Chapter 5

JAPANESE PATENTING – AN OVERVIEW

Chapter contents:

5.1 Chapter outline

As a continuation of the historical overview in Chapter 2, this chapter will give a brief history of patenting in Japan. Against this background of patent systems in the East and West, we shall then compare the different patent systems in Europe, Japan, and the USA. A sample of 24 large Japanese corporations will provide further comparisons, adding statistics and trend assessments as a basis for subsequent chapters.

5.2 Background

Japan's techno-economic developments since World War II have caught the whole world, including Japan, with stunning surprise. This is so, even in light of her crisis of the late 1990s. Japan's rise to a leading nation in many technological and business areas sent great technological and economic, as well as political and psychological, repercussions around the world. This is not the place to elaborate in any depth upon the causes and effects of Japan's successful techno-economic developments, but a few reflections are in order.[1]

The so1990s seemed to be a period of crossroads and confusion in Japan. Having by and large completed the catch-up process in many areas, new challenges increasingly arose as competitiveness became more dependent upon innovativeness. A long period of stable prosperous growth was moreover disturbed by a deep and prolonged recession after the collapse of the bubble economy. However, in a longer time perspective, Japan's success is indisputable and the recession in the 1990s may very well be seen in retrospect as having strengthened her industry. [2]

Japan herself cannot explain her success clearly. To what extent Japan's success can be

[1] Needless to say, numerous scholars have elaborated on the causes of Japan's techno-economic success, especially in the post-war period. For some references, see Chapter 6.

[2] The recession was no doubt the most serious one in the post-war period, and caused a great deal of soul-searching, analysis and attempts to reform. Many possible causes (like the financial system, the political system, etc.) and consequences have been pointed out, ranging from ultimate decline to radical crisis-induced renewal.

attributed to a small set of explanatory factors, as some analysts claim, or to a large eclectic set of factors related to Japanese culture, institutions, government policy, technology, management capability, etc. is unknown and will probably remain so. Moreover, Japan has not been accustomed to be in a leadership position (just as the USA is unaccustomed to not being in one). There still seems to be some lack of self-confidence in Japan, not the least among the old generation, for example regarding Japan's possibilities to make significant progress in basic science and radical creative and innovative work. On the other hand, there has been a significant generation shift among managers in Japan, as in all countries damaged by World War II, and changes in life-styles and values in the Japanese elite could lead the relatively collectivist and homogeneous Japanese society in new directions. This shift could create self-content and hubris[3]. On the other hand, a sense of insecurity (”fuan”) is deeply engrained in Japanese society.

It has not become clear, at least not to an outsider, how Japan, with the world's second largest economy, will use her economic surplus, which at some point became the largest that was ever amassed by a single country in history. The choice of different investment strategies in industry and government will also push the country in new directions. Despite the long-run appreciation of the yen with some periods of strong appreciation in the 1980s and 90s, there was no correspondingly strong wave of outward foreign direct investments, although Japanese FDIs certainly have grown considerably in the past few decades.[4] An inhibiting factor here may have been Japan's self-perceived lack of experience in managing international relations. However, over the long run, there have been strong investments in education and R&D at many levels, including a build-up of substantial R-capabilities (rather than only D) since the 1980s. This build-up within Japanese industry has created a ”research industry” with the world's largest civilian R&D community, which at some point owned almost half of the

[3] ”Hubris” was a deadly sin in Greek mythology, severely punished by the gods. This is a variant of the ”success-breeds-failure” syndrome.

[4] For an interesting analysis of the causes of this appreciation, see McKinnon (1996, 1997), attributing a substantial role to self-serving interventions in the USA.

world's patents.[5] At the same time, almost every major company has invested in the diversification of both products and in-house technology. Moreover, Japan has been and still is significantly acquiring inputs from the world's S&T system by various means, not only through technology intelligence and licensing, as traditionally done, but increasingly through acquiring stakes in small innovative companies in the West, joint ventures and utilization of Western universities. Japan's industrial R&D is therefore becoming increasingly internationalized (see further Granstrand 1998).

It remains to be seen whether Japan will follow the all too common pattern of Western nouveaux riches – to make bad investments, thereby breeding failure from success. In one way this has already happened in the Japanese "bubble economy" of the late 1980s and early 1990s with financial and real estate speculation. Conceivably, there is even a risk of over-investment in R&D, at least in certain areas – given the nature of Japan's science and technology system with research-weak universities, semi-public governmental R&D and large, fiercely competing corporations. These corporations, through long-time employment, employee loyalty, special norms of communications and other means, have been in a position to appropriate returns from investments in R&D, perhaps to a larger extent than Western corporations. At the same time as the corporate innovation systems have become strong in some key sectors, there remain substantial weaknesses in the Japanese innovation system as a whole, e.g. a weak entrepreneurial function with weak financial markets for risk capital and various strong rigidities in the educational and political systems.

Japan, with her lack of natural resources, is economically dependent upon her R&D and innovativeness, perhaps more than any other country in the world, and is becoming increasingly so. Moreover, since her R&D is predominantly civilian and concentrated in large corporations, protecting and commercially exploiting this R&D effectively becomes of utmost

[5] For the account of the build-up of R&D in industry, see Kodama (1995), who also describes how investments in R&D surpassed capital investments in large, Japanese corporations in the mid-1980s. See also Chapter 1. The severe recession or crisis in the late 1990s does not seem to have led to severe cuts in corporate R&D, while businesses have been divested and diversifications have been reconsidered. The crisis calls forth structural changes, that very well may strengthen large parts of the corporate sector in the long run. Some observers even refer to the crisis as a "happy crisis", although incurring substantial sacrifices.

concern; in fact, it is an issue of national economic security.[6] Consciously building and exploiting intellectual capital requires suitable economic institutions, such as industrial corporations (especially multi-national and multi-product corporations), national R&D institutes and projects, and a strong IPR system. Against this background it is quite natural that patenting and IPRs are of importance for Japanese industry, not only for large companies, but also for small ones which will become increasingly necessary in the future as an instrument to bring out innovations.

5.3 Historical overview of Japanese patenting

> We have looked to see what nations are the greatest, so that we can be like them. We asked ourselves ”What is it that makes the United States such a great nation?” We investigated and found that it was patents, and we will have patents.
>
> K. Takahashi
> First Director General of JPO, appointed 1885

In the era since industrialization took off in Europe, Japan like no other major country, has swung from extreme isolationism under the Tokugawa military rule to extensive international engagement. The turning point was the proclamation in 1868 of the Meiji restoration (or rather ”renovation” in Japanese). Although Japan’s transformation and techno-economic achievements since World War II are remarkable indeed, the pendulum’s momentum and pace of change were probably higher a century earlier. The long preceding period of isolationism, which lasted for more than two centuries, probably also paved the way for its contrary movement to some extent. The foundations of many current practices in Japan were in fact laid in the decades after Meiji (e.g. wearing Western suits,[7] competing fiercely in industry). Japan’s willingness and ability to absorb foreign things without being culturally

[6] Some would also argue that economic strength tends to lead – by design or default – to the build-up of military strength in one way or another; see Samuels (1994).

[7] Ueda (1994, p. 111).

subdued have been remarkably high ever since. This has indeed been the case regarding foreign technology. While the Tokugawa dynasty tried to perpetuate its power by preserving the status quo – including forbidding technical innovations[8] – the absorption, development and control of new technologies are at the heart of modern Japan's policies for establishment of her power and economic security in the world economic order. Thus, the course of isolationism and technological stagnation has been reversed with Meiji as a turning point.[9] To a considerable extent, new technologies also brought about the Meiji restoration. The superiority of US military technologies, dramatically demonstrated by Commodore Perry when his naval ship prompted Japan to open up in 1852, had a profound effect on Japanese leaders,[10] just as the superiority of US military and industrial technology had on the formation of Japanese post-war policies.[11]

Japan has centred her economic development around intellectual resources (intellectual capital), especially in science and technology. Thus, in the MITI vision of the "Strategy for Trade and Industry" in the 1980s, it was proclaimed that Japan should now establish herself as a Technological State, having succeeded in establishing herself first as a trading nation and later on as an industrial nation. Japan has become a symbol of what some authors label "techno-nationalism" (for this concept, see Nelson and Rosenberg 1993, p.3, and also Ostry and Nelson 1995).

It is to be expected that a nation lacking natural resources but aspiring to modernize will

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[8] One may observe that the Tokugawas' perception of the power-disrupting effects of new technologies was correct, although not their hopes for eternal control of technological change in a small part of a world that was after all essentially an open, globalizing system.

[9] This is not to suggest a simple "open-the-lid" kind of explanation, saying that the catch-up would owe its rapidity to the release of pressures for change built up during a long period of stagnation.

[10] See e.g. Francks (1992, pp. 25-26).

[11] A recent, and so far history's perhaps largest, example of the disruptive effects of technological change upon political structures is the downfall of the Soviet empire, following upon a short period of desperate high-level attempts to catch up through reconstruction from within ("perestroika"). It is interesting to speculate over why the technological and industrial catch-up process of the former USSR (it was in fact a catch-up process) initiated in the mid-1980s was derailed and did not succeed while catch-up processes in other regions and periods have succeeded (e.g. Japan and 19th-century USA). E.g. "glasnost" (i.e. openness, no secrets) was a radical shift away from an extremely secretive regime and perhaps counteracted its purpose of serving "perestroika".

sooner or later emphasize intellectual resources and their property protection as indigenous S&T achievements start to become relatively more important. Concomitant with Japan's techno-economic developments since the Meiji restoration has been the introduction and development of an IPR system, including a patent system, patterned on Western systems. An excellent account of these developments is given in Rahn (1983). A chronology is given in Table 5.1. One may note the early introduction of an IPR system and the continual developments of it in compliance with international legal developments as well as with domestic industrial developments. Certain asymmetries with other countries have been kept from time to time in order to favour domestic industry and its build-up of a technology base. However, a large number of licensing contracts were signed after World War II, which in retrospect proved to be a considerable bargain for the Japanese (by some called "the greatest bargain ever").[12]

In general the IPR system in Japan came into extensive use in the post-war period as one of the means for catching up and forging ahead. This was accomplished through the analysis of existing patents, licensing in and improving imported technologies, mostly through many small improvements that were readily and extensively patented.[13] Throughout this process, patent managerial skills, resources and methods were developed, as will be

[12] This does not mean that all technology has been acquired by Japanese industries in ways that could be called proper and fair by Western industries. However, much of the subsequent resentment and bashing of Japan for stealing Western technology has been exaggerated. Western industry has, in fact, had a weak protection of its technology by patents and secrecy in the post-war decades. There are many stories of Western companies opening their doors for Japanese visitors, proudly showing them their technologies; companies fumbling with their secrets and companies with weak or no enforcement of their patent rights, and so on. (Motorola, for example, was prior to the mid-1980s called "the sleeping giant" in Japan since it had many good patents but did not enforce their rights.) Some US technology was also diverted to Japan through anti-trust action, forcing US companies (e.g. Xerox) with a strong patent-based monopoly to sell licenses cheaply. The latter had more to do with US concern over potential cartels cheating US consumers than concern over Japanese companies potentially cheating US industry. (According to Prof. M. Scherer at Harvard, who was involved in the Xerox patent licensing decree, US authorities had no idea the Japanese firms would enter the copying business so quickly, but had they known, they would probably not have changed policy.) Nevertheless, there is evidence of Japanese misbehavior as well (e.g. the case of Hitachi spying on IBM in the 1980s) and any verdict must be mixed.

