Pursuit of Systems that Foster Innovation

Innovation and Patents

Traveling in Europe, I found myself charmed by streets lined with elegant buildings. Particularly overwhelming were the steeples that threaten to pierce the sky and the splendidly ornate exteriors of buildings in the Gothic style. Going inside, I would lose track of time staring up at high rib-vaulted ceilings where multiple arches intersect.

Gothic architecture became popular in Europe during the Middle Ages, from the latter half of the 12th century. I am amazed that it was possible to construct such majestic buildings 900 years ago. In reality, however, there were also numerous building collapses. In response, the architectural guilds of the time began to place self-imposed restraints on innovative technologies. While stricter controls bring innovation to a halt, they are no substitute for safety.

Gothic Architecture: The Duomo di Milano (top) and Rib Vaulting (bottom)

As Europe moved into the era of the Renaissance, it entered a period of conflict, leading to advances in military technologies such as castles. The people who ushered in this new technology were innovators who did not belong to the guilds and were given the name "ingeniators." This is the origin of the modern word "engineer." Different nations vied for their services. Ultimately, the city state of Venice adopted a policy of granting rewards for inventions as a means of keeping hold of the best ingeniators, formalizing the practice in 1474. This was the beginning of the patent system.

Competition and Collaboration Among Master Inventors

When speaking of patents and inventions, the name Thomas Edison comes to mind, but it was more than the number of patents he obtained that conferred the title of "master inventor" upon him. It is said that Edison focused on systems rather than on individual devices and made a thorough study of past patents when setting out to create a new invention. When setting out to develop the light bulb, he envisioned an entire power system that also encompassed the generation and distribution of electricity, and he progressively acquired the patents needed to build such a system.

One of the great mistakes of which Edison was guilty, however, was his obsession with direct current (DC). He took on Westinghouse Electric Company that was backing Nikola Tesla in pushing ahead with alternating current (AC) electric power, and ultimately lost out and retired from that line of business.

There were other inventors, too, who came out on top over Edison. One was Alexander Graham Bell, who is credited for inventing the telephone. His wife had impaired hearing, as did his mother, and both he and his father started out working in jobs that supported hearing impaired people. Bell was interested in the propagation of sound and his motivation as he went on to dedicate himself to inventing the telephone was underpinned by his love for his mother and wife.

Edison also fell victim to another big mistake. He had noted the black soot that adheres to the inner surface of light bulbs

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and set out to identify its cause, only to subsequently abandon this research.

Some years later, John Ambrose Fleming, who worked as an advisor to the Marconi Wireless Telegraph Company, invented the vacuum tube using the work done by Edison as a base. Vacuum tubes proved to be very useful for improving the quality of radio communications, which resulted in Marconi's wireless systems sweeping the world.

One catalyst for the spread of Marconi's wireless systems was the sinking of the Titanic in 1912. Although very few vessels were fitted with wireless systems in those days, the Titanic was equipped with Marconi equipment and had Marconi radio operators on board. The SOS transmitted by the Titanic's radio operator was received by the Carpathia, another vessel equipped with a Marconi wireless set. This vessel was able to come to the rescue four hours later. In the aftermath of the Titanic disaster, the International Convention for the Safety of Life at Sea (SOLAS) was signed in 1914, including a provision requiring that vessels with a capacity of more than 50 people should be equipped with a wireless system.

Aware of its national security implications, people became alarmed about the Marconi monopoly on wireless systems. In particular, because all of the warships of the U.S. Navy were fitted with Marconi equipment, President Woodrow Wilson, an advocate for the League of Nations who had a strong desire for peace, placed a series of restrictions on Marconi products.

The Assistant Secretary of the Navy, Franklin D. Roosevelt, who was later to become president, took steps to enable General Electric Company (GE) to acquire the stock of Marconi Wireless Telegraph Company of America. As a result the Radio Corporation of America (RCA) was establishment in 1919 as a GE-owned company for administering radio patents. Subsequently, AT&T Inc., which also held valuable radio patents, also acquired a stake in RCA, as did Westinghouse.

While it is something of a digression, David Sarnoff, the Marconi radio operator who received the signal from the Titanic late at night in a New York department store, later rose to become head of RCA. Ultimately, he became a media mogul as he turned the company into a leading manufacturer of radios and televisions.

On the basis of Marconi patents that had emerged from the research abandoned by Edison, GE, the company founded by Edison, AT&T, the company of Bell who strove to develop the telephone, and Westinghouse, which competed fiercely in the field of electric power systems, all existed alongside RCA and built up portfolios of radio-related patents, developing a business model based on licensing patents to companies that wanted to use them. This is what is called a patent pool.

