follow-up if a delay arose in the standard process so that the IP department would be able to complete a US patent application within 100 days of receiving the application request.

Then, accelerated examination was adopted for all applications in the USA to shorten the time taken

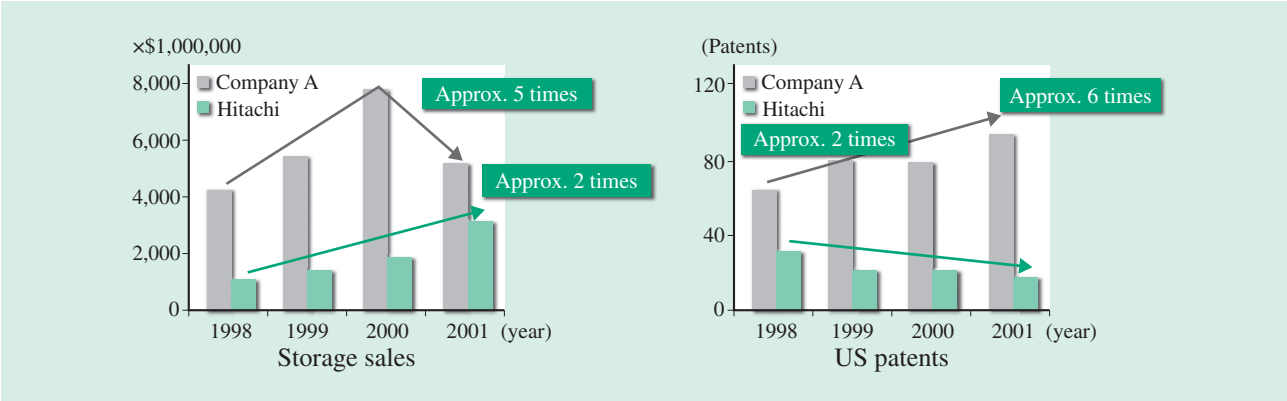


Fig. 3—Comparison of Hitachi and Company A.
Sales by a competitor ("Company A"), which were approximately five times those of Hitachi in 2000, had shrunk to only double Hitachi's sales in 2001 (see the left-hand graph, based on the company's annual report). Meanwhile, the number of storage-related US patents held by the company rose from approximately double the number held by Hitachi in 1998 to approximately six times as many in 2001 (see the right-hand graph, based on research by Hitachi using the United States Patent and Trademark Office).

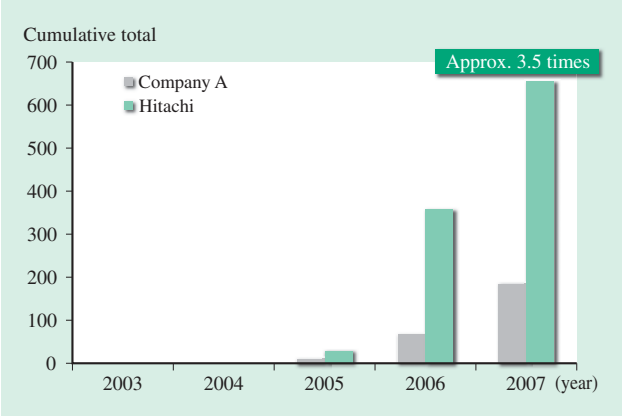


Fig. 4—Trend in Number of US Patent Registrations by Hitachi and Competitor.
Work by a special project succeeded in increasing the number of US patent registrations relating to storage for applications made by Hitachi after 2003 to approximately 3.5 times that of its major competitor ("Company A") (based on research by Hitachi using the United States Patent and Trademark Office).

from filing an application until acquiring the patent rights. This succeeded in shortening the examination period by one year. The opportunity was also taken to give technical lectures to the US patent examiners who assessed patent applications to ensure that patent examinations would be conducted properly and quickly by improving their technical understanding.

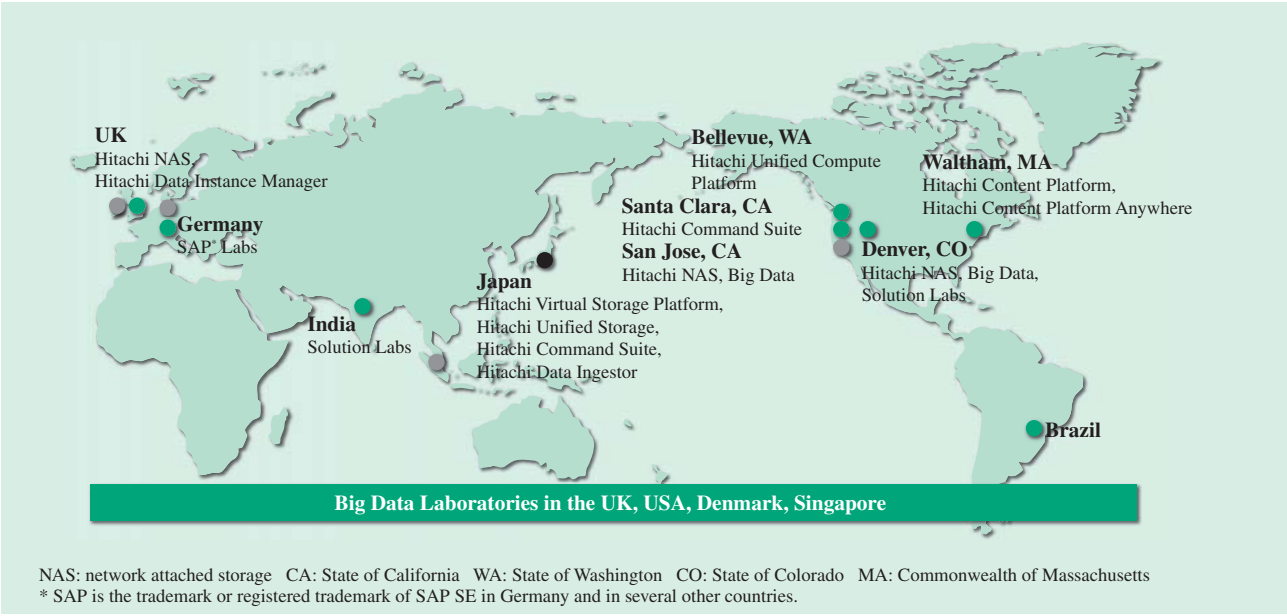
As a result of the special project, the total number of US patent registrations relating to storage reached approximately 3.5 times that of the competitor company in 2007 (cumulative total filed from 2003 onward) (see Fig. 4).

In this way, the special project conducted patent benchmarking against competitors with regard to storage products, and established an IP management plan that included targets for number of filings and plans for acquiring rights and conducting clearance. This IP management plan is implemented by the business divisions, research laboratories, and IP department in Japan working closely together, and has contributed to the continuity of the storage business.

IT PLATFORM BUSINESS GLOBALIZATION AND IP MANAGEMENT

IT Platform Business Globalization

Around 2007, Hitachi Data Systems began actively seeking to acquire companies to expand its data content services that support the management and storage of data. In 2007, for example, it acquired Archivas, Inc. based in Waltham, Massachusetts to expand its content management services[3]. In 2011, amid rapid increases in the quantity of data, primarily content data, being handled by companies, it acquired BlueArc Corporation based in the UK to enhance its competitiveness in terms of file storage devices for managing content data[4]. Hitachi also commenced development in the USA of the Hitachi Unified



NAS: network attached storage CA: State of California WA: State of Washington CO: State of Colorado MA: Commonwealth of Massachusetts
* SAP is the trademark or registered trademark of SAP SE in Germany and in several other countries.

Fig. 5—Global Research and Development Centers and Products Developed at each Center.
To support its global business operations, Hitachi has increased the number of its research and development centers outside Japan. The green dots represent development centers and the grey dots represent research centers.

