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Patents and the Intellectual Creation Cycle

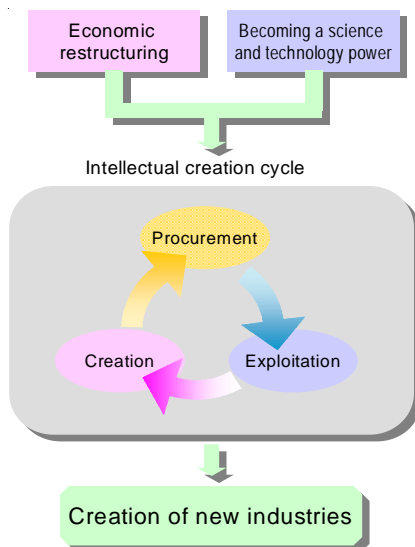
2.1 An Age of Intellectual Creation

What will the 21st century look like? Most likely it will be an age of intellectual creation, as people use their creative energies to come up with new goods and services. At the same time, it will be an era in which the patent system is used to ensure that the inventors share in these advances and that the concepts involved are made available to society at large.

The Japanese economy is currently in dire straits - mainly because it is mired in the Herculean task of cleaning up after the bursting of the bubble created when people were more interested in real estate investments and other "get-rich" financial wizardry than they were in finding ways to turn out better products at lower cost. Japan thus faces an urgent need to restructure its economy. As part of this, a Science and Technology Basic Law was enacted in 1995 as one step on the way to making Japan a powerhouse in science and technology.

Very simply stated, it is hoped that this law will foster an intellectual creation cycle in which, when someone develops a new technology, patent protection is established for the inventor's rights, these rights are used to make and sell a better product, and the resultant profits help fund research on the next new technology. If this cycle can be established, it will have a snowball effect. Whole new industries will be created and venture businesses, on the American model, will be able to thrive in Japan. Patents are the key to this process. (*Chart 2-1*)

Of course, as with anything else, there are pro-patent people and anti-patent people in Japan. The antis have a dislike of the entire patent concept and do not think that patents accomplish very much good. By contrast, the pro-patent people believe that patents offer important protection and incentives to people who innovate, and thus help to generate a variety of new technological advances. Today, the pro-patent forces are rightly in the ascendancy, worldwide.

Chart 2.1 Intellectual Creation = New Industries

2.2 The Networked Society

Computers are now commonplace, and everyone seems to be on the Internet. Indeed, we are in the midst of an information revolution comparable to the ancient agrarian revolution and the more recent industrial revolution. This new revolution is not over yet, and everyone expects further advances in information technology. As part of this on-going revolution, all manner of information is being put into digital form and then being uploaded to global computer networks so that anyone, anywhere, can access it almost instantaneously. New information thus becomes a shared resource, worldwide.

Looking ahead, further advances are in store for the social and technological structures used for creating, storing, and sharing information. Computers, for example, are now far more than number-crunchers and have been developed into systems for processing and conveying information.

This information revolution will inevitably impact our patent systems. For one thing, patents will be less concerned with physical "things" and more with intangible "concepts." In genetic engineering, for example, patents have been sought on DNA sequences, in which computer technology has been used to do the sequencing. Science and technology is expanding beyond the realm of physical objects and moving increasingly into the way in which they are used, covering ab-

stract concepts that cannot be seen or held. With this change, the scope of patents has also become more receptive to software and other intangible information concepts. Diagrams that used to be drawn by hand are now computer-generated. Experiments and proofs that used to be painstakingly compiled are now based upon computer simulations.

The second major change is in how patents are handled. The basic process is still that the patent application describing the new scientific or technological advance is filed with the Japanese Patent Office (JPO), the information is opened to the public, and the application is examined.

Yet the greater use of computer technology has fundamentally changed the actual handling. It used to be that the claim was written out on paper and the paper documentation was submitted to the JPO for examination. Today, the application is submitted as computer data. At the same time, an application no longer has to be brought in person or sent in by post. Instead, the applicant can get on-line and upload the application directly to the JPO. In turn, the JPO can contact applicants on-line.

In the same way, the public disclosure of patent information no longer has to be done with paper documentation. Instead, the contents can be uploaded to the computer network and made available there. Not only does this vastly simplify the process, it also makes it possible for people to access the information, no matter where in the world they happen to be. Consistent with this broader disclosure, researchers can now run computer searches to locate and download the latest technological information. This is a major impetus for more rapid advances in science and technology.

The advent of computerized networking has had major ramifications for patent administration, patent applicants, would-be patent users, and everyone else with an interest in accessing patent information worldwide.