[13] For some further readings, see Borrus (1990), Odagiri and Goto (1993), Foray (1994), Yamaji (1997), as well as Ordover (1991), pointing at the conduciveness of Japan's patent system to licensing and cross-licensing, and Aoki and Prusa (1995) pointing at the conduciveness of Japan's patent system to smaller quality improvements.

described in later chapters. Also, Japan has in various governmental and private ways supported the ongoing international harmonization of IPR laws. However, while one may say that large parts of Japan's industry have become leaders in patenting and IP management, Japan has not been a leader in developing the basic IPR legal framework.[14]

[14] Some efforts have been made, however. For example, a Japanese proposal was made in the 1980s for a new (sui generis) law for protecting computer software, a proposal that was dismissed by the USA. (See Samuelson 1993 for more details.)

Table 5.1 Chronology of the evolution of the Japanese IPR system until 1980

Year(s)	IPR-related event
1603-1868	The Tokugawa period with military rule and feudal system under the Tokugawa family.
1633	Adoption of a policy of national seclusion.
1718	The proclamation of a new law, which forbade ”new things”, i.e. technical innovations (Shinkihatto no ofuregaki – ”Ordinance Prohibiting Innovations”).
1852	Commodore Perry visits Japan, leading to the re-opening of the country.
1867	Yukichi Fukuzawa[1)] reported on the existence of patent laws in the US and Europe.
1868	Proclamation by Emperor Meiji of the modernization of Japan (Meiji ishin – ”Meiji Renovation”).
1871	Promulgation of the first Japanese Patent Law. Failed in the absence of applications for a whole year and was abrogated.
1884	Promulgation of the first Japanese trademark law.
1885	Promulgation of the Patent Monopoly Ordinance, modelled on American and French law, after extensive preparations by Korekiyo Takahashi (who later on served as Finance Minister (twice) and Prime Minister). However, foreigners were barred from obtaining patent rights.
1885	Establishment of the Japanese Patent Office. K. Takahashi became its first Director General.
1886	1384 applications were filed and 205 patents granted.
1888	Improved patent and trademark laws replaced the first ordinances. Promulgation of a design ordinance, modelled on English law.
1899	Japan became a member of the Paris Convention for the Protection of Industrial Property which had come into force in 1883. Foreigners became admitted to the Japanese industrial property system.
1905	Enactment of a Utility Model Law, inspired by German law.
1909	Revision of the four industrial property laws: the Patent Law, the Utility Model Law, the Design Law and the Trademark Law. A new section on employee inventions stated that the patent right belonged to the employer.
1921	Grand-scale revision of IPR laws, introducing novelties, such as first-to-file priority instead of the first-to-invent priority, employee ownership of patent rights instead of employer ownership, and an opposition system.

1935	Law for the Prevention of Unfair Competition entered into force, together with the ratified Hague revision from 1925 of the Paris Convention.
1938	Establishment of Japan Patent Association, an organization of leading Japanese companies.
1950	”Foreign Investment Law” and the ”Foreign Exchange and Foreign Trade Control Law” were enforced to regulate technology imports and foreign exchange for the reconstruction and renovation of Japanese industry. A period of substantial technology imports started, mainly from the USA, but also from Europe.
1958	Japan becomes the leading country in terms of number of patents and utility model applications filed per year. (A position retained since, as of 1995.)
1960	Enactment of revised IPR laws. Special injunction and damages as remedies for infringement were introduced.
1971	Revision of the Patent Law, allowing seven years for the request for examination and laying-open of the application.
1974	Liberalization of technology imports.
1976	Adoption of the product patent and the multiple claims system (although allowing only dependent sub-claims).
1978	Japan acceded to the PCT, and JPO became one of the international searching authorities under the PCT.

Sources: Compiled from Doi (1980), Rahn (1983), with the assistance of A. Mifune and K. Norichika.

Note:

1) See a 10 000-yen bill for his picture.

Around the turn of the millennium Japan has amassed substantial financial resources by world standards and also controls considerable physical resources through foreign direct investments, foreign holdings and other means. Still she is more dependent upon her intellectual capital (including goodwill and ”relational capital” in relations with her neighbours) than most countries and regions of the world. IP has also become recognized as an issue of economic security at the national level in the same way it has been recognized as an issue of corporate economic security in several large corporations.

The developments in the IPR systems and IPR relations between Japan and the USA are summarized in Table 5.2.[15] In the 1980s, patent-related trade friction between the USA and Japan grew to what some observers later termed a ”patent war”.[16] The following citation illustrates the kind of patent and litigation strategies advocated by a major newspaper in the ”patent war”.

> What should our attitude be towards the raging patent war between Japan and the U.S.? First, in the light of the history of patent wars, there is no alternative but to fight patent with patent. Needed in this process are expediting technological development, establishing as many patents as possible and securing cross-licensing contracts to offset patent royalty payments. To these ends, joint technological development may be considered by leading manufacturers of this country, the U.S. and Europe. ...
>
> Second, in its patent wars with the U.S., Japanese industry should openly seek court decisions on the rights and wrongs of each case and avoid out-of-court settlements as much as possible. ...
>
> Third, the Japanese government should strive to reconcile institutional differences in patent applications that exist among Japan, the U.S. and Europe. ...
>
> Editorial, Mainichi Daily News
>
> March 31, 1992 (excerpts)

It is particularly noteworthy that the editorial above advocates the avoidance of out-of-

[15] See Chapter 2 about the background developments in the USA. See also Collins and Bosworth (1994) and NAS (1994).

[16] See Warchofsky (1994).

court settlements, which traditionally have been the preferred mode of patent conflict resolution in Japanese industry for cultural reasons. To some extent Japanese corporations became reactively litigious and aggressive in court (with the aid of US lawyers). Goals were set up in some cases to win patent disputes with US companies in order to win demonstration effects, prestige and self-confidence. All in all, however, the warfare aspect was a bit overplayed by the popular press[17] and gradually the feelings of animosity declined somewhat after a peak in the early 1990s.

[17] Nevertheless, it should be noted that US litigation language traditionally contains war terms and metaphors, just as the management field has borrowed concepts as well as methods from the military field. Cf. the expressions common in legal circles ”to wage a battle”, ”defendant”, ”business intelligence”, ”competitive strategy”.

Table 5.2 Chronology of the evolution of the IPR system in Japan and the US (1980-1995)

	Japan	USA
1980		US Copyright Law amended
		Chakrabarty case (microorganism patent)[1]
1981		Diehr case (computer program)[2]
1982		CAFC[3] established
1983		Patent Commissioners' trilateral conference started
1984	JPO "paperless project" initiated	
1985	Maskwork Law enacted	WIPO Harmonization conference
	Copyright Law amended (computer program)	USITC litigations increased
1986	TI semiconductor patent litigation initiated at USITC[4]. Kilby patent granted[5]	GATT TRIPs started
1987	Patent Law amended (refined multiple claims system introduced)	
1988		US Trade Act (Special 301)
		US Tariff Act 337 amended
1989	Copyright Law amended (fair use)	Japan on Watch List of Special 301
1990	Unfair Competition Protecting Law amended (trade secret)	
1991	Trademark Law amended (new service mark registration system introduced)	
1992	Honeywell won patent litigation against Minolta	US Patent Law reform report
1993	Patent Law and Utility Model Law amended; Unfair Competition Protecting Law amended	GATT TRIPs completed
1994		US-Japan Patent Commissioners'
		Understanding signed

Source: Mr. K. Norichika and the author.

Notes:

1) The patentability of a bacteria genetically engineered by A.M. Chakrabarty was finally decided by US Supreme Court, overruling USPO's rejection of the patent application. This decision opened the possibility to grant patents for living organisms.

2) A US Supreme Court decision, which through its interpretation by USPO opened the possibility to grant patents to computer software.

3) CAFC = Court of Appeals for the Federal Circuit.

4) Texas Instruments claimed eight Japanese and one Korean company infringed on 10 of their patents for DRAMs (see Warchofsky 1994).

5) In 1961, Texas Instruments had filed the patent in Japan for the integrated circuit, called the "Kilby patent" after its inventor Jack Kilby. JPO required the application to be divided into several parts, the first of which was granted in 1977.

5.4 Present (1995) Japanese patent system in international comparison

As described in Chapter 3, the basic design idea of any patent system is that society promises an individual or organizational inventor enforcement of limited but transferable monopoly rights in exchange for disclosure of the invention, provided it fulfils certain requirements (being technical, novel, and non-obvious). Society's purpose for providing such a transaction possibly is to stimulate both the development, commercialization and disclosure of new technologies.

This design idea is fairly simple but nevertheless opens up numerous national variations of patent systems in practice. Nations strike different balances between societal interests and individual interests (cf. Chapter 1), depending upon cultural and economic traditions as well as upon their stage of development. Certainly in Japan the IPR system and its enforcement practices were adopted and modified in the interest of catching up technologically with the West. The determination with which the Japanese IPR system has been used for the purpose of catching up has apparently been much stronger in the past than the determination in the USA and Europe to use their IPR systems to preserve their once undisputed leading roles in technological development and commercialization.[18]

The question now arises of what will happen with the IPR system in Japan and elsewhere when Japan adopts the role of one of the leading nations in a wide range of technologies. At the same time, the USA, to a certain extent, and particularly Europe have been falling behind in several areas, although the USA has forged ahead in some broad areas as well as regained some leads in the 1990s. All in all, everyone has to realize that a mix of catch-up and innovative behaviour is needed to compete based on increasingly interrelated and expensive technologies in an increasingly integrated international economy. There is much pressure for international harmonization if IPR systems, but the national differences in the leading triad are still substantial, as evidenced by Table 5.3. Moreover, there are deep cultural differences underneath, e.g. a higher emphasis on individual rights and court

[18] Developing countries have been criticizing Western patent laws for overly favoring countries which are technical leaders. This may be a valid criticism, but nevertheless Japan presents a case of catch-up, being nurtured by an IPR system aligned to – but not identical with – Western patent laws. At the same time it should be kept in mind that the IPR system in Japan has been used in conjunction with various national protectionist measures.

resolution of conflicts in the West as opposed to more collectivist thinking and concern for harmony and consensus-seeking in Japan. (See e.g. Helfgott 1990.) Nevertheless, the business forces for international harmonization are strong, and it is likely that they will succeed as internationalization of S&T in general proceeds. This is highly desirable for the efficiency and promotion of S&T, as well as for internationalization in general (see Chapter 10). It may also be argued that for Japan's catch-up, the IPR system has worked well, partly because of the lackadaisical use of it in the West. However, it may not work equally well for other countries wanting to catch-up in future technologies, including Western countries that are behind or have fallen behind. The Japanese success has led the USA to strengthen its IPR system to make similar successes harder to achieve. At the same time other leading countries, including Japan, share such interests, as illustrated by Japan's tough attitudes towards South Korean requests for Japanese licenses. Some even argue that the Japanese success has "closed the window" for those developing countries that want to catch up.

5.4.1 Problems with international patenting

As Table 5.3 shows, the Japanese patent system is more similar to the European system than to the US system. Some observers also believe the US system is the one that will change the most in the harmonization process. However, the present assertiveness in the USA regarding patents leaves some doubts about this. The adoption and development of an IPR system in China and in the former USSR will of course be important in this context.