Compute Platform to encourage the use of converged platforms for servers and storage, and established a Big Data Laboratory to serve as a research center in the USA in 2013 (see Fig. 5).

IP Management in Support of Global Business Activity

Hitachi also manages patent portfolios for each product, filing applications with reference to assessments, based on product strategy, of the importance of each of the inventions that result from the research and development conducted at these companies acquired by Hitachi Data Systems or at Big Data Laboratories. For file storage and content management products, for example, Hitachi conducts patent benchmarking against competing products and formulates and implements IP management plans that include targets for number of filings and plans for acquiring rights for each product.

As a result of this IP management performed in the USA and other countries outside Japan, the number of patents for inventions created overseas is rising steadily year-on-year, and the patent portfolios for each of the products handled by Hitachi Data Systems, together with the patent portfolios built up in Japan, support the global deployment of these products. Based on its patent portfolios, Hitachi also publishes information about patents that cover its products through websites and other media (see Fig. 6)[5]. Hitachi Data Systems also helps promote Hitachi's technical capabilities by including patent information in messages and other external communications.

Fig. 6—Patent Web Page for Hitachi's IT Platform Business. The web page presents information about patent topics such as the patents that cover technologies used in products and the size of the patent portfolio for each technology, in Japanese and English.

USE OF IT IN SOCIAL INNOVATION BUSINESS AND ASSOCIATED IP MANAGEMENT

Use of IT in Social Innovation Business

Hitachi currently operates its Social Innovation Business globally, supplying safe and secure social infrastructure that is enhanced by IT. Pursuing this business requires Hitachi to use big data analytics that utilizes IT to solve the problems facing society and its customers.

For example, the shale oil and gas development business needs to reduce its development costs. In response, Hitachi is planning an oil and gas service to support oil field development by collecting information about oil field locations, environmental regulations, and geology in the cloud (infrastructure), performing data searches on the cloud (content), and conducting analyses (information) (see Fig. 7)[6].

Future IP Management

As Hitachi shifts direction to focus on its Social Innovation Business, which uses IT, IP management faces major challenges.

The first challenge is to have a greater local focus. The Social Innovation Business involves Hitachi undertaking proof of concept (PoC) projects with customers based on an understanding of their problems and collaborating with them on solutions. In light of the fact that PoC projects are undertaken together with customers in different parts of the world, it is important to provide IP support for undertaking collaborative creation with customers as close as possible to the site where the PoC project was conducted. Accordingly, there is a shift away from Japan-focused IP management toward having the sites where collaborative creation takes place take the lead in IP management. In other words, having a greater local focus will be a challenge for the future. In the case of the oil and gas service described above, for example, solution development is largely being undertaken in the USA. Accordingly, Hitachi has adopted an organizational structure in which the US IP office also takes the lead in formulating and implementing IP strategy.

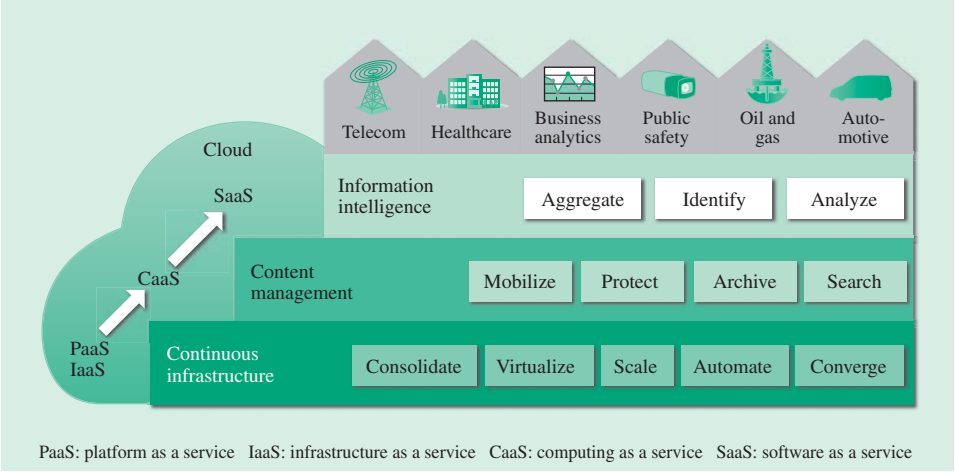


Fig. 7—Use of IT in Social Innovation Business.
The utilization of big data analytics through the use of IT is essential to Hitachi's pursuit of its Social Innovation Business.

The second challenge is the need for IP management to transcend departmental and national borders. Looked at in terms of IT, delivering a solution demands that development be undertaken on a "One Hitachi" basis that transcends departmental and national borders, requiring vertically integrated development that combines things like IT infrastructure technologies such as servers and storage, content management technologies such as search and data protection, and information intelligence technologies such as collation and analysis. Accordingly rather than formulating and implementing IP strategies for each product as in the past, it is important to implement IP strategies that promote partnerships with customers and transcend inter-departmental borders between the customer-facing departments and the departments that develop the IT infrastructure and other core technologies, content management technologies, and information intelligence technologies. Because the relevant departments are spread across the USA, Japan, and the rest of the world, there is also a need for a deepening of global IP management that transcends national borders. Accordingly, as a first step in that direction, Hitachi is seeking to share its IP strategies for the IT sector by having Hitachi Data Systems staff attend the IP strategy conferences that in the past have been held by the Information & Telecommunication Systems Company at Hitachi, Ltd.

CONCLUSIONS

In the past, Hitachi's IT platform business has adopted an IP strategy that involves rigorous management of patent portfolios for each product based on patent benchmarking against competitors to support an export-based business model.

Now that the Social Innovation Business is operated globally, however, there is a need to change IP strategy also. In the future, in addition to implementing IP strategies that use IP to encourage partnerships from sites close to the customer in order to support collaborative creation of solutions with customers by customer-facing departments, Hitachi will also promote the sharing of IP strategies between relevant departments to support solution businesses operating as "One Hitachi" that transcend departmental and national borders.

REFERENCES

(1) IT Platform Division Group pamphlet (Jul. 2014) in Japanese.
(2) "Worldwide Disk Storage Systems Forecast and Analysis," IDC, 2002-2006, #28261 (Dec. 2002).
(3) "Hitachi Data Systems to Acquire Content Archiving Leader Archivas, Inc.," Hitachi Data Systems News Release (Feb. 2007), http://www.hds.com/corporate/press-analyst-center/press-releases/2007/gl070206.html
(4) "Hitachi Data Systems Announces Acquisition of BlueArc," Hitachi News Release (Sep. 2011), http://www.hitachi.com/New/cnews/110908.html
(5) "IT Platform Patent Information," Patent web page for Hitachi IT platforms, http://www.hitachi.co.jp/products/it/unified/patent_en/index.html
(6) H. Abdessamad, "Thriving in the New Digital Era: Transforming Ourselves, Transforming the Industry."

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Featured Articles

Trends in Design and Associated IP Management

Atsushi Katayama
Masayuki Ohki
Tatsuya Tokunaga
Yukinobu Maruyama
Masashi Tsukamoto
Yumiko Tanuma
Kazuya Narahashi

OVERVIEW: Hitachi's involvement with design and IP can be thought of as evolving through three different phases: (1) an era of equipment design, aimed primarily at home appliances; (2) an era of information design, based on IT devices, systems, and interfaces; and (3) an era of social services and solutions, and of innovation. The scope of design expanded through each of these eras, leading to ongoing changes in the nature of IP management. In the era of equipment design, IP management was primarily concerned with using design patent rights to protect the externally visible features of products, whereas in the era of information design, the focus was on protecting product designs using patent rights as well as design patent rights. The era of services, solutions, and innovation was also a time of "collaborative creation with customers," meaning working in cooperation with customer companies to create ideas, with important considerations being the development of new design techniques for this purpose and the protection of rights. This article describes representative examples of IP strategies adopted to deal with this expansion in the scope of design.