Hitachi's Patent Culture as the Soil of Innovation

Namihei Odaira, Hitachi's founder, encouraged inventions by staff, saying that invention was the life mission of engineers. Just as Edison made a rigorous study of patents, Odaira, too, made a careful study of existing inventions, purchasing and collecting copies of patent applications. Although Odaira dealt with patent applications and related work personally in the company's early days, he progressively delegated this task as the company grew in size.

Subsequently, Kanichi Kodama joined the company in 1917. He initially worked on the development of small induction motors, also going on to take responsibility for patent applications. The number of such applications gradually increased, and patents became his sole job in 1921, working with an assistant named Kiyoshi Namerikawa. This was Hitachi's first intellectual property department.

The work of Kodama's team extended beyond filing applications and also included educational activities such as giving lessons to designers about patents and their significance, prompted by revisions to the patent law that year.

Just as Venice had once used a rewards scheme for inventions to boost the motivation of ingeniators, Hitachi also institutionalized incentives at this time that granted bonus payments to those who had been awarded patents or similar. To encourage innovation among ordinary staff as well as designers, Hitachi introduced an incentive scheme that rewarded good ideas and was targeted at workplace innovations that did not qualify for obtaining a patent. Various other policies were also devised based on considerations of encouraging innovation and human resource development, including insight prizes for improvement proposals based on small insights and implementation prizes for those who eagerly adopted other people's innovations.

These measures honed the awareness of innovation among all staff and, in terms of the organization, fostered a corporate culture that placed a high value on it. This culture in turn inspired an even greater desire for innovation among engineers.

These attitudes and traditions continue to exist today in different forms, going beyond the technical innovation of

patents to express itself in Hitachi staff around the world, showing up in a wide range of fields including corporate social responsibility activities.

Origins of International Standards

Devices, and even entire systems, were still simple in the easier going times when the likes of Edison and Marconi were active. Now, however, in the modern era where technology has become more complex, it is no longer possible for a single company to be responsible for an entire system and there is instead a need to ensure the interoperability of equipment developed by different manufacturers. This raises the importance of standards in terms of their role in intellectual property strategy.

Standards, as they are understood in the modern context, date back to the time of the French Revolution. As part of its unquiet times, France recognized the importance of the high-volume production of muskets and the interchangeability of parts. This idea of interchangeable parts spread to America in the post-revolutionary period, where it was taken even further. Colt's Manufacturing Company LLC., the company that developed the Colt revolver of western movie fame, made advances in the standardization and interchangeability of parts. Moreover, numerous engineers moved on from Colt, spreading the practice of standardized manufacturing across the United States. For example, a factory established by Francis A. Pratt and Amos Whitney, former Colt employees, is now known as Pratt & Whitney, an aircraft engine manufacturer that ranks alongside the likes of GE and Rolls Royce.

Regulation that Encourages Open Innovation

Making a shift from competition to collaboration, GE and AT&T put their patent pools to good use in the USA's wireless systems business. Unfortunately, patent pools also carry with them the potential for an oligopoly of large companies. The dominant positions of GAFA are currently coming under intense scrutiny, and the USA has traditionally been very wary of oligopolies of large companies.

As computers emerged as an industry in their own right, the rising complexity of technology caused American companies to be placed in difficult positions in various different ways. When Ronald Regan became president proclaiming a strong America, he issued a rapid succession of policies for encouraging innovation to boost industrial competitiveness. The Bayh–Dole Act of 1980 encouraged industry-academia collaboration and the Small Business Innovation Research (SBIR) program launched in 1982 served as a foundation for the rise of start-ups. The National Cooperative Research Act of 1984 gave a new lease on life to U.S. businesses that had previously been prohibited from engaging in joint research involving two or more companies by the strict interpretation of anti-trust law and caused open innovation to proceed at an accelerating pace.

Standardization in Europe

Action on standardization picked up pace in 1993 with the formation of the EU. An earlier New Approach directive on standardization issued by the European Commission in 1985 had strengthened the role of bodies such as the European Committee for Standardization (CEN), putting in place the infrastructure for standardization.

While I have already discussed the role of Marconi in wireless systems, in the context of European standardization, I cannot omit to mention the GSM standard for mobile phones. Having lagged behind Japan and the USA in the development of the original analog mobile phones, Europe took the opportunity provided by the formation of the EU to proceed with formulating the GSM standard out of fears that Japanese and American companies would establish a monopoly in the market.