First to file vs. First to invent

Differences in national patent laws as illustrated in Table 5.3 create various problems in international patenting, sometimes resulting in friction in international relations as well. In particular, the "first to invent" priority rule in the USA creates problems when confronted with the "first to file" priority rule in Europe and Japan. Naturally, the one who is first to invent may differ from the one who is first to file a patent application, so problems to determine who has priority to an invention may occur in international patenting.[19]

[19] From time to time it has been hypothesized that the USA would sooner or later yield to the pressure to adopt

Table 5.3 Comparison of patent laws in Japan, Europe and the United States (as of 1997)

	Japan	**Europe** (EPO, EC)	**United States**
Priority ground[1)]	First to file	First to file	First to invent
Filing	Inventor or assignee	Inventor or assignee	Inventor only[2)]
Grace period[3)]	Limited to 6 months prior to national filing date		One year prior to US filing date
Whole contents prior art effects[4)]	From convention filing date[5)] a) Secret prior art for novelty b) No secret prior art for obviousness	From convention filing date[5)] a) Secret prior art for novelty b) No secret prior art for obviousness	From national filing date[5)] a) Secret prior art for novelty b) Secret prior art for obviousness
Patent lifetime	15 years from publication date but not exceeding 20 years from filing date	20 years from filing date	20 years from filing date
Laid-open publication	18 months from filing	18 months from filing	No[6)]
Subject matter excluded from patenting	-Substances manufactured by the transformation of the atom -Inventions liable to contravene public order, morality or public health	Required -Plant or animal varieties[7)] -Essentially biological	-Nuclear weapons -Inventions liable to contravene public order, morality or public health
Patent term extension or restoration[8)]	Patent term extendible for some products subject to approval at most 5 years	Patent term extendible for some products subject to approval at most 5 years	Patent term extendible for some products subject to approval at most 5 years
Opposition[9)]	Post-grant opposition (within 6 months after the publication of granted patent. Evidence added within 3 months after filing opposition.)	Post-grant opposition (within 9 months after the publication of granted patent)	No opposition system Post-grant reexamination (without argument)
Deferred examination[10)]	7 years from filing date	6 months from publication of search report	No deferred examination

cont'd)

the first-to-file priority rule while retaining some other unique feature as a compromise. However, there are no signs at present (1998) that this will take place in the near future. For a qualitative comparison of the first-to-file and the first-to-invent rule and an advocacy of the latter, see Kingston (1992), and for a theoretical comparison with a certain advocacy of the first-to-file rule, see Scotchmer and Green (1990). Systematic empirical research on the issue is lacking, however.

(cont'd)

Allowance for amendment[11)]	Restrictive amendment practice (more severe under the latest revised Patent Law)	Most strict amendment practices (although applicants can oppose their own applications to amend them)	Liberal amendment even after final rejection and final allowance
Claiming practices[12)]	Limitation in claiming practices	Strict claim form, but liberal claiming including dependent claims referring to other dependent claims	Permit any number of independent and dependent claims, separately enforceable. Permit means plus function claims
Claim interpretation	Comparatively narrow interpretation	Leaning to broad interpretation	Broad interpretation
Language of application[13)]	Japanese English	English, French or German	Any language acceptable, formal specification in English requested later

Source: Original material for this table has kindly been provided by Prof. A. Mifune. The table has been updated to be valid as of Dec. 31, 1997. Minor qualifications and exceptions may apply.

Notes:

1) That is the ground for deciding who is first and therefore has priority to an invention.

2) Assignee in certain limited situations. However, assignees do a large part of the filing work in general.

3) That is, the period before patent filing date, during which the invention may be publicized without violating the novelty requirement.

4) That is, whether prior art in information in submitted, but yet not published patent applications, can be taken into account when assessing whether the novelty and non-obviousness requirements are fulfilled. Secret thus refers to non-published information in patent applications.

5) That is, the date for filing in a country which is a member of the Paris Union, comprising all countries which have signed the Paris Convention.

6) Laid-open publication was adopted 1995 in the context of GATT, but the final adoption has been delayed.

7) A change has been proposed and the nature of the requirement in unclear.

8) This is of particular importance for the pharmaceutical industry.

9) That is, of third party.

10) This refers to the possibility of the patent applicant to request a postponement of the patent examination procedure of the patent office.

11) That is, possibility for the applicant to make amendments to the application after filing date.

12) That is, to what extent the inventor can make different claims in the same patent application regarding the functionality and performance of the underlying invention and its possible sub-inventions.

13) Most signatory nations require a patent to have its document finally written in their own language to be valid.

Submarine patents

The previous absence of a laid-open publication (i.e. an open, pre-grant publication) of patent applications in the USA has created problems in the past with so-called ”submarine patents”, i.e. inventions made early that show up unexpectedly at a much later date when finally granted patent rights.[20] This possibility in the USA for keeping an invention secret while being processed by the USPTO has been notoriously exploited by a few inventors who by various means have been able to prolong the patent examination process.[21] Meanwhile, other companies may think the area is clear from patents, and some company may even come up with a related invention, for which a patent is granted in some other country. Thus, other companies are inclined to go ahead with R&D, production and marketing in the area.[22] Finally, the submarine patent surfaces and, to the extent that infringement is feared or has occurred, it enables the patent holder to collect royalties or damages.[23] It should be noted, however, that cases like these have been rare (although notorious), and that inventors blatantly exploiting this opportunity could lose the patent rights or the right to sue.

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[20] A further step towards international harmonization has been taken in the context of GATT, as the USA has agreed to adopt laid-open publication, thereby eliminating ”submarine patents” (although not yet enacted in 1997).

[21] One way to do this is to withdraw the application temporarily in order to modify and/or add patent claims in it.

[22] This is sometimes referred to as ”letting the pig grow” from the point of view of the ”submarine patentee”. One way to limit this possibility is to have a limited time for litigating against a clearly detectable infringer.

[23] An often quoted example of a submarine patent is the Lemelson patent. This patent, covering some methods and devices for automatic analysis of electronic images to detect product defects for instance, was filed December 24, 1954 and granted September 1, 1992, thus being ”hidden” for 38 years. Other examples are the Gould patents (for lasers, being used in semiconductor manufacturing), filed in 1959 and granted in 1987, and the Hyatt patents (for microprocessors), filed in 1969 and granted in 1990. Totally 109,728 patents were issued in the US in 1992, and of these 623 had been filed at least 10 years earlier, i.e. about half a percent.

It must be kept in mind, however, that on the surface this practice of creating submarine patents was legal in the USA, although not clearly in the spirit of patent laws. As a patent strategy, it has presumably paid off well in several cases and it has also been used by companies since long (see e.g. Vaugham 1925). The new amendments to the US patent statute in connection with GATT agreements will provide for publication of pending US applications and thus make the submarine patent strategy less effective. Still, however, claim refinements or new claims within the scope of the patent application could be filed at a later date before issuance of the patent. Thus, time limited submarine claims are still possible (Glazier 1995).

Kilby patent

A third type of problem arises from old inventions that finally are granted patent rights. The delay may be due to excessive nursing of the patent application as described above or some other procedural matter, such as deferred examination in Japan. A case in point is the Kilby patent.[24] This patent was used by Texas Instruments in their offensive move in the mid-1980s to enforce their patent rights through drastic royalty increases and litigation.[25]

International friction

Problems like these and other types naturally occur as a result of incompatible and/or imperfect patent laws. As the pro-patent era has emerged these problems have become more serious and visible and soured relations not only among companies, but also among countries, notably between the USA and Japan.

Seen in a historic perspective, such international friction arising in connection with the patent system is not surprising. Patent laws were originally adopted and adapted to suit national interests, such as the stimulation of technological catch-up with other more advanced nations at the time. Foreign discrimination was partly built into the patent system and its operations, and is still present to some extent.[26] International cooperation and treaties have served to eliminate foreign discrimination[27] and increase international harmonization, but this process is painstakingly slow as technical gaps proliferate, leaving much to be done.

5.4.2 Strengths and weaknesses of patent systems

In viewing the effectiveness of the patent system, one must consider all of its constituent parts in a society. These parts are considered to be 1) legislation per se, including provisions for

[24] The Kilby patent concerned the invention of one version of the integrated circuit made by Jack Kilby in the late 1950s at Texas Instruments. Almost at the same time, Robert Noyce, later co-founder of Intel, invented another version of the integrated circuit, solving the problem of interconnection. (See Warchofsky 1994, p. 112-113.)

[25] See Warchofsky (1994) for details.

[26] See e.g. Kotabe (1992) who found discriminatory practices in Japan, as well as in the USA and Europe against foreign patent applications. US patent laws have also discriminated against foreign inventors to some extent.

[27] An example is the Paris Convention of 1883.

change in legislation; 2) law adherence by the public at large in the society; 3) law enforcement provisions (which may be unsatisfactory) by policing and prosecuting functions; 4) court practices and finally 5) penalty provisions or a corrective and preventive system in general. Public bodies perform legislation and court practices, while companies must carry out the policing and prosecution by themselves. This does not need to be the case, however. Subject to the law in general, private companies could form associations for IPR protection with their own additional rules, and policing and prosecution could conceivably be carried out by public or semi-public bodies.[28] The question of how to mix public and private functions for upholding an effective IPR system as a whole is important and interesting, but nevertheless must be left aside here.

Table 5.4 shows the perceptions in large Japanese companies of the strength of the different constituent parts of the patent system in Europe, Japan and the US. As seen in the table, the perceptions of the protective strength differ widely for these three regions, and the perceptions differ across industries as well. In general, Europe ranks highest, showing significant differences with the USA regarding legislation and law adherence, but insignificant differences regarding court practices on average. However, the industry differences are large, especially for the USA, with the electrical industry deviating the most. The most likely reason for this is the wave of litigation from US firms, or in other terms the ”patent war”. This has particularly struck the large electronics companies in Japan, creating many hard feelings against US firms and the way the patent system functions in the USA. Court practices that are perceived as discriminating against Japanese companies, e.g. through jury verdicts, naturally lead to a feeling in Japan of inadequate protection in the USA. That is to say, Japanese companies feel they have inadequate protection against US patentees claiming infringements rather than inadequate protection of Japanese patentees against their infringers. Thus the table’s subjective perceptions must be interpreted very cautiously. The answers to the second question (coded F12b) in the table could, however, be taken to indicate the emergence of a pro-patent era across regions and industries in the 1980s, especially in the

[28] A case could develop for fighting intellectual piracy in parts of Asia.

USA, and especially felt in the electronics industry.