INTRODUCTION

FROM when it was first established in 1957 to the 1980s, intellectual property (IP) management at the Design Division*, Hitachi, Ltd. (see Fig. 1) was primarily concerned with using design patent rights to protect the externally visible features of home appliances and other consumer products and equipment.

Subsequently, as products became more varied to satisfy increasingly diverse user needs, enhancements to usability and functionality became important product features, and an effective IP strategy was one that helped maintain product competitiveness by using patent rights to protect the designs that provide ease-of-use. Accordingly, the Design Division has been working with the Intellectual Property Division from a comparatively early stage on ways of using patent rights to protect designs.

* Department name as of March 2015.

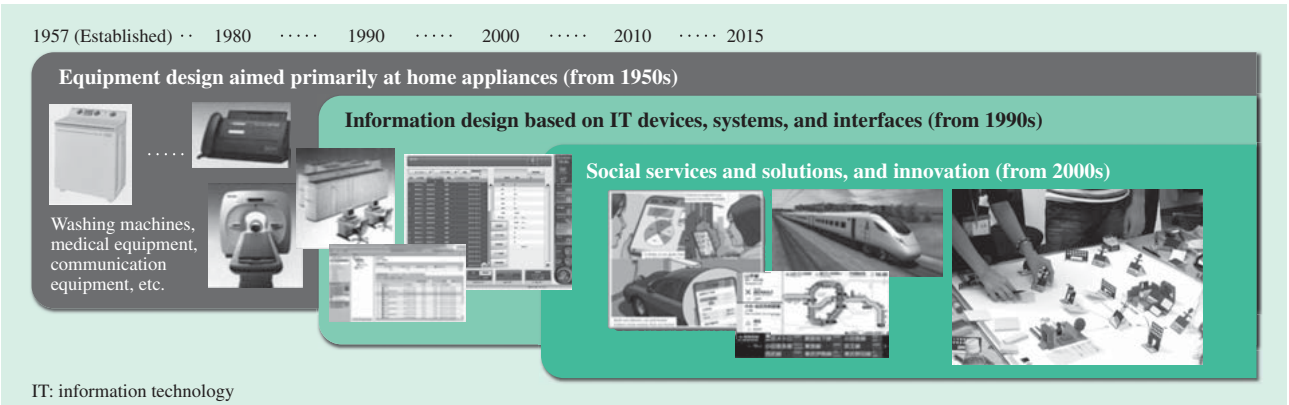

Fig. 1—Trends in Design.
Hitachi's involvement with design and intellectual property (IP) can be broadly divided into three different phases, with the scope of design increasing over time.

With the rapid spread of information technology (IT) since the mid-1990s, Hitachi has been strengthening its usability designs for things like enabling the intuitive interpretation of operation screens or improving their intelligibility, and for its interactive designs that seek to provide bi-directionality in the operation interface between humans and machines. For these "information designs," Hitachi has adopted a strategy that combines design patent rights and patent rights, with design patent rights used to protect graphics and patent rights used to protect things like screen transitions and data structure concepts.

Since the mid-2000s, the scope of design has expanded to encompass the subjective values that users perceive through products and services[(1), (2)], with the development of proprietary design methodologies for use in product development. In recent years, in relation to the services and solutions or product developments of Hitachi's Social Innovation Business, it has also become necessary to promote these design methodologies both inside and outside the company. Accordingly a shift is underway in IP strategy away from having the protection of designs from competitors as its primary consideration and toward strategies that promote Hitachi's design methodologies to customers.

IP STRATEGY FOR ERA OF HOME APPLIANCES AND OTHER EQUIPMENT DESIGN

The focus of IP management during this era was the use of design patent rights to protect the external design of home appliances such as refrigerators, washing machines, and televisions (see Fig. 2, Japanese design registration No. 324027 and others). A feature of the strategy for applying for design patent rights was that it made active use of the similar design registration system to obtain rights in the form of "principal designs" for the designs used in product development, and as "similar designs" for associated peripheral designs and partial model upgrades. In addition to providing broad-based protection for Hitachi designs, this practice involved a strategy for preventing competitors from copying equipment designs through measures such as issuing warnings based on design patent rights. For a considerable period of time, this practice remained the main way in which design patent rights were used to protect designs.

In the 1980s, based on a background of increasing diversity and sophistication in product functions and the intensification of competition between companies, the challenges for product design were to achieve better operation and excellent usability while still holding down development costs. In the case of home appliances in particular, numerous ideas were investigated for promoting routine ease-of-use in clearly intelligible terms. Measures relating to the structural design of products were particularly effective for this.

Fig. 3 shows a vacuum cleaner suction head developed with a focus on usability. A problem with previous vacuum cleaner heads was that they were not good at cleaning along walls or confined spaces because of their very limited horizontal turning angle.

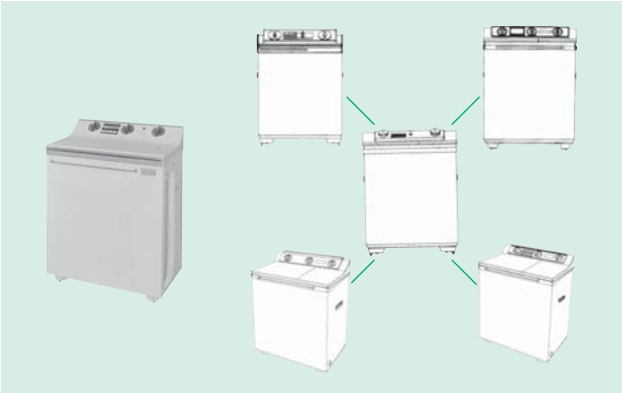

Fig. 2—Best-selling Washing Machine (Dual-tank) and Associated Portfolio of Design Patent Rights.
Hitachi utilized the similar design registration system to obtain rights to associated designs as well as the product design.

Fig. 3—Multi-angle Head.
The vacuum cleaner became a hit product thanks to a suction head that rotates in response to twisting the hose grip.

In response, Hitachi devised a mechanism that could turn the head 180° to the left or right by twisting the cleaner hose's handgrip, thereby making it easy to orient the head for cleaning along walls or in confined spaces.

Fig. 4 shows the ingenious design for the joint between the head and hose that enables the head to rotate 180° to the left or right with ease. This resulted in the "multi-angle head," with this movement being the core product concept.

Hitachi adopted an IP strategy for the idea behind the multi-angle head that used design patent rights to protect its external design and patent rights to protect the head mechanism. This provided multi-faceted protection for the product and discouraged copying by competitors (Japanese patent No. 2963413 and Japanese design registration No. 1026499).

Hitachi has continued applying for patents as it has made further product enhancements. Hitachi has acquired approximately 50 design patent rights and patent rights for the multi-angle head, thereby helping protect it against copying by competitors, and increasing sales.

Since the 1980s, the scope of design has expanded to encompass non-consumer products such as IT equipment, rolling stock, medical equipment, and elevators and escalators. An IP strategy that combines both design patent rights and patent rights has been widely deployed, being particularly effective for equipment and system products that include display screens. This IP strategy will be more fully adopted with the arrival of the information design era.

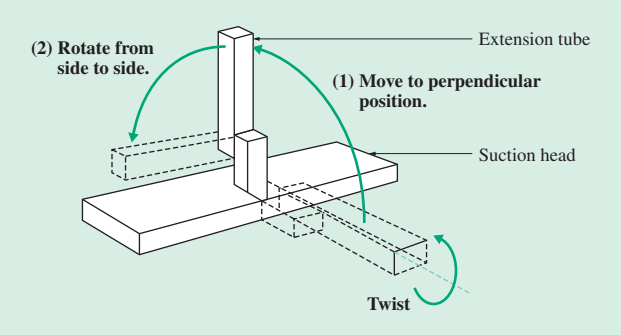

Fig. 4—Head Rotation Mechanism.
A mechanism for rotating the suction head when the hose grip is twisted was created by fitting a joint that enables the extension tube to move relative to the suction head, both perpendicularly (1) and from side to side (2).