The third major change on the horizon is that the 21st century is likely to be an era of increasing e-commerce. It is expected that the use of computers will vastly facilitate a wide range of transactions and business relationships. At the same time, it will open the way for easier copying and rearranging of data that has been put into digital form, and it will make it easier for anyone to generate and transmit such data. This has been a subject of intense discussion within the World Intellectual Property Organization (WIPO), because it is so important that the underlying technology be patent-protected, if e-commerce is truly to develop. Very rapid advances are being made in e-commerce systems, and patent protection is essential to encouraging such progress. At the same time, the spread of e-commerce means that more and more information will be transmitted worldwide, which underlines the need for greater protection for the intellectual property rights embedded in that information.

2.3 Patents Support Venture Start-Ups

The Japanese economy is being transformed. After World War II, Japan developed the ability to turn out top-quality products inexpensively, and became the world's factory. Yet even as Japanese technology improved, currency fluctuations and technological advances enabled other Asian countries to use their abundant labor to produce plentiful manufactures for global export. As a result, Japanese industry became undermined. Color television sets, video-cassette tape decks, automobiles and other products were increasingly being made in other countries.

This is a time of transition for Japanese industry. Looking just at manufacturing, 4.6% of all companies fold every year. By contrast, the rate of new company start-ups is only 3.1%. More firms are closing than are being created, and unemployment is on the rise. Faced with increasingly stiff global competition, major companies are having to restructure with a vengeance. Thus, companies listed on the major stock exchanges are cutting their staffing by 3.1% per annum. By contrast, the newer and nimbler companies in the over-the-counter (OTC) market are expanding their staffing by 3.2%.

What is to be done? In the past, some might have looked for financial answers, but it was the infatuation with financial instruments and wizardry that led to the bubble economy and its disastrous aftermath. It is clearly essential that Japan develops new industries, based upon new technologies, to produce world-class products of unquestioned value. And experience has shown that such new industries can best be created, not by giant companies building upon their established lines, but by university researchers, small and medium enterprises (SMEs), and individual inventors, pooling their creativity to come up with new ideas and new products. Expectations are thus high for Japanese start-up ventures.

Patents: Linking Technology, People, and Capital

Japan needs to foster greater entrepreneurship and the creation of new industries if it wants to break out of its current malaise and lay the foundations for the new millennium. But what is needed to encourage entrepreneurship and start-up ventures? There are three main factors.

The first thing is the new technology needed to enable the start-up company to produce new products. New technology can be likened to the seeds for new products, and the supply of this vital ingredient is crucial.

Second is the need to bring together outstanding people who share the dream of a better future. It is thus important to encourage greater cooperation between industry and academia and to instill a greater sense of entrepreneurial opportunity in all students.

Third is the need for capital, to ensure that the effort can go smoothly. Because this means procuring capital for projects that are just getting started, and may entail considerable risk, it is essential to attract money from a wide variety of sources and to mobilize all manner of private-sector funding.

It is patents that link these three elements - technology, people, and capital. Once a new technology is patented, it is possible for ordinary investors to assess the technology's merits and its potential. The patented technology is granted protection from knock-off or copycat technologies for 20 years. During this time, new products can be commercialized and the fledgling company can become well established, enabling investors to feel secure in buying the new firm's shares. And in the quest to assemble a strong team, the quality of applicants' patents is an important indication of their potential contribution to the venture. Thus, patents are an important means of linking technology, people, and capital.

Given that, how have patents actually been used in the establishment of start-up ventures in Japan?

Sakichi Toyoda: Japan's Premier Entrepreneur

Japan is home to many venture start-ups, but perhaps one of the most successful has been the Toyota Group. It was Sakichi Toyoda who planted the seeds that grew into today's Toyota Group. When the Japanese Patent Office commemorated its 100th anniversary in 1985, it drew up a list of Japan's top ten inventors of all time. Sakichi Toyoda led the list. His patent, (JP 1195, B) for an automatic loom, was crucial to Japan's development and provided a major impetus for its industrial revolution.

Sakichi Toyoda was born in 1867. Even as a child, he was very interested in inventing things. When imported machinery was being used widely throughout Japan, he developed a wooden loom powered by human muscle, as part of an effort to enhance the productivity and quality of the looms then in use and to get Japanese textile firms to use Japanese machinery.

In 1886, when he was going to night school, he heard of the new patent system that had been established the previous year. "This," he thought, "is a system designed to protect Japanese inventors. With these new rules, nobody can come along and steal a new invention that you have worked so hard to perfect. This is a system that will allow inventing to flourish in Japan. What a great idea!"

Even before he knew of the patent system, Toyoda had been working on developing his improved loom, but the system inspired him to new heights. He patented his new loom and then, building upon this foundation, began work on developing a machine-driven loom, starting with a machine-driven wooden loom and then moving on to a fully automatic version. This loom was able to hold its

own against the best that the rest of the world had to offer, and it was not long before he started exporting the equipment. Toyoda was one of the first Japanese to earn royalties from his patents.