Table 5.4 Strength of patent systems in Europe, Japan and the USA as perceived by large Japanese corporations

(Scale: False = –2, –1, 0, +1, +2 = True)

(Code) Proposition[1)]	Chemical (n = 9)	Electrical (n = 10)	Mechanical (n = 5)	Tota[2)] (n = 24)
(F12a) The patent laws in Europe, Japan and the US provide adequate protection through:[2)]				
Legislation in Europe	1.25	0.86	0.50	0.95
Legislation in Japan	1.11	0.88	0.00	0.77
Legislation in USA	0.50	-0.38	0.60	0.19
Law adherence in Europe	1.00	1.00	1.25	1.05
Law adherence in Japan	0.89	0.63	0.40	0.68
Law adherence in USA	0.63	0.13	1.20	0.57
Law enforcement in Europe[3)]	0.50	1.00	1.25	0.84
Law enforcement in Japan	0.33	0.75	0.40	0.50
Law enforcement in USA	0.88	0.00	0.80	0.52
Court practices in Europe	0.50	0.57	0.25	0.47
Court practices in Japan	0.56	0.63	0.00	0.45
Court practices in USA	1.00	–0.63	0.75	0.33
Infringement penalties in Europe	0.63	0.86	0.50	0.68
Infringement penalties in Japan	0.33	0.63	0.00	0.36
Infringement penalties in USA	1.00	–0.25	1.00	0.52
(F12b) The patent protection has grown stronger over the last decade as a means of protecting new technology on:				
The European market	0.88	1.00	0.60	0.87
The Japanese market	1.00	1.10	0.60	0.96
The US market	1.56	1.80	1.80	1.71

Notes:

1) The proposition roughly as it appeared in the survey questionnaire together with its question or variable code. (See Appendix B for the complete questionnaire.)

2) The sample of 24 large corporations consists of 9 mainly chemical ones, 10 mainly electronic ones and 5 mainly mechanical ones. See Appendix B.

3) Enforcement here refers primarily to enforcement through policing and prosecution.

5.5 Japanese R&D and patenting in international comparison

5.5.1 Growth of R&D and patenting[29]

In most industrialized countries industrial production and R&D have grown and become steadily more internationalized, especially after World War II. In the last decade or so, it has also become more common among advanced industrial companies worldwide that their R&D investments surpass their physical investments. Since patenting is closely linked to R&D (which in turn is linked to company sales), one may also expect that patenting has grown on average and become more internationalized. Table 5.5 shows this to be the case. On average the growth rate is highest for external or foreign outward patenting (that is patents extended to foreign countries by domestic residents), followed in falling order by inward foreign patenting (that is domestic patents taken out by foreign residents), R&D expenditures, industrial production, and finally domestic patenting with the lowest growth rate. Thus international patenting has grown faster than R&D and production, while domestic patenting shows only a modest growth on average. Among the countries in the table, Japan's growth rates are highest over all, except for inward foreign patenting which actually ranks among the lowest. Sweden has the second highest growth rate in R&D and also has the largest difference between growth rates for R&D and domestic patenting. The USA has the second highest growth rate in industrial production and ranks highly in the other categories.

[29] A general warning should be mentioned here regarding the use of patent statistics. Simple comparisons of patent counts across countries must be treated with much caution since the patent systems differ (see Rahn 1983, p. 485 and also Chapter 9). Still some results, like the Japanese record growth in number of patents, are too robust to be explained away by the incommensurability of patents across countries. For further readings, see Frame and Narin (1990), Narin and Frame (1990), Chakrabarti (1991), IIP (1994).

Table 5.5 The development of international patenting in various countries[1) 2)] (percent annual change)

Source: Archibugi and Pianta (1992).

Country	Industrial production 1979-88	R&D expenditures 1979-88	Domestic patenting 1979-88	Foreign patenting 1979-88	External patenting 1979-88	External/domestic 1979	External/domestic 1988
USA	2.66	5.30	2.44	6.30	7.50	1.73	2.67
Japan	3.84	8.15	8.30	3.85	11.53	0.25	0.33
Germany	1.70	3.58	0.54	4.87	6.79	2.28	3.93
France	1.82	4.86	1.16	5.95	7.64	2.41	4.22
UK	1.44	2.43	0.64	5.49	8.34	1.37	2.65
Netherlands	1.50	3.83	2.00	10.17	6.91	5.18	7.90
Switzerland	2.21	4.75	-2.21	9.87	3.38	4.60	7.58
Sweden	1.98	7.71	-2.39	10.12	8.56	2.51	6.52
Austria	1.82	3.95	-0.75	13.51	7.44	1.66	3.39
Canada	2.39	5.60	6.28	2.88	8.31	2.83	3.35

Note:

1) Domestic patents are patents granted in the country to residents of the country. Foreign patents are patents granted in the country to foreigners. External patents are patents extended to foreign countries by domestic residents.

2) The highest and lowest values for each column in the table are overlined and underlined respectively.

Table 5.6 further shows the growth of patents granted in the USA in 1978-1991, broken down by country and sector. Industries that are associated with a high growth in patenting on average are fine chemicals (including drugs), mechanical engineering, electronic capital goods and components, and telecommunications.[30] Japan again stands out with the highest growth rate in all of the specified industries, except in telecommunications, raw materials and defense. In these three industries the USA ranks highest. Surprisingly, the USA ranks lowest in other chemicals and motor vehicles. On average, however, two small countries, Sweden and Switzerland, rank lowest, with negative growth in a number of industries.

As with all comparisons of growth rates, differences in absolute levels must be kept in mind. Table 5.7 further shows for a few countries and industries the number of US patents held by a country divided by the total number held by a set of eighteen OECD countries. Except for pulp and paper, the patent shares (defined in this way) have increased considerably for Japan, while they have decreased for the USA as well as for Germany, Sweden and the UK.

[30] Growth in patenting is associated with growth of R&D. The relative (percentage) growth of R&D in turn is not necessarily highest in R&D-intensive industries (the growth rates may e.g. be independent of size, that is they follow Gibrat's law, se e.g. Scheerer 1980).

Table 5.6 The average annual percentage change in US by different countries and industries, 1978–1991[1)]

Source: Deiaco (1993).

Industries	Austria	Canada	Switzerland	Germany	France	UK	Italy	Japan	Netherlands	Sweden	USA
Fine chemicals	0.78	2.07	-1.36	9.64	6.28	2.21	5.21	47.7	0.21	0.00	29.9
Other chemicals	1.57	5.71	-0.83	7.21	2.71	-4.61	1.35	85.9	4.85	-1.50	-20.7
Composite materials	0.64	0.78	-0.07	6.91	1.28	-2.14	1.57	48.2	0.57	-0.36	25.7
Mechanical engineering	0.41	19.7	5.64	55.9	20.8	-1.28	15.5	285.2	6.64	-7.78	156.6
Motor vehicles	0.35	2.00	-0.64	4.71	-0.42	-0.85	0.50	28.1	0.07	0.21	-5.1
Electrical machinery	0.36	3.78	-2.21	4.64	5.28	-2.42	1.64	64.1	-0.92	-0.57	26.2
Electronic capital goods and components	0.67	1.85	2.42	7.00	3.78	3.78	1.85	177.3	4.14	0.57	125.7
Telecommunications	0.71	2.28	-1.42	5.35	6.07	3.50	0.21	54.3	2.21	-0.71	75.8
Electronic consumer goods	0.14	2.64	0.28	3.64	2.28	2.78	0.50	169.5	-0.28	-0.14	38.7
Technologies for extracting and processing raw materials	0.64	2.71	-2.78	4.21	4.21	0.86	1.64	11.3	0.57	0.21	13.2
Defense-related technologies	0.21	0.14	0.14	4.41	2.35	1.71	0.21	0.85	0.07	0.28	16.7
Others	0.14	13.7	2.64	12.8	7.07	2.14	4.28	34.3	3.78	1.92	222.1

Note:

1) The highest and lowest values for each country are overlined and underlined respectively.
The highest value for each industry is marked |.

Table 5.7 The share by different countries and industries of the amount of US patents granted in 1978 and 1991[1)]

Source: Deiaco (1993).

	USA		Japan		Germany		UK		Sweden	
Industry	1978	1991	1978	1991	1978	1991	1978	1991	1978	1991
Mechanical engineering	62.8	56.9	10.5	20.4	10.8	10.6	4.2	3.3	2.0	1.1
Electrical machinery	64.5	55.5	14.6	26.0	8.7	7.3	3.5	2.4	1.4	0.0
Motor vehicles	39.2	30.7	28.9	44.7	15.6	12.9	3.3	2.6	—	—
Pharmaceuticals	30.8	21.3	17.6	28.6	18.2	16.5	13.1	12.6	1.8	1.3
Pulp and paper	50.6	51.7	7.8	5.2	—	—	—	—	10.8	12.6

Note:

1) The shares have been calculated for 18 OECD countries. The highest and lowest values for each column in the table are overlined and underlined respectively.

The patent statistics above show the growth of patenting, particularly international patenting, as well as the outstanding growth of Japan's patenting. Japan's patenting has also grown faster than other countries in a broad range of industries with respect to patents granted in the USA. However, the present purpose is not to make a detailed benchmarking of different countries using patent statistics. This is a special topic in itself, which has been treated in a number of studies.[31]

5.5.2 Quality of patents

First, a reminder of the general warning against interpretations based only on patent statistics is in order. Simple patent counts do not account for the large variations in the technical and economic qualities of patents. A popular quality indicator of patents is the number of times a patent document is cited in other patent documents.[32] However, patent citation counts per patent issued can vary greatly over industries, countries and years due to skewed distributions and averages over a small number of patents.[33] Comparisons of trends are a little less dangerous. Keeping this warning in mind, we proceed boldly to Figures 5.1 a-e, which show time trends for average patent quality.

Figures 5.1 a-e show how patent quality has improved over time.[34] The general trend is

[31] For some methodological discussions, see Chapter 9 and Appendix A and references given there.

[32] In the prior art search performed by a patent examiner in order to establish the novelty of an invention for which a patent has been applied for, previous patents appear as relevant. Such information is sometimes supplied by the applicant as well. Other relevant patents may therefore be cited in the final document of a specific patent, just as a published article may cite previous publications. Apart from variations and arbitrariness in citing behavior, the assumption is that the more a patent becomes cited by subsequent patents, the higher its technical quality, analogously to the use of citation counts in scientific literature.

[33] Skewness is a prevalent feature also in the patent world. A small number of patents account for a large number of citations and just a few patents may yield high pay-offs. In other words, technical as well as economic qualities of patents show high concentration. Only a weak correlation between technical and economic quality of a patent has been indicated, based on just a few available studies (see in particular Trajtenberg 1990. See also Chapter 9.)

[34] The indicator used is based on the ratio between the average citation intensity (i.e., the number of citations per

that, except for pharmaceuticals, Japan has upgraded the quality of her patents, just as she has upgraded the quality of her products. There is also another possible parallel between Japan's patent quality and product quality. The quality of Japanese products was once low by Western standards, and therefore, many Western companies in the 1960s and 70s thought Japanese products would not present future competitive threats, thereby ignoring any upward trend. Similarly, many Western companies today view Japanese patents as being of low quality. Figures 5.1 a-c show that this view is no longer justified in general (although Japanese pharmaceutical patents are cited below average as shown).

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patent) for a country's companies in an industry and the average citation intensity in the industry across countries, so that a value above one indicates a higher patent quality than average. The indicator time series is then smoothed by using a 3-year moving average.

Figure 5.1 a-ePatent quality in different industries and countries 1978-90 (three year moving average)

(Source: Deiaco (1993).