IP STRATEGY FOR ERA OF INFORMATION DESIGN

As the era of information design, the 1990s were characterized by the use of IT to enhance product functions. It was during this period that graphical user interface (GUI) design became important. It was also during this time that the Design Division established a department to undertake specialized research into usability design and utilize it in product development. Subsequently, in the 2000s, the department worked with Central Research Laboratory, Hitachi, Ltd. on experimental work on interactive designs that involved research into operational performance achieved through the use of IT for interaction between humans and machines. Hitachi undertook an active program of patent applications for the results of this research, establishing a portfolio of approximately 40 patents.

This section describes the design of screens used in analyzers, this being a representative example of the application of information design to a product. Normally, the important considerations for screen design include not only the visual appeal of the graphics but also its ease-of-use (how easy the screen is to view and how clearly it presents information). The information used in special-purpose instruments such as analyzers is more high-level and complex than for home appliances and other consumer devices, and the laboratory technicians who perform analyses need to handle a large amount of information. In addition to the appearance and ease-of-use of icons and other controls, and data structures, screen transitions, and other features designed with an emphasis on clarity of purpose, ideas that relate to challenges specific to special-purpose instruments, such as indicators for showing things like analysis progress and equipment status, are also important to the GUI design for these instruments. Hitachi has built up a solid IP portfolio through an IP strategy that combines design patent rights and patent rights, using design patent rights to protect graphical characteristics, and patent rights to protect the concepts behind things like ease-of-use, data structures, and screen transitions.

Fig. 5 shows two operation screens for a clinical analyzer. The left side of the screen on the left displays the contents of the specimen rack in a way that mimics the physical instrument, and the right displays detailed information for the selected specimen rack. In the screen on the right, the left side displays a specimen list with a menu display button appearing next to the selected specimen in the list. Clicking this menu display button displays an array of menu buttons corresponding to the available operations for that specimen.

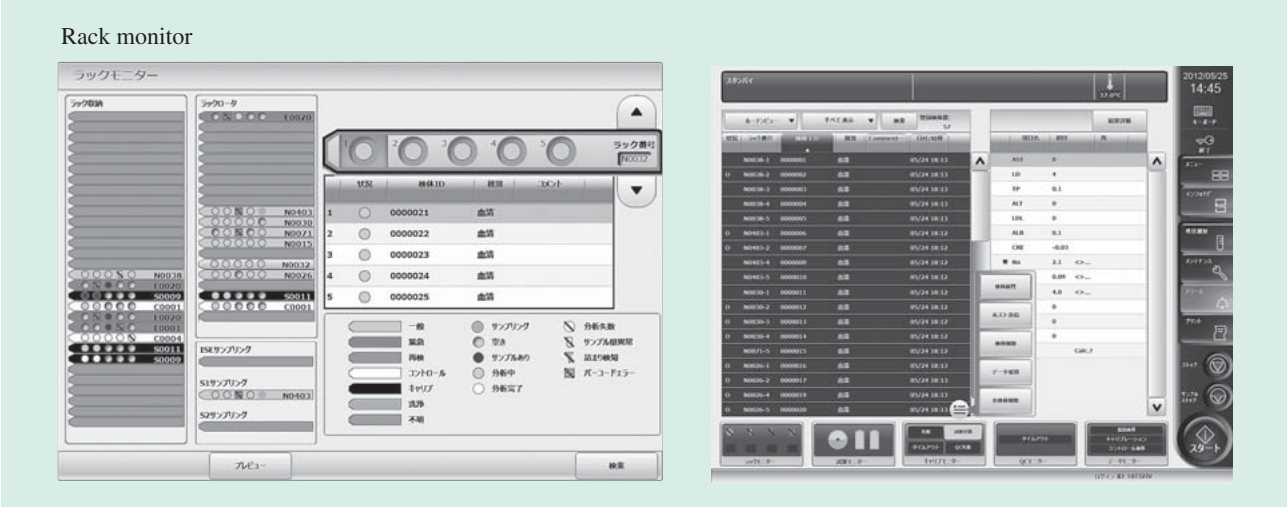

Fig. 5—Clinical Analyzer Operation Screens.
The layout of operation screens mimics the actual analyzer to make operation easy to understand.

By using this screen layout, which mimics the physical design, Hitachi succeeded in developing a clinical analyzer that allows laboratory technicians to check on analysis progress from remote locations, and with operation that is easy to understand. The screen design is protected by both patent rights and design patent rights (Japanese patent No. 5476389 and Japanese design registration No. 1408834).

ERA OF SOCIAL SERVICES, SOLUTIONS, AND INNOVATION, AND ROLE OF IP

As indicated by the expression, "design stories from things," the late 2000s was a time of transition away from the highly product-oriented design approach of the past and toward a design approach that focused on the value perceived by customers and other end users through products, services, and solutions. This involved the adoption of new development processes featuring the participation by design, research and development, and business units together with customers and other end users in the collaborative creation of new value. The challenge was to establish technological methodologies for collaborative creation with customers through the ability of design to make things visible, with this representing one technique for integrating a variety of different knowledge. In addition to researching these methodologies, the Design Division developed a number of collaborative creation tools and introduced them into practical use.

One strategy for IP management is to use trademark rights for protection along with design patent rights, patent rights, and similar. There are examples of consulting companies, think tanks, and similar organizations registering their methodologies as trademarks, and Hitachi recognized that this would also be beneficial for promoting its design methodologies and other tools outside the company.

The following sections describe IP management at the Design Division, including the trademark rights to its representative design methodologies and tools.

Experience Design at Hitachi

Experience design is a design methodology that Hitachi has been building up over the last decade or so.

One of its major features is the rigorous use of ethnography[3] to identify the genuine issues and latent needs at customer workplaces, and its techniques for describing the future form that users want products to take and how customers should go about their operations. The stakeholders present in a workplace, and who interact there, include end users, workers, and the staff who manage and operate equipment and systems. Factors such as the problems that occur with equipment and other systems used in the workplace and the nature of the services available vary over time, as do the severity of problems. Experience design is an approach to design that identifies the issues to be resolved from increasingly complex problems in order to develop services and other solutions.

The following describes some of the typical design tools used for experience design.

(1) Customer journey map

A customer journey map is a tool that uses a time-series format to show how workers and the people who utilize available services interact with equipment,

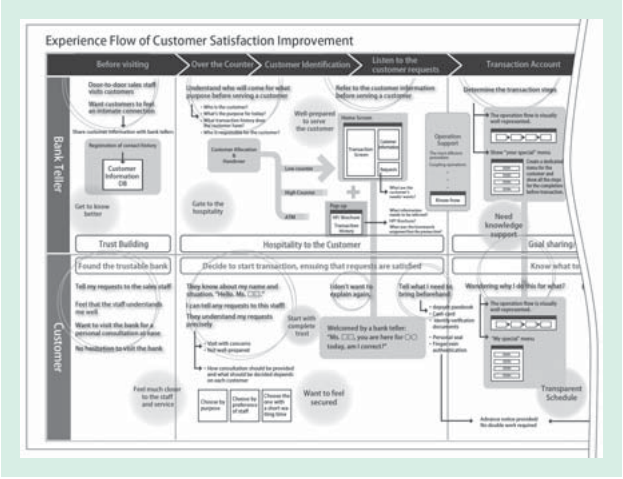

Fig. 6—Customer Journey Map.
This example map was created to identify service requirements and other issues by presenting the events experienced by bank tellers and customers in a time-series format.

systems, and services, and to identify things like the problems inherent in equipment and systems or the requirements of services from a record of the events that people experience. Fig. 6 shows an example customer journey map.