Eventually, he had 84 patents and 35 utility model registrations. He was one of the first Japanese entrepreneurs to recognize the importance of patents and it is no exaggeration to say that patents changed his life.

Konosuke Matsushita and the Matsushita Socket

Konosuke Matsushita is another outstanding example of Japanese entrepreneurship. Even though he never got beyond elementary school, it was a diligent inventor and smart businessman who founded the Matsushita Group (Panasonic). Starting with his 1917 utility model registration for the Matsushita socket (a screw-in socket adapter that could take two light bulbs), he formed his own company to manufacture sockets. This company grew into Matsushita Electric Industrial and then blossomed into the Matsushita Group. Among Matsushita's many patents - about 100 in all - are the two-bulb screw-in socket, a battery-powered light for bicycles, an automobile headlight, and a square light bulb.

Matsushita had a very difficult youth. At 15, he went to work for Osaka Electric Light, working his way up from the line to become an inspector. It was while he was working as an inspector that he became acutely aware of the extra time and trouble involved in connecting to sockets, and realized the need for improved equipment to boost the factory's productivity. Thus it was that he set to work improving the socket. It was early in the 20th century that he learned the importance of patents.

Matsushita drew dozens of diagrams of sockets and produced large numbers of prototypes. It was a long and arduous process of trial and error before he hit upon the idea of a socket in which it was not necessary to wrap the wire around a screw. He took the idea to his superiors at Osaka Electric Light, but they only scoffed at it. So he decided to quit Osaka and set up his own company to manufacture the new sockets. But before he did that, there was one more thing he had to do - he had to file an application with the JPO to show all the world that he was the one who had thought of this improved socket. All too often, after someone has sweated and slaved to come up with a new invention or product, a larger company with greater capital resources moves in and steals the idea. The better the invention, the greater the danger; and the Patent Law is the inventor's only protection against such theft. Even though most people were then unconcerned with such matters, young Matsushita was very aware of this system's importance and promptly set to work drafting his patent application. The application was accepted by the JPO and four months later, in January 1917, Matsushita was notified that his new

patent had been granted. Only then did he quit Osaka Electric Light and devote himself to manufacturing the improved socket.

Even today, Matsushita companies carry on their founder's awareness of the importance of patents, and are active in filing applications and obtaining patents.

Masaru Ibuka: Student Inventor

Masaru Ibuka is famous as a co-founder of Sony. Yet he was also a good inventor, with 50 patents and 53 utility model registrations to his name. When Ibuka was still a student in the Waseda University science department, he was absorbed in research on changing the frequency of light with sound or an external voltage - work that led to the invention of a "running neon light" and a patent for a device to change the frequency of light rays. This neon light was demonstrated at the Paris Exhibition of 1933 and won a prize as one of the most outstanding inventions shown. A student who obtained outstanding patents, Ibuka was famous at the JPO as "the student inventor." In today's terms, his was a prime example of spinning off university research for commercial applications. Yet Ibuka was very much the exception, and there were few students who obtained significant patents at that time.

Following graduation, he planned to go into business for himself and to continue to pursue his technological bent and his interest in developing new ideas and concepts. During the war, he had to work on military research, but the specifications that came down from military headquarters were extremely detailed and left virtually no room for the technical people to exercise their ingenuity. This was a source of great frustration and in 1946, right after the war ended, Ibuka was quick to move - to establish Tokyo Tsushin Kogyo, predecessor to today's Sony.

Ibuka continued inventing for a long time. The next thing he invented and commercialized was an electrical heating unit. This sold very well, but the company later discontinued production, fearing that the lack of proper insulation and a thermostat might make it a dangerous product.

What really attracted global attention was that Ibuka was first in the world to use the transistor in an electrical appliance designed for ordinary household use. At the time, transistor production technology was still primitive, yield rates were very low, and transistors were not commercially produced. Even in the United States, they were only used in military equipment where cost was not a factor. Yet Sony acquired the rights to use the transistor technology. Again, this was very much like Ibuka - wanting to acquire the best technology no matter where it had been invented.

At the time Sony acquired the rights to the transistor, it was generally thought to be unsuitable for consumer products. But Sony applied its creativity and ingenu-

ity to the problem. Ibuka looked at the poor yield figures and decided that the first step was to improve production yields. He clearly had the engineer's mindset, and soon devised the necessary technical improvements to make it possible to use the transistor in general consumer products.