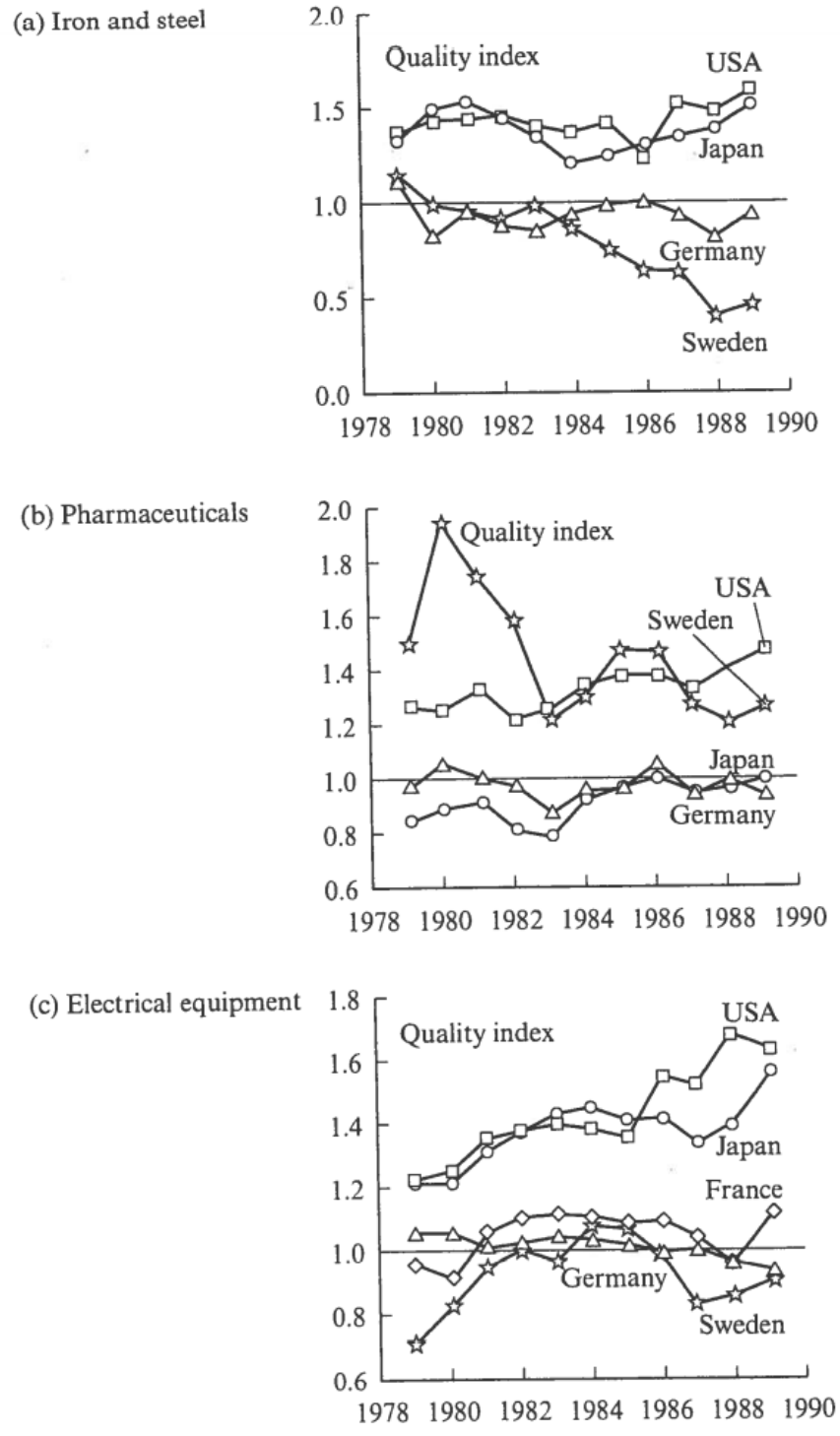
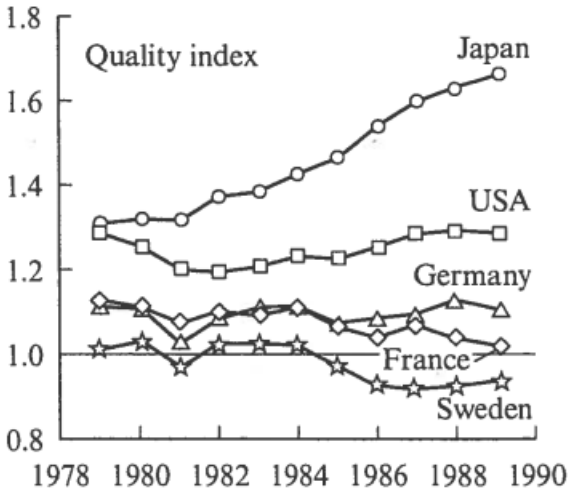
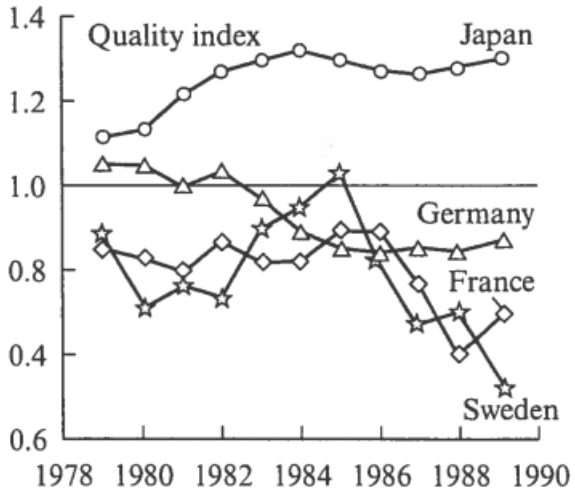


Figure 5.1 a-e (cont.) Patent quality in different industries and countries 1978-90 (three year moving average)

(d) Worked metal products, machines and equipment



(e) Motor vehicles



Source: Deiaco (1993).

Figure 5.1 Patent quality in different industries and countries, 1978–1990 (three-year moving average)

As shown in Table 5.5 above, Japan, for the period 1978-1988, ranked highest among a number of OECD countries regarding growth of industrial production, growth of R&D expenditures, growth of domestic patenting, and growth of international patenting (while the growth of foreign patenting in Japan ranked next to the lowest). International patenting also grew considerably in other countries in this period. However in most OECD countries domestic patenting grew poorly or even negatively in this period. What then explains the continued high levels of patenting in Japan? Large Japanese corporations take out a great portion of Japanese patents and much of the growth in Japanese patenting is attributable to the growth of patenting in these corporations. We will therefore take a closer look at these corporations in the next sections and then turn to explanations for the high patenting propensity in Japan in Section 5.8.

5.6 Survey Data on R&D and patenting in large Japanese corporations

In this study a sample of 24 large Japanese corporations, drawn from chemical, electrical/electronic and mechanical industries, has been surveyed through a mail questionnaire. (The sample and questionnaire are described in more detail in Appendix B.) Tables 5.9, 5.10 and 5.11 give some R&D and patent statistics, as reported by the IP departments of the corporations in the survey questionnaire.

As can be seen in Table 5.9, R&D expenditures grew 53 per cent in the period 1987-1991 with an even greater growth in international R&D.[35] Moreover a substantial portion of R&D was devoted to research although product development dominated, a larger portion of which went into development of new rather than existing products. Although the difficulty of upholding a common distinction between R and D as well as between new and existing

[35] Growth rates in absolute as well as in relative terms must be interpreted and compared with caution, of course, especially when size increases from low levels. The share of foreign R&D to total R&D grew by as much as 216 per cent from 1987 to 1991 as shown in Table 5.9, while the share only increased from 1.6 per cent to 5.0 per cent.

products and processes makes the figures very uncertain, the data are in line with the generally acknowledged emphasis in Japan on research and development of new products initiated in the 1980s. Moreover, licensing in grew substantially and exceeded licensing out.

Table 5.10a shows that domestic and international patenting also grew but at a more modest rate. The growth of patent portfolios was fairly consistent (around 10 per cent) across sectors. The dominance of electrical corporations in patenting, for example in the US, is also clear from the table data. The length of time patents are kept in force is moreover fairly equal across industries, while the share of patents that are kept in force the maximal length of time varies across industries. Table 5.10b shows the fairly low shares of patent applications in Japan that led to patents, and the low share of patents that were commercially and economically successful. The industry differences in this respect are noteworthy, however. The long time between patent application and market introduction, particularly in the chemical and pharmaceutical corporations, are also noteworthy.

Table 5.8 R&D structure in large Japanese corporations

(Code) Variable	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(B1) Total R&D expenditures worldwide in your company 1991 (MUSD)	255	1 984	1 285	1 190
Growth ratio 1991/1987	1.38	1.56	1.50	1.53
(B2) Percentage of R&D conducted abroad in 1991	5.57	3.86	5.80	5.00
Growth ratio 1991/1987 [1)]	7.85	3.39	1.71	3.16
(B6) Percentage of company's total R&D expenditures that were: [2)]				
Related to development of new products, 1991	44.4	22.8	32.5	35.5
Growth ratio 1991/1987	1.04	1.00	1.13	1.06
Related to development of existing products, 1991	21.2	47.8	30.5	31.4
Growth ratio 1991/1987	1.00	1.00	0.88	0.97
Related to development of new production processes, 1991	15.1	13.8	11.8	13.8
Growth ratio 1991/1987	0.96	1.00	1.09	1.04
Related to development of existing production processes, 1991	15.3	6.3	16.0	12.9
Growth ratio 1991/1987	0.91	0.83	1.36	0.94
Unrelated to specific products or processes, i.e. research, 1991	11.7	9.5	9.3	10.4
Growth ratio 1991/1987	1.04	1.21	0.65	0.91
(B8a) Total licensing receipts, 1991 (as % of total R&D)	9.2	5.20	7.33	7.5
Growth ratio 1991/1987	1.51	1.53	1.38	1.47
(B8b) Total licensing expenditures, 1991 (as % of total R&D)	3.2	3.6	8.3	4.4
Growth ratio 1991/1987	0.74	1.00	0.86	0.85

Note:

1) The growth is from low absolute levels, which gives high growth rate.

2) The figures do not add up to exactly to 100 per cent due to partially missing data, particularly from the electrical corporations.

Table 5.9a Patenting in large Japanese corporations

(Code) Question	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(D2a) Total number of priority applications filed in 1991[4)]	393	5 285	2 100	2678
Growth ratio 1991/1987	0.96	1.05	0.79	0.99
(D2c) Total number of patents in force in your company's patent portfolio, 1991[4)]	4.022	22 857	9 380	11 954
Growth ratio 1991/1987	1.09	1.10	1.10	1.10
(D2d) Total number of patents granted to your company in the USA in 1991	53	495	123	230
Growth ratio 1991/1987	1.36	1.12	0.57 [1)]	1.02
(D6a) Company's average number of years for keeping a patent in force	10.5	11.4	9.20	10.5
(D6b) Percentage of patents that are kept in force:				
The maximum patent protection time	4.9	36.1 [2)]	3.8	16.1
(D7) Percentage of patents with domestic priority for which a foreign application was filed in 1991	33.0 [3)]	13.6	17.2	23.2
Growth ratio 1991/1987	1.06	1.36	1.13	1.12

Note:

1) This figure is highly influenced by Honda and Toyota.

2) This figure is large due to the high patent retention (i.e. different patenting strategies) reported by a few electrical companies.

3) Chemical corporations have a longer tradition of foreign patenting, especially for licensing purposes.

4) In some instances, contradictions between the responding data and data from other sources (i.e. JAPIO) have been observed. The data in this table represents that which was received by questionnaire and portrays an accurate representation of the magnitude of patenting by sector.