While they can take many different forms, customer journey maps are useful tools for enabling the people involved in development to share information about issues by recording specific details about the distinctive events that occur, depending on what is being studied and the type of activity involved.

(2) Stakeholder map

Fig. 7 shows an example of a service study that uses a stakeholder map.

Fig. 7—Example Service Study Using Stakeholder Map.
The stakeholder map encourages discussion of the service model by allowing participants to move origami models around as they work.

A stakeholder map is a tool that enables participants to study a service model and engage in discussion by using *origami* models to represent the elements, such as people or buildings, that form part of the hypothetical service, and recording information such as the role and relationships of each element. What is unique about a stakeholder map is that it is a simple process that feels like a game in which participants can inspire each other through discussions that transcend their different fields of expertise[4].

The Design Division developed the customer journey map, stakeholder map, and other tools by itself. They are used in a wide variety of situations. One of the challenges for these tools is to use IT to improve efficiency, and further development continues with this objective. For the stakeholder map, for example, Hitachi has developed technology that uses image recognition techniques to record the relationships for each stakeholder in a system to facilitate things like record-taking and modifications in the model-making stage, and to display this information automatically, while also enabling things like moving the *origami* or physically recording notes in order to continue encouraging the generation of ideas through discussion. This technology has been patented (Japanese patent No. 5174563).

IP Protection of Design Tools

Techniques such as the customer journey map and stakeholder map are design tools for working with customers and other stakeholders to develop things like products and services. While IP management still needs to prevent copying and imitation by competitors, a strategy is required that can promote Hitachi's "experience design" to customers and encourage collaborative creation. Accordingly, Hitachi uses trademark rights as well as design patent rights and patent rights to protect its design tools. That is, it seeks to establish a brand by obtaining trademark rights to design tool names. The following are two examples.

(1) Customer journey map (ExperienceTable): Japanese trademark No. 5310747

(2) Stakeholder map (BusinessOrigami): Japanese trademark No. 5231393

CONCLUSIONS

The Social Innovation Business that Hitachi is strengthening seeks to meet the various challenges facing society by gathering knowledge from many people, including customers. Accordingly, along with

its past role of protecting Hitachi IP and preventing copying by competitors, the IP strategy for the Social Innovation Business also needs to make large numbers of people, including customers, aware of Hitachi IP and encourage them to use it. Along with a deepening of collaborative creation with customers, Hitachi plans in the future to supply value to customers by using a wide variety of IP, including copyright and trade secrets as well as patent rights, design patent rights, and trademark rights.

REFERENCES

(1) J. Furuya, H. Kitagawa, and K. Kashimura, "Experience Design for Enterprise Value Improvement," Hitachi Hyoron **89**, pp. 726–729 (Sep. 2007) in Japanese.
(2) "Experience Design for Social Innovation," Hitachi Review **62**, (Sep. 2013).
(3) K. Kashimura et al., "Design Approach based on Social Science for Social Innovation Business," Hitachi Review **63**, pp. 548–559 (Nov. 2014).
(4) Hitachi, Ltd., "Experiential Value: Introduce and Illicit Ideas (Business Origami)," http://www.hitachi.com/rd/portal/contents/design/business_origami/index.html

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Featured Articles

Construction of a Collaborative Creation Platform
—A New Approach to International Standardization—

Yoshiaki Ichikawa, Dr. Eng.

OVERVIEW: The standards required to promote Hitachi's Social Innovation Business are not the technical standards of the past but a new type of standard that applies to services and other societal practices. This in turn requires that international standardization be approached through collaborative creation involving not only technology suppliers, but also a wide variety of stakeholders. This article looks at how this new approach (rule-making standards) differs from how international standards were treated in the past (technical standards), and considers the effect that rule-making standards have on business development. It also presents examples of rule-making standards for which Hitachi is playing a leadership role.

INTRODUCTION

JAPANESE organizations, including Hitachi, has had a long involvement with international and technical standards, with a variety of objectives. On the one hand, there is a need, particularly in the case of corporate activity, for dealing with international standardization as part of a business strategy. Hitachi's Social Innovation Business in particular, because it is characterized by the use of information technology (IT) in social infrastructure to help solve the problems facing society, requires a completely different approach to that of businesses that sell consumer products.

This approach involves looking at things from a user's perspective, rather than a technology supplier's perspective, and this means undertaking development jointly with "customers," which in this context includes investors and government officials. This corresponds to Hitachi's concept of "collaborative creation."

This article describes the author's experience as a leader in international standardization together with examples and example problems, and seeks to explain, in as intelligible a form as possible, the ways in which international standardization can be utilized in business.

ORIGIN OF INTERNATIONAL STANDARDS

Before considering their relationship with business, the article will first look at the World Trade Organization (WTO) to review what "international standards" actually are. The WTO's agreement relating to technical trade negotiations is commonly referred to as the Technical Barriers to Trade (TBT) Agreement. In accordance with the basic principle that industrial and other product standards, and the procedures for assessing compliance with those standards, should not create unnecessary barriers to international trade, Article 2 of the WTO's Agreement on Technical Barriers to Trade stipulates that central government bodies shall use international standards as the basis for technical regulations.

In this context, what is meant by an "international standard"? One definition is found in section B "Decision of the Committee on Principles for the Development of International Standards, Guides and Recommendations with Relation to Articles 2, 5 and Annex 3 of the Agreement" of the Annexes to Part 1 in the document of resolutions, G/TBT/1/Rev.10. This section specifies the following conditions called the six principles for international standards.

(1) Transparency
(2) Openness
(3) Impartiality and consensus
(4) Effectiveness and relevance
(5) Coherence
(6) Development dimension

The International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), and International Telecommunication Union (ITU) are also expected to satisfy all of these principles (see Fig. 1).

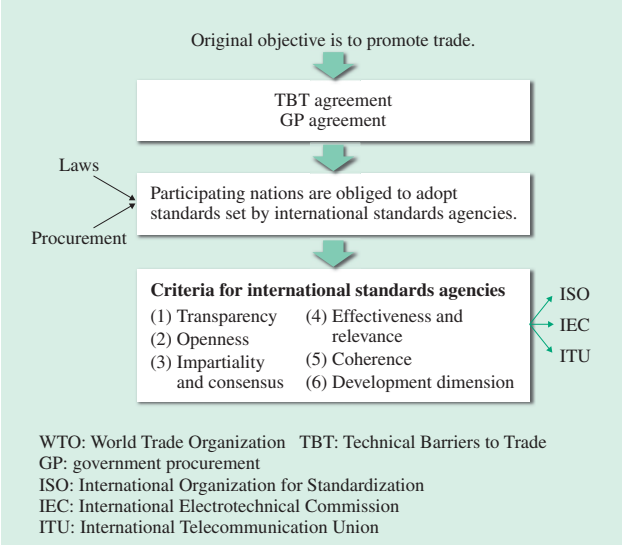


Fig. 1—International Standards and the WTO.
The WTO requires international standards to comply with six principles.

However, the same standard can be divided into two types, namely technical standards and rule-making standards.

Technical standards are defined in Japan by Article 2 of the Industrial Standardization Act as including such things as the type, model, figure, dimensions, quality, performance, production or design methods, analysis, terminology, units, and measurement methods for industrial products, as well as the design and construction methods and safety criteria for buildings.

When actually reading the text of these standards, it often takes the form of stipulating that products must satisfy some particular criteria. Accordingly, standards of this type always raise fears of disclosing a company's know-how relating to its own products. It is fairly common for the company staff involved in the development and sales of products to hold a poor opinion of standards, and this fear likely contributes to this poor opinion.