Ibuka produced Japan's first transistor radio, the world's first solid-state television, and numerous other innovative products which Sony then produced and marketed. Another project that took much of his time and energy was the development of the first tape recorder to be made in Japan. In a very real way, Sony was one of Japan's first postwar start-ups, and Ibuka was instrumental in making it a true multinational company. The development of color television technology was particularly arduous. Yet the company's very survival was at stake, and he pushed himself as hard as he pushed the rest of the technical staff, until they finally developed the Trinitron technology.

Even as a student, Ibuka had recognized the importance of patents. He was determined that Sony products should embody Sony technology and that their company would grow into a world-class organization. It is no exaggeration to say that this student inventor built Sony into one of the world's leading corporations. He was a co-founder, imbued with the spirit of the entrepreneur and fascinated by technological innovation. Even after he became president of the company, he declared that curiosity and the thirst for knowledge were the company's most important manufacturing resources. Ibuka wanted to be able to go down to the shop floor at any time, with the result that he always wore work clothes, not only in his office but even when he was meeting people from outside the company. Indeed, this was a tangible representation of his desire to never leave the world of technology, invention and patents.

Soichiro Honda: Inventor in the Shop

It was Soichiro Honda that Ibuka looked up to, as his surrogate older brother. Although Honda was only an elementary school graduate, he was very interested in technology, had a passion for inventing, and developed a number of world-class products. Using his patents as the foundation, he put a small start-up company together and was determined from the very first to make the world his marketplace. Honda is another of postwar Japan's pre-eminent success stories.

Founding his company in 1948, Honda started by putting a small military-surplus engine onto a bicycle. He attached an old metal hot water bottle as a gas tank and was on the way to producing mopeds. From that, he moved up to motorcycles and started to develop the best motorcycles in the world.

Early in his career, Honda set himself the goal of winning the world's most prestigious motorcycle races. At the time, there were about 100 Japanese compa-

nies making motorcycles, and Honda was one of the smaller ones. It was obvious that, if they expected to win, they would have to build better motorcycles. This meant getting complete combustion, to provide greater fuel efficiency. They asked around at universities all over the world, but nobody was studying gasoline combustion.

Pleased to find an opening, Honda set to work on combustion research. They studied spark plugs, valves, air/fuel mixture ratios, and everything else. This was pioneering research, and it contributed significantly to enabling Honda to sweep all five TT races on the Isle of Man in 1966 and to demonstrate Honda's technological supremacy. Honda also did important research and development into the metals used in motorcycles, and he later had the distinction of being the first Japanese to be made a life member of the American Society for Metals.

All the while, he was working on developing a lightweight motorcycle for the consumer market, and the result was the Super-Cub that Honda marketed so successfully. This lightweight motorcycle was very popular, not only in Japan, but also overseas, and it became a worldwide best seller. Spurred by Honda's success, the other motorcycle companies stepped up their research and development efforts until the Japanese industry was the global pacesetter.

Following the company's success with motorcycles, Honda went into passenger cars. In 1966, he took the initiative by becoming the first company to start work on meeting the stiff emission regulations, designed to cut down on air pollution. At the time, the U.S. Big Three automakers and the main Japanese automobile companies were saying that it was technologically impossible to meet the proposed standards. But Honda said, "This is when we should show them what we can do. I want us to be first in the world to meet the standards." Driven by a sense of mission "for mankind's sake," Honda startled the rest of the world when it became the first to develop a compound vortex controlled combustion (CVCC) engine, which provided low emissions and good mileage. When other automakers came to Honda seeking to license the technology, Honda declared that air pollution was not just a Honda problem - it was a global problem - and quickly made the technology available to other companies, to help curb automotive exhaust emissions.

Over the course of his life, Honda was awarded 115 patents and 359 utility model registrations. Among his many famous comments regarding inventing are:

- "Inventing is pure sweat. But thinking of new things is a joy."
- "Man is an animal who evolves and progresses through inventions."
- "Go to the shop floor. Use your hands, your body, and your mind. If you do, wisdom will follow."
- "Doing things yourself: that is crucial to inventing."

- "Patents are a blend of ideas and timing."
- "The world of invention is a world of pain. Yet it is the exquisite pain of achievement."

Even today, Honda's spirit lives on in his company, and the company has continued to grow, through technological innovation and patents, until it now has sales of about 27 billion dollars per annum and employs nearly 29,000 people.

2.4 Patents' Asset Value

What is the total asset value of all Japanese patents? The total asset value for all of Japan, measured in terms of national wealth, is estimated at about 29 trillion dollars. Because the asset value of patents is not included in this figure, it has to be calculated from total spending on research and development and other relevant data - which gives a rough value of 872 billion dollars. This is equivalent to about 3% of national wealth.

In the past, national wealth was generally said to be largely the total value of land, but people no longer believe that land prices will go up forever and Japan has gone off what might be called the land standard. It is thus crucial for Japan that it further enhances the value of its patent assets.