Table 5.9b Patenting in large Japanese corporations

(Code) Question	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(D4) Share of patent applications for which a patent is granted in:				
Europe	85.0	78.8	89.0	83.7
Japan	55.0	64.3	58.0	59.6
USA	88.3	85.3	89.0	87.3
(D5a) Percentage of patents granted that are exploited commercially through own production	20.7	31.7	25.7	26.1
(D5b) Percentage of patents granted that through own production have led to economically successful new products or processes [1)]	12.3	20.3	6.5	14.7
(D5c) Percentage of patents granted that are licensed commercially	4.5	22.7 [2)]	3.00	11.3
(D12) How many years on average before market introduction of a new product is a key patent applied for in the R&D process	7.00	4.8	4.3	5.7

Note:

1) Assuming patents are applied for in Japan in the first place, this means that only 6.8 per cent (D4xD5b) of patents applied for by chemical corporations lead to economically successful new products or processes, while the corresponding figures for the electrical and mechanical corporations are 13.1 per cent and 3.8 per cent respectively. However small samples and missing data make these compound figures uncertain. The low value for the mechanical sector is noteworthy, however. This figure apparently illustrates the ”patenting paradox” mentioned in Chapter 3, which illustrates the fact that some companies continue to patent without considering patents as particularly important on average.

2) This high figure is probably due to more widespread block-licensing among electrical corporations, which in turn is an indication of higher patent interdependencies.

3) There was a high variation in the data received, with some companies responding that patent protection was not sought until some time after market introduction as opposed to before.

Table 5.10c shows the detected infringement propensity and which industry was most involved in litigation. An indication of litigious propensity is given by looking at the ratio of the number of litigated patents to the number of infringed patents (D10/D9xD2c), as detected by the companies. However the sample is small, and some data are missing and the collected data refer only to one year. Thus the results can not be taken as representative. A downward bias could perhaps also be expected regarding outward litigation in Japanese corporations that traditionally are not litigious and do not want to appear as litigious. On the other hand the propensity to litigate has increased among large Japanese corporations as a response to the increasing propensity to litigate among US corporations, and the Japanese corporations do wish to make this signal clear to their competitors. One can also note that chemical corporations in the sample have a high ratio of outward litigation to inward litigation.

Table 5.10 Infringements and litigation in large Japanese corporations

(Code) Question	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(D9) Percentage of own patents for which infringements were detected in 1991(approx. # of detections)	1.22 (62)	2.00 (241)	0.13 (18)	1.12 (103)
Growth ratio 1991/1987	1.20 (1.29)	1.33 (1.35)	1.63 (1.80)	1.27 (1.36)
(D10) Number of patent litigations filed from your side against other firms or parties in 1991	3.1	0	0.25	1.4
Growth ratio 1991/1987 [3)]	3.10	n.a.[1)]	n.a.[1)]	3.50
(D11) Number of patent litigations directed against your firm in 1991	0.3	1.5	1.7	1.0
Growth ratio 1991/1987 [3)]	n.a.[1)]	8.82	5.00	7.70
(D10/(D9xD2c)) Litigious propensity 1991 (%) [2)]	5.0	0	1.4	1.4

Note:

1) Not applicable since 1987 value is zero.

2) That is, the number of litigated patents divided by number of patents with detected infringements. Small samples and missing data make this compound figure uncertain, however. The zero value for electrical corporations is not representative for other years.

3) Growth rates are high since growth takes place from low levels.

Table 5.11 Sensitivity of the R&D investments of large Japanese corporations to patent protection time (in 1992)

(Code) Question	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(F13) What would the effect be on your company's total R&D budget as a rough percentage, if the maximum patent protection time were:				
(a) Increased by 3 years	+8.5	+2.8	+0.3	+4.8
(b) Decreased to 10 years	-21.2	-3.7	-0.3	-10.7
(c) Decreased to 0 years (i.e., patent protection ceases)	-59.2	-40.0	-5.5	-38.2

Table 5.11 shows that patent protection actually stimulates R&D investments as intended, especially in the chemical industry. The industry differences are large, however, depending upon differing technological and patenting opportunities, differing product market lifetimes and the different relevance of alternative appropriation mechanisms or commercialization strategies; see Chapter 6. Taylor and Silberston (1973) found, based on a sample of 27 UK firms, that R&D budgets would be cut by 5 per cent if patent protection was removed, except specialty chemical firms and pharmaceuticals who would cut their budgets by 25 per cent and 64 per cent respectively. Thus the sensitivity of R&D budgets in the UK in the late 1960s was much lower on average than in Japan in the early 1990s. Mansfield also indicates a fairly low sensitivity of the rate of invention to the removal of patent protection. Chapter 3 also gives some theoretical calculations of company responses to changes in the maximum patent protection time. These calculations are surprisingly consistent with the data for the chemical corporations. The chemical industry is also traditionally most dependent upon and sensitive to the strength of patent protection. On the other hand the low sensitivity to patent protection time among mechanical corporations is surprising, also when compared to the share of patents they maintain for the maximum patent protection period (see question D6b in Table 5.10a). Similarly the electrical corporations keep a large share of their patents in force for the maximum time while they are rather insensitive to a reduction of this time by 10 years.

Whether this is due to small samples, the skewed nature of patent value, deficient patent management or something else must be left as an open question. However the results for the total sample are in line with expectations. The figures indicate a lower sensitivity than a simple theoretical calculation, as done in Chapter 3, would yield. Since there are other appropriation mechanisms for R&D investments, this is a reasonable result.

5.7 Patenting trends in large Japanese corporations

As mentioned several times, a strong basic trend towards an increased role of and attention to patenting appeared in the 1980s. This is corroborated and detailed in Table 5.12. Some summary observations from the table are:

1) Patenting and licensing have taken on a wider variety of roles and especially a greater strategic role in the corporations studied, regardless of industry. The role of patents in standard-setting, which is also a new kind of role for patents, has moreover increased in importance. Infringements and litigious activities in connection with patents have also increased. This will be further elaborated in Chapters 6 and 7.

2) The cross-linkages from patents to products/processes and vice versa have also grown in both directions. This is to say that new products and processes are becoming increasingly multi-technological (see D15-21 in the table). This is in line with a general trend towards more ”mul-tech” products and processes in industry. At the same time, new patents are becoming more widely applicable to different product areas, i.e. inventions become more multi-product related or generic in that sense (see questions D15-12 and D15-22). This will also be dealt with further in Chapters 6 and 7.

3) Across industries, patenting has been significantly upgraded in the corporations as indicated by increased top management attention, increased resources and increased status. This will be further elaborated in Chapter 8.

4) Patent literature is more intensely used as a source of information about new technologies and other companies. This will be further dealt with in Chapter 9.

5) Patenting propensity has increased among the companies (see further next section) and the ”speed to patent” in the R&D process has increased (see further Chapter 7).

Naturally, one cannot be very conclusive about simple trend perceptions pertaining to a sample of companies as shown in Table 5.12 over a relatively short period. However, the statistical evidence supports the trends indicated above as well as the case interviews pointed out in this study.

Table 5.12 Patent trend assessments in large Japanese corporations, 1987-1992

(Scale: False = -2, -1, 0, +1, +2 = True)

(Code) Trend proposition	Chemical (n=9)	Electrical (n=10)	Mechanical (n=5)	Total (n=24)
(D15) In your opinion have any essential changes on an average occurred in your company during the period 1987-1992 with regard to the following:				
(1) Patents are sought earlier in the R&D and innovation process	0.89	0.60	1.40 (5)	0.88
(2) The use of patent literature as an information source has increased	1.11	0.90	1.60 (2)	1.13
(3) The resources for the firm's patent activities have increased	1.22 (5)	1.60 (2)	1.00	1.33 (5)
(4) Hiring patent agencies or similar outside assistance has increased	0.56	1.30 (4)	0.80	0.92
(5) The status of patent activities within the firm has increased	1.11	1.50 (3)	1.80 (1)	1.42 (2)
(6) The cost of license negotiation has increased	0.78	1.30 (4)	1.20	1.08
(7) Licensing is becoming increasingly broad-based	0.56	1.20	1.20	0.96
(8) Patent pooling has increased in importance	0.22	0.50	0.80	0.46
(9) The average number of years for keeping a patent in force has increased	-0.22	-0.10	0.20	-0.08
(10) The number of countries in which patents are sought has increased	0.75	0.50	1.00	0.70
(11a) The frequency of patent infringements has increased	0.67	1.10	1.40 (5)	1.00
(11b) The frequency of competitors' patents blocking your activities has increased	1.00	0.60	1.00	0.83
(11c) The frequency of your patents blocking the activities of your competitors has increased	0.56	0.50	1.00	0.63
(11d) The frequency of patent litigations has increased	0.67	0.70	1.20	0.79

(12a) The possibility of finding generic patents has increased	0.33	0.60	0.40	0.46
(12b) Your company's propensity to patent has increased	1.33 (3)	1.11	1.20	1.22
(13a) Your company's propensity to license out has increased	0.33	0.60	0.60	0.50
(13b) Your company's propensity to license in has increased	0.63	0.60	0.40	0.57
(13c) The role of patents in joint ventures and cooperative R&D has increased	0.89	0.80	1.20	0.92
(13d) Patents are increasingly sought in order to generate license incomes	0.44	0.70	1.60 (2)	0.79
(13e) Increasing R&D costs have increased your propensity to license out	0.33	0.40	0.60	0.42
(13f) Royalty rates have increased when licensing out	0.44	0.60	0.40	0.50
(13g) Royalty rates have increased when licensing in	0.67	1.30 (4)	0.80	0.96
(14) The strategic role of patents in your company has increased	1.56 (1)	1.30 (4)	1.20	1.38 (3)
(15) The strategic role of licenses in your company has increased	1.33 (3)	1.30 (4)	1.60 (2)	1.38 (3)
(16) The role of patents in standard-setting has increased	1.13	1.00	1.00	1.05
(17) The role of cross-licensing has increased	1.11	0.67	1.00	0.91
(18) Top management attention to IPR and patenting matters has increased	1.44 (2)	1.70 (1)	1.40 (5)	1.54 (1)
(19) The importance of trademarks has increased	0.89	1.10	1.25	1.04
(20) The importance of prophylactic publishing has increased	-0.33	0.10	1.00	0.13
(21a) New products are related to an increasing number of patent classes	1.11	0.80	0.80	0.92
(21b) New production processes are related to an increasing number of patent classes	0.67	0.70	1.00	0.75
(22) New patents are related to an increasing number of product areas	1.00	0.20	0.80	0.63

Note:

1) The top five ranks of values in each column are shown in parentheses.

5.8 The propensity to patent in Japan

5.8.1 Quality and quantity of patents

As seen above, Japan's industry has an outstanding post-war record of patent growth, abroad (especially in the USA) as well as at home. This is corroborated by data over several indicators, such as patent numbers (number of patent applications and patents granted in Japan, USA, Europe etc. over the last few decades); patent shares (regarding both applications and patents granted); patent intensities (e.g. number of patents per R&D worker or R&D dollar); and patent citations. [36]

What accounts for this record?[37] The relevance of the question is underscored by the fact that the growth of patenting in many countries declined until recent years and in some cases even turned negative (see Griliches 1984)[38]. The survey study here cannot give an answer to this question on the basis of cross-national comparisons. However, some suggestions will be made on the basis of the sample of corporations studied.