This situation does not apply, however, to rule-making standards. In the case of international standards in particular, the number of standards of this type has been increasing in recent years. These standards stipulate the form that business practices and services should take, something that is not included in the standards for industrial products. Well-known examples of management system standards such as the ISO 9000 and ISO 14000 series can be thought of as amongst the first standards of this type. The text of these standards tends to take the form of stipulating what actions organizations must take, what criteria services must satisfy, and how society should organize itself.

Nowadays, the international standardization process involves developing and publishing both types of standards together. However, this article will focus primarily on rule-making standards. This is because, as explained below, these standards hold the greatest potential for utilization in business.

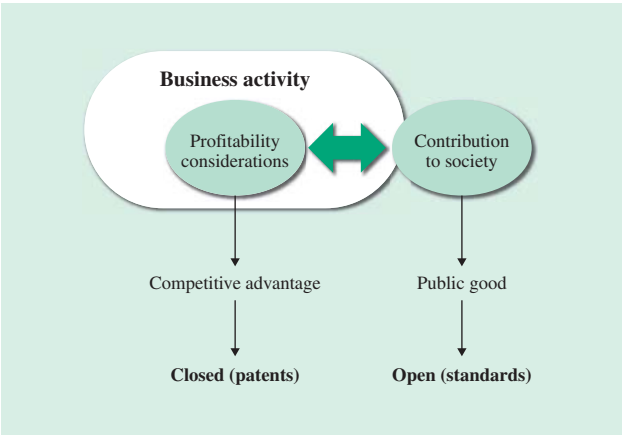


Fig. 2—Conventional Way of Thinking about Standards.
Standards have been thought of more as a public good, rather than as a pathway to profitability.

RETHINKING STANDARDS FROM A BUSINESS PERSPECTIVE

This section describes how international standards are thought of at companies. Based on the author's experience speaking with staff at Hitachi and elsewhere, the most common way of thinking about international standards is that represented by Fig. 2. As shown in the figure, the default attitude when considering business activity separately in terms of its profitability and of its contribution to society, is obviously to see profitability as the key consideration, and contribution to society as an offshoot to that.

Competitiveness plays an important role in this way of thinking, with patents emerging as an effective way of securing competitive advantage. On the other hand, standards fall under the category of those activities aimed at the public good, as offshoots of the consideration of contributing to society and are associated with the idea of the widespread dissemination of know-how. Looked at in this way, international standards do not appear to offer effective opportunities for their use in business.

Consider the following hypothetical example involving a company ("Company A") that sells high-

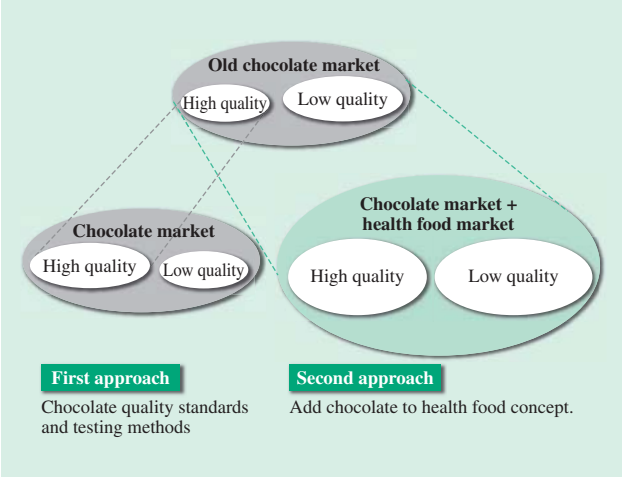


Fig. 3—Hypothetical Example of Chocolate Business. The second approach is to stipulate rules for society.

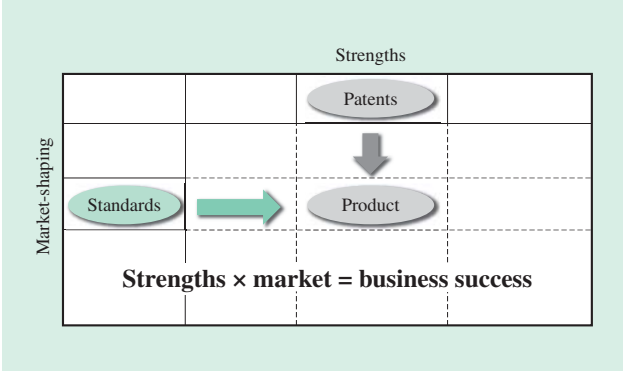


Fig. 4—Role of International Standards in Shaping Markets. Whereas patents protect a product's strengths, standards act to shape their markets.

quality chocolate (see Fig. 3). The market in which Company A operates is shown in the figure as an ellipse. The high-quality chocolates made by the company have lost market share due to competition from low-quality/low cost products. How can the company use standards as a way to overcome this situation? Two different approaches can be considered.

The first approach is a strategy for achieving market share through differentiation. This assumes that the quality of the company's products has not been recognized by consumers (even though they may appreciate the difference when they taste them). Establishing standards for chocolate quality and testing procedures makes this clear. One example of this sort of standardization is to use star labeling on packages to indicate quality grade, such as displaying five stars to represent high quality.

This approach is an easy one to imagine and is likely to prove beneficial. However, it is also likely to be difficult to implement. International standardization is a group exercise with representatives from numerous countries and companies working together and requires a consensus to be reached. It is not possible to leave out competitors who wish to participate. This means that it is difficult to reach agreement among all participants for these types of standards. In other words, very little "collaborative creation" takes place.

The second approach is to create standards that do not directly relate to the technology of chocolate making. Health foods are one example. Rather than specific products, this should be thought of as public rules for maintaining people's health by improving dietary habits. This might include, for example, rules that promote polyphenols, of which chocolate has an abundance. While clearly this will not promote chocolate alone (because other products such as red wine also contain polyphenols), it nevertheless can significantly expand the total market by opening up a new market in terms of health food that is separate from chocolate's traditional position as part of the confectionary industry.

Moreover, standards of this type are easy to establish. This is because industry competitors will also benefit to some extent. Whereas the first approach leaves the total market size unchanged, with competition within this market making it difficult to reach agreement, the second approach delivers a win-win outcome for everyone involved.

In other words, international standards can be thought of as an effective means of shaping international markets. This makes it an important factor in achieving business success alongside patent activities. Fig. 4 represents this view. If certain products have certain technical advantages, these can be effectively protected using patents, for example. However, this alone is insufficient to ensure the success of the business. The market of customers who recognize these advantages also needs to be large. Standards represent very effective tools for creating such markets.

As indicated by the examples above, the standards that promote business should not be those that relate to product technology but rather those that relate to how a product is used and the uses to which it is put (including services that use the product), and those that take the form of societal rules that uncover new value in the products. In this respect, these standards have a close affinity with the rule-making standards described earlier.

PERSPECTIVES ON UTILIZING STANDARDS FOR SOCIAL INNOVATION

This section looks at the relationship between standards and business from a different perspective (see Fig. 5).

The central part of Fig. 5 represents business activities in terms of their sequence. Almost all industries have developed based on a background of societal challenges, and as a way of overcoming them. The following explanation uses as an example the supply of energy to a city in an emerging nation where a national project has been launched to provide an electric power grid (a policy that has been adopted to overcome this challenge). As a result of the project, the power utility (which is a customer from the viewpoint of product suppliers) identifies the requirements, translates these into key performance indicators (KPIs), and undertakes an international procurement process. It is at this point that product suppliers bid for contracts. The company that wins the tender supplies the products and that company, or a local company, gets the contract for operation and maintenance.

In terms of this sequence, traditional standardization corresponds to the technical standards (product dimensions, performance, protocols, and so on) indicated by the box at the bottom of the figure. Typical examples are voltage standards, and rules regarding connector shapes, etc. that apply to transmission lines. The major objective and benefit of this type of standardization is commonality, meaning that, once formulated as an international standard, all companies are able to make use of the standard as they wish. As such, companies tend to view this as something they hope some other company or country will handle without their needing to contribute. In other words, there is little prospect of it helping them in their business.