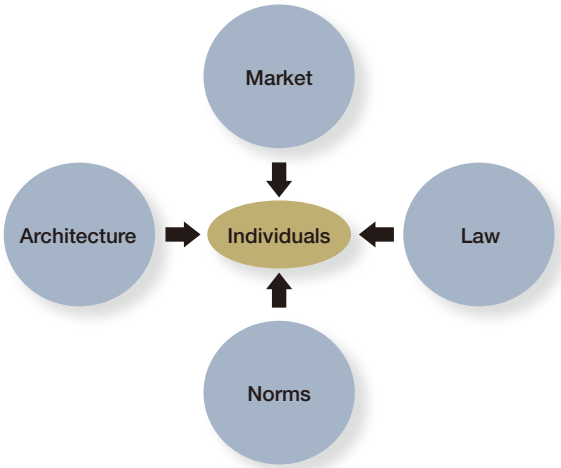
Marconi had a monopoly of both wireless base stations and terminals. GSM, in contrast, made a point of being open about the specifications of mobile devices that take a lot of effort to get widely adopted, but divulged little of the technologies in which European manufacturers demonstrated competitive strength, including wireless base stations and control stations. It is important that intellectual property strategy in an era of open innovation combines both open and closed strategies that have carefully analyzed the strengths and weaknesses of one's own company.

Europe has much experience with standardization given that it is full of national champions jostling each other in different industries. In addition to GSM, RAMS for railway systems, the Euro vehicle emission standards, and AUTOSAR for automotive software development are all international standards that emerged from Europe and have been successfully taken up in large emerging nations such as China and India.

Hitachi's Activities in Era of Open Innovation

Professor Lawrence Lessig, a world authority on cyber-law, talks about the four modalities that constrain people's behavior: laws, norms, markets, and architectures.

Lessig's Four Modalities



Legal regulation cannot be either too strict or too loose. As with the guilds of the Middle Ages referred to earlier, there are times when it is better to put a priority on safety and restrict innovative technology. There are also times when the deregulation adopted by Europe and the USA in the 1980s and 1990s is needed to encourage open innovation. "Norms" means social ethics and morality, and the norms of business should also include things like the Sustainable Development Goals (SDGs) and the Society 5.0 concept proposed by Japan. In markets, the spread of sharing businesses has seen a shift in people's behaviors from the consumption of tangibles to the experience of the intangible functions of goods, services, etc. Architectures are particularly important in a data-driven society. Even if large amounts of data can be acquired, the outcomes that people want will not be achieved if individual items of data have different formats. This makes it necessary to work toward interoperability across different data.

The Centre for the Fourth Industrial Revolution (C4IR) established in 2017 by the World Economic Forum (WEF), the organization that hosts the Davos meetings, is a research institution that aims to establish laws that are suitable for the era of the Fourth Industrial Revolution and to have those laws adopted globally. Hitachi is sympathetic toward these goals and has participated in the center's activities, having become a partner soon after it was established.

With regard to norms, Hitachi has selected 11 of the 17 SDGs and intends to contribute to achieving them through its corporate activities overall or through its individual business activities.

In response to markets shifting from consumption to experience, Hitachi has been enhancing its Lumada solution platform for accelerating digital innovation by customers. The important thing for a platform-based business model is to have a strategy of open and closed innovation. While it secures the background intellectual property (BGIP) that will serve as core technology in Lumada, such as artificial intelligence (AI), on the other hand, Hitachi also makes flexible arrangements with customers to facilitate the use of the foreground intellectual property (FGIP) created in the process of data analysis.

What is important for ensuring interoperability is in fact international standardization. Hitachi has supplied a number of international chair-people for experts' committees at organizations involved in international standardization, including the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO).

Beginning with Namihei Odaira, who placed a high priority on patents on the basis that invention is the life-mission of engineers, Hitachi's intellectual property strategy now extends beyond simply dealing with patents and has developed into something with a truly broad scope. It is tied in with both business activities and corporate social responsibility activities and encompasses work with organizations like the WEF and C4IR that are involved with new areas of legal regulation as well as with organizations like the IEC and ISO.

The guild members of the Middle Ages and the ingeniators of the Renaissance utilized intellectual property to bring about innovations that still remain today, centuries later. I hope that we, too, can make use of intellectual property to build a corporate culture that fosters innovations that transcend time and space.

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