As seen in Table 5.1, Japan took the worldwide lead already in 1958 in the number of patent and utility model applications. The dramatic increase in patent application filings in Japan even before the pro-patent era of the 1980s has to a large extent been attributed to efforts by leading electrical and electronics firms. In the early 1980s, Hitachi, Toshiba, Matsushita, Mitsubishi Electric, NEC and Fujitsu were reported to account for about 25 per cent of all applications filed with JPO (Rahn 1983, p. 485). In a report from 1976, the JPO enumerated the following concrete causes for the rise in patent applications (as described in Rahn 1983, pp. 486-488):

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[36] Note that patent numbers, patent shares, patent intensities and patent citations are four general categories of patent-related indicators for comparing (benchmarking) nations as well as companies (see Chapter 9). Additional ones are conceivable as well, e.g. utilizing the age of cited patents to indicate newness of related technologies (see Narin 1991).

[37] The question about possible effects of this record will be addressed further below.

[38] One explanation forwarded by Griliches is that the USPTO has had a shortage of patent examiners. In fact , the number of patents granted correlate well with the number of patent office examiners.

1) Causes on the enterprise side:

   a. Utilization of applications for enterprise strategies (e.g. for propaganda purposes)

   b. Omissive preliminary search activities

   c. Increase in defensive applications

2) Causes on the patent administration side:

   a. Quality of the examination (inconsistent and sometimes low requirements on the level of inventiveness)

   b. Low application fees and request for examination fees

3) Causes on the service organization side:

   a. The situation of the patent attorney business (with a tendency to file inadequate applications)

   b. Incomplete organization of search services and inspecting systems

With the emergence of the pro-patent era in the 1980s, IPR activities and status have increased considerably in Japan. However, it is fair to say that IPR is still an issue with limited attention from the public at large.

The higher propensity to patent in Japan's industry compared to US industry was singled out by Westney (1993) as one of nine key characteristics distinguishing technology management and behaviour in Japanese firms from US firms (see further Chapter 6). Westney presents two sets of explanatory factors, likely to complement each other. The first set refers to strategic motives of three kinds: (1) to access others' technology breakthroughs by surrounding them with patents, thereby forcing the other party to cross-license; (2) to conceal one's own R&D priorities by patent flooding (see Chapter 7); and (3) to offset licensing expenditures. The second set of explanatory factors refers to organizational factors, especially the internal incentives R&D personnel in Japanese companies receive for patents.

In addition to these types of explanations, Westney refers to factors such as the fact that the Japanese patent system, compared to the US, has lower requirements upon the level of invention needed for a patent application to be granted (approved), and that – despite this[39] – Japanese patent applications have a lower rate of success for approval. The latter factors would to some extent account for a higher volume of patents granted in Japan and a higher volume of Japanese patent applications in general. Historically this may have been the case, as is indicated in the JPO report from 1976 (see above).[40] A contributing factor has been Japan's legal framework in the past, with a utility-model law and a narrow scope of protection with a single-claim system until 1987.[41]

An important overall factor behind Japan's large volumes of patent applications for mostly minor inventions has been the catch-up process described earlier. However, when discussing quality of patents, several distinctions must be made. First there is the legal quality of the application in terms of formulating its wording, supporting it with evidence of novelty and aligning it with the legal framework.[42] Second, there is the technical quality, roughly expressible in terms of level of invention. Third, there is the economic quality in terms of potential economic value for the rights holder. Unfortunately, the correlation between legal, technical, and economic qualities of patent applications and patents are not strong.[43] Minor technical inventions may have major economic value and vice versa. The common attitude among Western engineers of frowning on minor "junk patents" or "petty patents" is often

[39] Or perhaps because of this. It could very well be the case that a lower requirement could lead to lower level of quality of applications, and then even to a lower success (approval) rate.

[40] JPO has been repeatedly criticized in the 1980s and early 1990s for having long examination times and large back-logs. JPO has responded that it has capacity problems and that industry has to raise the quality of applications and to decrease the quantity. JPO has also launched a computerized system for paperless patenting in order to increase efficiency.

[41] That is, a patent system in which only one claim is allowed in a patent application. (Europe and the USA have had a multi-claim system since long ago.) Also Japan did not have a doctrine of equivalents allowing for an extended interpretation of the patent claim to technically equivalent claims. Thus, each patent gave a narrow scope of protection. This behavior of narrow rights-granting was in line with Japanese culture, in which granting strong rights to individuals was not considered as primary as in the USA, for instance.

[42] An omissive or incomplete search of state-of-the-art or prior art may lead to many disapproved patent applications, for example.

[43] There is no scientific empirical evidence for this proposition, however, but only evidence based on the impressions of the practitioners interviewed.

economically questionable from a corporate point of view. Just as questionable is the behaviour, also common among Western engineers, of seeking technically major patents and then neglecting to support them with subsequent patents, minor as well as major. Many companies can certify that it is costly to have an engineering culture that gives priority to technical qualities with little regard to economic values (see further Chapters 7 and 8).[44]

Still another distinction to be made is between domestic and foreign patent applications and patents. In most cases the domestic application is the priority application, and only the ”best” applications are followed up by foreign applications.

Regarding the technical quality of Japanese patents, several studies have shown, based on number of citations, that Japanese patents in general in the 1980s were not inferior. (See e.g. Narin et al. (1992), and also Section 5.5 as well as the repeatedly published Patent Scoreboards in Business Week.) There were significant sector differences, however. The number of citations of Japanese patents in pharmaceuticals was low while it was high in electronics (see Figure 5.1).

The technical and legal quality of patent applications reflects on their approval rate.[45] There is reason to believe that this approval rate is increasing at least among large, leading companies in Japan; see Table 5.13. The technical and economic quality of patents is also indicated by the share of commercially exploited patents and share of patents supporting economically successful products, as well as by the maintenance profile (or vintage structure) of the company’s patents, i.e. how long patents are kept in force by the company. Table 5.14 gives an overview of these indicators.

All in all, there is insufficient reason to believe in low quality levels of Japan’s patents as a dominant explanation behind its large quantity of patents.

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[44] The same may be said regarding one-sided emphasis on legal quality, of course. This may not be as prevalent as one-sided technical emphasis, at least in patent application work. However, in a more general context there are several anecdotes about how legally ”good” contracts, e.g. in joint ventures and licensing, have stifled cooperation and efficiency.

[45] The economic-quality dimension of patents should in principle not influence the approval decisions (apart from a general but weak requirement of usefulness of the invention). (See Merges (1988) for a good review of this issue.)

Table 5.13 Approval rates of patent applications

	Approval rate (%) in		
	Europe	Japan	USA
Japanese companies[1)]	83.7	59.6	87.3
Swedish companies[1)]	87.5	80.0	85.4
Average approval rate in 1983-1987[2)]	87.2 (UK) 58.6 (WG)	16.8	59.4

Notes:

1) As estimated by the companies in 1992 for the period 1987-1991. The samples are described in Appendix B.

2) These data, published in Westney (1993, p. 42) as well as in Westney (1994, p. 162), apparently refer to the ratio of gross number of approvals to applications received by the patent office in the respective countries during the time period 1983-1987. Europe is represented by the United Kingdom and what was then West Germany. Such a ratio is also influenced by patent office capacity constraints (resulting in delayed approvals) and by differences in the legal framework with respect to whether requests for examination are needed or not.

Table 5.14 Quality indicators of Japanese and Swedish patents[1)]

	Share of commercially exploited patents[2)]	Share of patents leading to economic success	Share of patents licensed commercially[3)]	Number of years of patents in force	Share of patents kept maximally[4)]
Japanese companies	26.1	14.7	11.3	10.5	16.1
Swedish companies	60.5	38.1	4.9	11.4	21.6

Notes:

1) Estimated by the companies in 1992. The samples are described in Appendix B.

2) Through own production.

3) This figure is biased upwards due to block licensing and broad cross-licensing agreements.

4) More detailed data in maintenance profile were collected as well, but are not shown here.

5.8.2 Reasons behind Japan's high patenting propensity

Legal, economic and historical factors in a company's environment influence its patenting behaviour, as do internal factors related to the company's economics, management, strategy, organization, culture and so on. These factors interact over time. For example, as mentioned several times, the lack of natural resources in Japan yielded emphasis on intellectual capital with a concomitant build-up of R&D resources and IPR resources. The role of the historical catch-up process in Japan has also been noted repeatedly. The patent culture and top management attention to patenting in companies like Canon is described in Chapter 8. This in turn has led to a build-up of substantial IP departments and resources with strong IP management which in turn has further boosted the quantity and quality of patenting.

In the questionnaire survey of large Japanese corporations, data on R&D and patenting facts were collected together with perceptual and qualitative data. Stepwise, linear regressions on the questionnaire data were then run to determine which variables reduced most of the variance in the number of patent applications and patents granted (in the USA) in the Japanese corporations in the sample. Not surprisingly, IP resources were most important in this respect; that is, the number of patent personnel was the primary explanatory variable, followed by the total amount of patenting expenditures. Variables of much lesser importance were the total amount of R&D and the percentage of sales based on patents, i.e. question F1 in the questionnaire; see Appendix B. [46]

Table 5.15 summarizes the factors believed by the Japanese companies in the study to be behind the increased importance of patenting as expressed in the questionnaire survey

[46] 'Explanatory' here means reducing the sample variance in the dependent variables number of patent applications and patents granted, for the different corporations in the sample. Primary explanatory variable refers to the variable that reduces most of the variance for a given number of variables in a regression run. Exploratory variations of dependent and independent variables and various lag structures for the years 1987 and 1991 were tried in the regression runs. The significance of IP resources (i.e. variables E.6.a and E7 in the questionnaire) as primary explanatory variables was robust under these variations. (Strictly speaking, ordinary significance levels are unreliable for exploratory regressions performed on the same data set.) However, different variables with far less significance appear in the third place depending upon which dependent variable is used to indicate the volume of patenting.

(question F6b), company by company (not all of them). The factors pointed at in the table give a rough idea of the inside-out perspectives in the corporations. As indicated, there are a few general reasons related to US policy changes, intensified international competition, growing technology interdependencies and institutional changes. These kinds of answers have then been complemented by answers given in in-depth interviews. Essentially the answers confirm the emergence of the pro-patent era with its various features. However, it must be kept in mind that Japan's patenting propensity was high already before the pro-patent era, indicating more deep running historic, institutional reasons.

Table 5.15. Most important factors behind increased importance of patenting.[1)]

Com-pany	Three most important factors behind increased importance of patenting		
	Factor (1)	Factor (2)	Factor (3)
1	Patent litigation and mediation system	Increase in patent licensing	Expedition of patent examination period
2	Prevailing competitors	Prevailing patent infringement	Cross-licensing with competitors
3	Increase in royalty	International harmonization of patent laws and practices	Increase of patent infringement suits
4	To prevent competitors from copying	To keep strong shares of market	To encourage engineers to create new technologies
5	The business of functional products has increased	The business has become worldwide	The case of cross-license in some areas has increased
6	The competition for developments of new technologies has increased	Intensification of patent protection, especially in the USA	Markets and /or firm activities have become borderless
7	Specialization and concentration in technical strategy	Tie-up with technologically advanced corporations	Acquiring exclusive possession legitimately
8	Competition of R&D has grown more intense	Evaluation of patent has been changed (becoming more effective weapon)	USA’s policy for patenting
9	Market globalization	R&D cost increases	Short life cycle of new products
10	Trend in the USA that patents produce money	Growing numbers of technology transfer cases	–
11	Increased need of high value-added products	Stricter earth environment protection policies	More severe competition in development as the technological gap between companies is narrowed

Note:

[1)] The wording of the question F6b was: ”In case the importance of patenting for commercialization of new technologies in general has increased, which are the three most important factors behind this increase in your opinion (please specify briefly)”. A selection of answers is presented here, with the original wordings (with some minor exception).