Recently, however, keywords like "packages" and "turnkey" have been coming into vogue in relation to the export of social infrastructure. The sense in which these keywords are used extends beyond the supply of products to encompass solving problems on the customer's behalf. That is, the scope of business is extending toward the upstream ends of the sequence of processes shown in Fig. 5.

Large and highly profitable European and American companies have adopted a business model under which downstream products tend to be purchased externally and added value is created at the upstream end. If Fig. 5 is thought of in terms of budget size, it

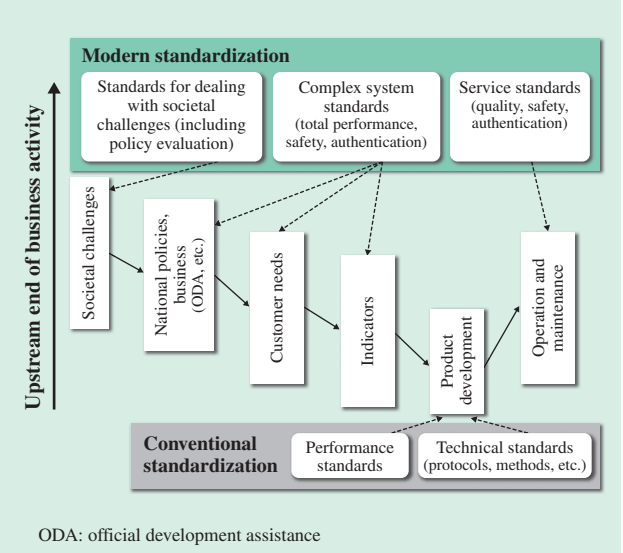


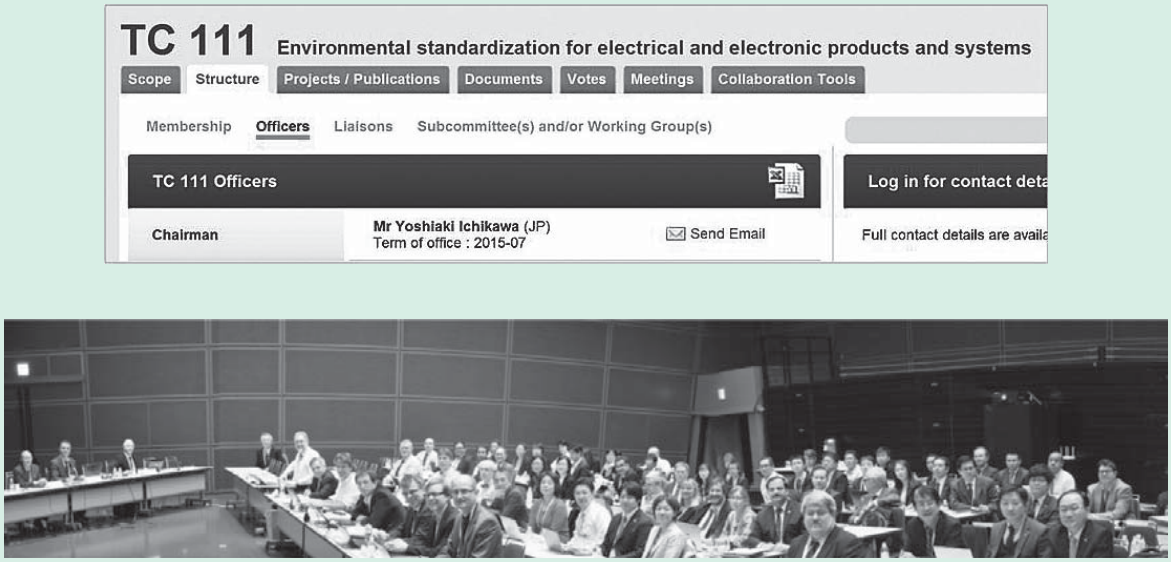
Fig. 5—Scope of Standardization and Sequence of Business Processes.
Modern standardization deals with the upstream end of business activity.

is clear that this becomes more finely resolved the further downstream it goes, resulting in lower profits. The most interesting processes are the upstream ones. Also, it is when looking further upstream that one encounters "societal challenges."

It appears from this interpretation that the nature of standards that companies should be seeking in the future is different from those of the past. This means standardization that is targeted at "standards for dealing with societal challenges," "complex systems," and "services," indicated by the boxes at the top of Fig. 5. Furthermore, this is something that various other countries have already recognized.

A clear trend has emerged among the topics of recently established specialist committees at ISO. Specialist committees called technical committees (TCs) or project committees (PCs) work on the formulation of standards in specific fields indicated by their titles. To issue an international standard (ISO standard) requires a two-thirds majority among the member countries of the associated committee. The topics of these committees differ considerably from how things are thought of in Japan. TC 247 deals with "Fraud Countermeasures and Controls," TC 272 with "Forensic sciences," and TC 292 with "Security and resilience." As their names indicate, these committees deal directly with standardization of societal problems. That is, they formulate standards that stipulate rules for society.

As explained earlier, the international standardization mechanism has been given formal



TC: technical committee

Fig. 6—IEC TC 111 that Deals with Environmental Problems.
The photograph shows a scene from the TC 111 meeting at the 2014 Tokyo conference of the IEC.

status by the WTO and is able to create standards that are binding across all countries (standards for which there is a legal obligation of compliance). This means that standards of this type must be accepted without feeling awkward.

Meanwhile, it pays to remember, of course, that business motivations also lie behind all of this. Take the example of the TC 272 committee on "Forensic sciences." To many readers, the title will be suggestive of the US crime show "Crime Scene Investigation (CSI)" or other police shows set in a forensic laboratory. These shows involve the use of the latest scientific analysis techniques to identify criminals.

The standard being formulated by this TC is ISO 18385, "Minimizing the risk of human DNA contamination in products used to collect, store and analyze biological material for forensic purposes." It stipulates quality management procedures and verification methods for ensuring that the swabs and other items used to collect deoxyribonucleic acid (DNA) samples are not contaminated with other people's DNA.

If, for example, a Japanese producer of high quality swabs for collecting DNA samples were to attempt to create an international standard, the committee might have been given the title, "Quality Requirements for DNA Collection Swabs." In fact, the committee chair, Australia, chose "Forensic sciences" as the title. Behind this, it can be assumed, lies an intent to expand the proprietary market for high-quality swabs. In practice, cases of false arrest resulting from contaminated swabs also likely provide a powerful incentive for the work.

With the title "Forensic sciences," this committee has given itself a broad brief that will enable it to go on to create a variety of further standards once this one is complete. This may shape the markets for businesses that deal with a variety of new technologies relating to forensic science.

EXAMPLES

This section presents two examples of international standardization in which the author played a leadership role.

IEC TC 111

At the IEC, the author chairs TC 111, which is titled "Environmental standardization for electrical and electronic products and systems." Meetings held by this technical committee (see Fig. 6) are regularly attended by close to 100 people, and its activities are deeply entwined with laws that give form to societal rules.

Fig. 7 shows one example. TC 111 has issued a standard (IEC 62321) that stipulates test methods for determining the concentration of hazardous substances in electrical and electronic products.

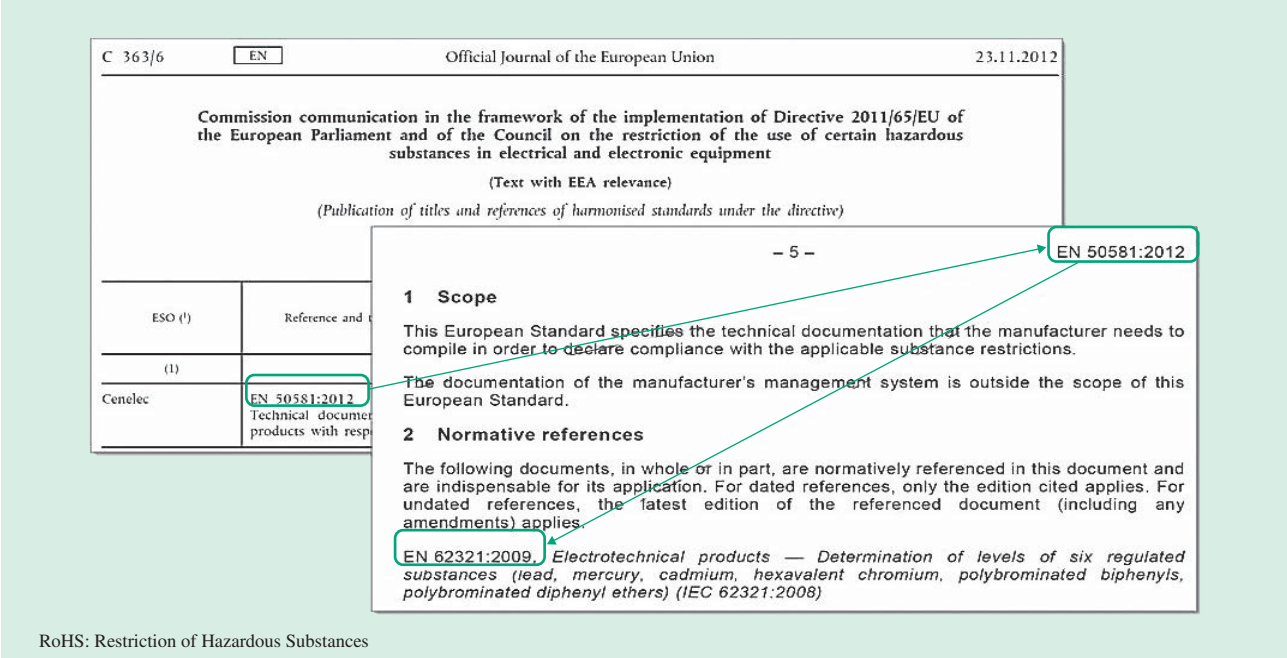


Fig. 7—Reference to Standard as Mandatory Requirement in Europe's RoHS 2 Directive.
Because the standard formulated by the TC 111 committee is referenced in the RoHS 2 directive as a mandatory requirement, it in effect stipulates the law.

This standard was formulated to check compliance with the Restriction of Hazardous Substances (RoHS) directive that has been widely adopted as law in Europe and other parts of the world (prohibiting the presence of cadmium and five other hazardous substances).

After TC 111 issued the standard, the European Commission (EC) issued European Standard (EN)* 50581 requiring compliance with the RoHS directive. This included a "normative reference" to (obligation to comply with) EN 62321, the standard created by IEC TC 111 (EN 62321 is word-for-word identical to IEC 62321). In effect, IEC TC 111 stipulated rules that came to form part of EU law.

The Japanese and other companies on TC 111 are the sort of companies that comply most closely with the RoHS directive, and had been working rapidly on developing technologies for this purpose. The standard can be thought of as one that will help these products exhibit their strengths in the market.

Fig. 8 shows another example of the results of this work. While environmental measures taken by Europe have in the past been focused almost exclusively on global warming, they have also recently been working on product policies targeted at resource efficiency. That is, policies designed to encourage wider adoption of products that are easy to recycle.

* Has force roughly equivalent to a law, such that compliance with the standard is treated as compliance with the law.

TC 111 had been involved in work on product recyclability from an early stage, and had been working toward the publication of Technical Report (TR) 62635 on methodologies for conducting quantitative assessments of recyclability from the design stage (TR 62635 was subsequently published in 2012). It was during this period that the author visited the Directorate-General for the Environment at the EC.

On informing an official who dealt with product policy that this TR was being drafted, the official requested to be included in the process. Naturally, this request was accepted and specialists were promptly dispatched to join in the committee's activities, with the resulting outcomes being included in a subsequent policy announcement. The underlined section of Fig. 8 states that rules had been significantly changed to be brought into line with IEC TR 62635. The power of standards can even influence the direction of future laws. Naturally, this can also be expected to provide business benefits by expanding the market for products with excellent recyclability.

ISO/TC 268/SC 1

Another international standards subcommittee (SC) on which the author serves as the Japan chair is ISO/TC 268/SC 1 "Smart community infrastructures." This subcommittee also deals with a very upstream topic, that of urban problems, with a focus on smart

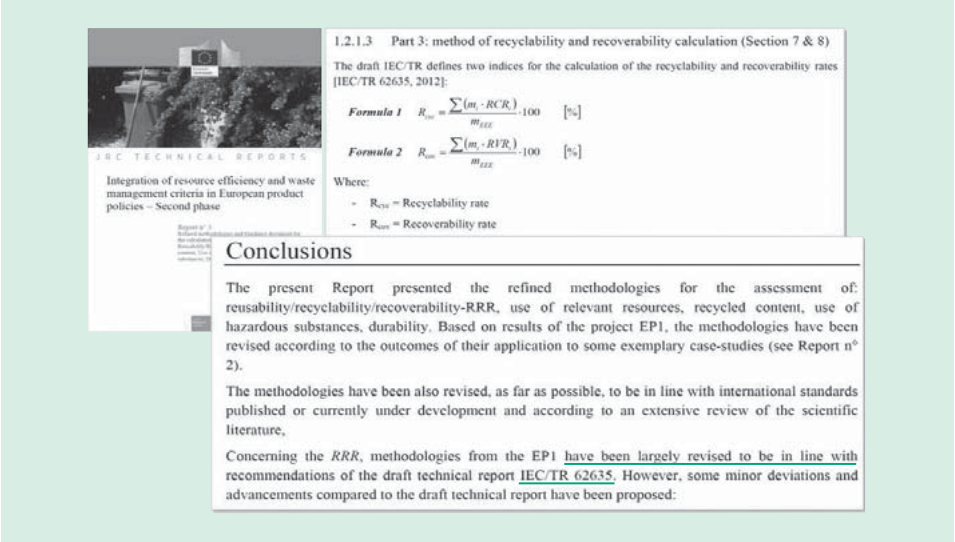


Fig. 8—Reference in Europe Policy Announcement. The European Commission policy announcement specifies major amendments to bring rules into line with the standard issued by the IEC TC 111 committee.

cities and infrastructure, areas that are closely related to business.

ISO/TC 268/SC 1 is a new subcommittee proposed by members of the Japan Smart Community Alliance (JSCA). The international proposal was issued in the winter of 2011 and the subcommittee started sitting in 2012. The subcommittee has already issued one technical recommendation (TR), ISO TR 37150, and it has a technical specification (TS), ISO TS 37151, on which international voting has been completed. Both of these deal with metrics for reviewing the "smartness" of community infrastructures.

When introducing social infrastructure in the future by exporting it to emerging economies in the form of packages or engaging in urban renewal, the aim will be to develop the rules that will shape the huge market for ensuring the widespread adoption of appropriate technologies that conform to these objectives.

CONCLUSIONS

Both the IEC TC 111 and ISO/TC 268/SC 1 committees referred to in this article are engaged in the creation, not of technical standards, but of rule-making standards. Standardization of the sort that can be utilized in business should not involve stipulating the technology itself, but rather should aim for standards for making effective use of that technology. Suitable areas for standardization are those such as societal challenges and services that are at the upstream end of business processes, and the aims should be to build win-win relationships with other industry participants to expand the market for the technology and to open up new markets.

REFERENCE

(1) Y. Ichikawa, "Business and Standardization," Jidosha Gijutsu, Vol. 69, pp. 51–56 (Jan. 2015) in Japanese.

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