5.8.3 Reasons behind a low patenting propensity in some European corporations

The high patenting propensity in Japanese companies is outstanding, and the reasons behind it have been elaborated above. But what reasons lie behind the often low patenting propensity in many Western firms? We may shed some light on this question by looking at the large Swedish corporations in the sample, which mostly have had significantly lower patenting propensity than their matching competitors in Japan. First, some illustrative anecdotal evidence has been collected in interviews, for example:

In the 1960s and 70s the white-goods company Electrolux (with global operations, employing over 100,000 people) emphasized market lead times rather than patenting. Acquisition of companies was a dominant growth strategy. In connection with the acquisitions of foreign companies like Zanussi in Italy and White in the USA, corporate management in Electrolux later became alerted to the importance of patenting, since these companies, especially White, had a much more pro-patent culture. The subsequent need to find patenting personnel has then forced Electrolux to internationalize patenting operations to some extent.

Within the telecom equipment manufacturer, Ericsson, patenting was almost never considered a strategic issue until the late 1980s and early 1990s.[47] During the 1960s and 70s Ericsson's patenting work was considered of high technical and legal quality but was nevertheless of minor importance. In the 1980s, in connection with a management and policy shift in patenting and R&D, patenting operations deteriorated. Although patenting was not considered unimportant, e.g. in licensing and pricing, R&D people were usually too busy with R&D to spend much time on patenting, and top management did not do much to change this, beyond lip-service. A turn-around in efforts and management attention to IP in Ericsson, as well as in many other telecom companies, took place in connection with Motorola's push of their standard blocking patents in mobile communications in the late 1980s, as described in

[47] One can note here that Ericsson's start-up phase in telephony from its foundation in 1876 was facilitated by the omission of Bell to take out a patent in Sweden on his invention of the telephone, plus the fact that the Bell companies used a high-price strategy in Scandinavia.

Chapter 6.10. This triggering event was like a ”wake-up call”, although it did coincide with several other conducive event streams. First, Ericsson got a new CEO with hands-on experience in patenting from outside the telecom sector. Patent issues now did not experience the traditional difficulties in getting top management attention. On the contrary, the agony in Ericsson over Motorola's behaviour was shared and fuelled by top management. Considerable resources for patenting were set aside, ambitious targets were set, extensive recruiting was done, attitudes were changed, etc. This created a sudden turnaround in IP practices. Second, the mobile communications business was beginning to thrive, which involved Ericsson in the business climate of consumer electronics, including its stronger emphasis on IPRs. The mobile communications division in Ericsson thereby became a kind of lead-house for IPR issues in Ericsson. Third, the telecom service sector was further liberalized with the break-up of AT&T and the Bell system in 1983[48], and became subjected to technology-based competition with an increased role for IPRs. Fourth, the awareness of the emerging pro-patent era had grown in general, signalling a need for change throughout Swedish big industry.[49]

In summary, some reasons behind a low patenting propensity are:

1) Emphasis on other strategies for technology exploitation, e.g. secrecy and/or market lead times.
2) Lack of competition.
3) Lack of a patent culture in a company or a whole industry.
4) Disappointing experiences from trying to enforce patent rights in the past, with low probability of winning in court, low damages etc.
5) Engineering attitudes, overly emphasizing the technical quality of patents and snobbishly frowning at small, ”petty patents” or ”nuisance patents”.
6) Lack of management attention and mismanagement.[50]

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[48] The liberalization of the US telecom sector started in the late 1960s with the so-called Carterphone decision, allowing non-Bell companies to attach certain equipment of their own to the Bell system.

[49] Some rough figures indicate the magnitude of Ericsson's turnaround regarding patenting. In about 7 years time, Ericsson increased the number of patenting employees more than 10 times and the number of priority applications more than 20 times, with 50 priority applications in 1987, 145 in 1991, and 1200 in 1997.

[50] It is partly in the nature of patenting that business managers can largely escape any blame for mismanagement of IP in the absence of an enforced corporate IP policy unless high damages and injunctions occur.

7) Absence of litigation, large damage claims, injunctions etc.
8) High costs of patenting
9) Self-fulfilling attitudes in an industry,[51]

Several variables used to explain the low patenting propensity in Sweden are similar to variables used to explain the high patenting propensity in Japan. There are differences in weights attached to these variables, which were likely derived in turn from historical and cultural differences. However, some institutional and general business conditions have become more similar between East and West in the post-war period, such as increased internationalization, increased technology-based competition, increased R&D costs and increased privatization of R&D results. One must also keep in mind that before the pro-patent era in the 1980s, incentives to patent were much weaker, except for a few industries such as chemicals and pharmaceuticals, where invent-around possibilities could be limited (see Chapter 6). Patenting, paradoxically, seems to have been of less importance for companies accustomed to being on the technological forefront, than for companies trying to catch up.

Thus, one might expect that companies in the West would increase their patenting propensity, but with varying time lags, as a reaction to the pro-patent era and to Japan having caught up and continued to pursue patenting aggressively, and then as a result of the self-reinforcing nature of patenting. Many large Swedish corporations have indeed increased their patenting propensity in the 1990s, sometimes slowly, sometimes abruptly. Acting as ”alarm bells” or alerting events have been e.g.:

1) Recognition of weak bargaining power
2) Acquisitions of companies with a patent culture
3) New entrants on the market with aggressive patent strategies

[51] If every competitor thinks patents are unimportant and therefore does not apply for patents, patents do become unimportant. No one then has an incentive to change this situation, which thus becomes an equilibrium, although an unstable one, since if someone starts to patent effectively, others have to follow (cf. the expression ”there is no way to fight a patent but with a patent”; see Chapter 5).

4) Litigation and large damage claims

5) Missed business opportunities

6) Severe blockages encountered

7) Alarming patent statistics coming from benchmarking projects or public ranking lists

Most importantly, however, the uncertainty arising from the frequent patenting of competitors, triggers increased attention to and efforts in patenting, leading to increased patenting propensity. The hike in patent values since the 1980s, with some specific widely publicized examples, seems to be of much less importance than the insurance value of patents, or the expected cost of not taking out patents. This is especially true, since the insurance value of a patent increases when others insure themselves as well through patenting.[52] In contrast, the lottery value of a patent (i.e. the value of a patent as a lottery ticket), is decreased as others increasingly participate in the lottery.

5.9 Summary and conclusions

This chapter started with a review of the history of the patent system in Japan. The Meiji restoration in the mid-1860s, inspired in no small measure by the perceived importance of technology, was of course a major turning point in Japan's general development towards an

[52] This is not in contrast in principle to normal insurances, e.g. of homes against fires or cars against collisions or bodies against illness. The probability of a fire in an insured house may increase due to adverse selection of insurance holders and their moral hazards. The probability of a house fire may also increase for a specific house as other houses nearby become insured, because of adverse selection and moral hazards among their insurance holders and the possibility of a fire in one house spreading to other houses. Similarly the probability of an insurance holder being subjected to collisions or illnesses may increase as more people take out insurances, due to bad driving on roads or infectious diseases catching on. What does differ between a normal insurance and a patent as an insurance of freedom of action in a business (i.e. insurance against blockage or imitative entry) is the possibility of a patent holder to inflict one-sided damages on others on purpose, which is a strong form of moral hazard.

industrial state. Shortly thereafter a patent system was tried in Japan, inspired by the perceived importance of patents for the development of industry in the West and in the USA in particular. Thus Japan's patent system was installed right at the beginning of her industrialization. However one can not infer that the patent system was of decisive importance for Japan's industrialization. The ability to catch up by absorbing and modifying technology from the West, and particularly from the USA after World War II, was much more important. The patent system was, however, widely used in the catch-up process. Since the end of World War II Japanese corporations have accumulated very large patent portfolios and substantial patenting capabilities. Concomitant to the post-war growth of industrial production and R&D, Japan has developed an outstanding patenting record in the world, with large electrical corporations at the forefront.

The modern Japanese patent system is more similar to the European patent systems than the US one, but there are also some features specific to Japan, in particular regarding the way cultural factors and the catch-up process have influenced the use of the patent system. Thus the symbolic value of patents as rewards is important, as is technology diffusion and the use of patent information for technology intelligence. The individual inventor's right is downplayed in relation to the company and the nation, and harmony and non-litigious forms of conflict resolution are emphasized.

Survey data from 24 large chemical, electrical and mechanical corporations further indicate the growth of R&D, foreign R&D, licensing out, domestic and international patenting, and patent portfolios. The emphasis in R&D on research and new product development is significant in the 1980s, as is the sensitivity of the size of R&D investments to the length of patent protection. The survey also indicates a wide array of consistent trends. The most important of these are the increasing strategic importance of patents and top management attention paid to patents, the increasing resources for patenting, the increasing interdependencies between patents and products, the increasing propensity to patent, infringe and litigate, and the increasing use of patent information for technology intelligence.

The extraordinarily large quantities of Japanese patents in international comparison need to be explained. A traditional explanation is that Japanese patents are of low quality. This may have been true in the past, just as it was the case for Japanese products, but it is no longer true. If the quality of a patent is broken down into legal, technical and economic quality aspects, each of which can be indicated in various ways, this study shows that Japanese patents are no longer inferior, on the contrary, just as is the case with Japanese products.

The chapter has analyzed various explanations for the high patenting propensity in Japanese corporations. In summary, the different types of (non-conflicting) explanations for the high quantities of Japanese patents are (where 1, 2 and 3 are derived from the current study):

1. Historical/institutional explanation, referring to
    a. Catch-up effects
    b. Lack of natural resources
    c. Patent culture (see further Chapter 8)
    d. Legislation (single claim, narrow scope, utility models)
    e. JPO behaviour

2. Strategic/managerial explanation, referring to
    a. Response to pro-patent era and US litigation
    b. Increasing economic value of patent portfolios
    c. R&D strategies and effectiveness (Kaizen, exploratory R&D, etc.)
    d. Patent strategies (with emphasis on continuous patenting, flooding, fencing, licensing, bargaining power, technology acquisition)
    e. Internal incentives

3. Regression based explanation, referring to the most important company variables explaining the number of patent applications which were
    a. Number of patent personnel

b. Amount of patenting expenditures

4. Explanation in Westney (1993), referring to
   a. Strategic motives (technology access, offset royalties, etc.)
   b. Organization (incentives, etc.)
   c. Legislation

5. Explanation by JPO in 1976, referring to
   a. Enterprise causes (patent strategies, omissive search, defensiveness)
   b. JPO causes (low requirements and fees)
   c. Patent attorney causes

In order to contrast and enrich the various explanations offered for the high patenting propensity in Japan, the chapter finally presented some possible reasons for the opposite phenomenon of a low patenting propensity, which was the case for Swedish industry up until the early 1990s.