Invention Protection and Economic Development

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Invention Protection and Economic Development

Shinichiro Suzuki

Introduction

Nowadays, intellectual property issues are of interest not only to legal specialists, but also to experts in a wide range of other fields such as technology, economics, and education. Even controversy concerning the necessity of the patent system, which was once the subject of fierce debate between lawyers and economists, is now becoming confined to certain technologies and organizations.

Although this textbook examines the economic significance of invention protection under the patent system, it does not attempt a theoretical analysis from an economics perspective. Its objectives are to introduce the debate up to now concerning the economic significance of the patent system and examine how this system has been used to meet policy goals, as these are matters that those involved in the promotion of intellectual property rights ought to understand.

Please note that the various views described within are those of the writers of the papers cited. They do not express the official views of the Japan Patent Office.

1. Invention Protection and Economic Theory

1.1. Theories of Invention Protection

1.1.1. The Views of Early Economists

Invention protection systems[1], which confer monopoly rights to the originators of new ideas for a limited period of time, can be traced back to the Greek colonial city of Sybaris in 500 B.C. In this city, the developers of new food preparation methods were awarded a one-year monopoly. In the 12th-15th centuries, this system began to be used as a policy tool in the city states of Italy, and later spread to the rest of Europe. Many of these early invention protection systems involved the individual conferral of privileges (invention privileges) by the government, parliament, or monarch.

The various privileges possessed by monarchs and feudal lords had long been recognized as inalienable rights, but the Puritan Revolution and Glorious Revolution in the 17th century led to a rejection of royal authority. At the same time, calls for free trade grew and economists began to debate the rationality of free trade.

Adam Smith, in *An Inquiry into the Nature and Causes of the Wealth of Nations*, which was published in 1776, argued that monopolies were inevitably harmful, but that temporary ones may be vindicated as a way of recompensing inventors for the risks they have borne and the expenditures they have made.[2]

John Stuart Mill, in Principles of Political Economy, which was published in 1848, claimed that the "the condemnation of monopolies ought not to extend to patents." He argued that "the originator of an improved process is allowed to enjoy, for a limited period, the exclusive privilege of using his own improvement," and that inventors should be both compensated and rewarded.[3]

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1 To avoid confusion with the debate on property rights, which is described later, the use of monopoly rights such as patents to protect human intellectual creations is referred to here as "invention protection."

2 Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, W. Strahan and T. Cadell, London (1776), Book V, Chapter 1, Part III

> "When a company of merchants undertake, at their own risk and expense, to establish a new trade with some remote and barbarous nation, it may not be unreasonable to incorporate them into a joint stock company, and to grant them, in case of their success, a monopoly of the trade for a certain number of years. It is the easiest and most natural way in which the state can recompense them for hazarding a dangerous and expensive experiment, of which the public is afterwards to reap the benefit. A temporary monopoly of this kind may be vindicated upon the same principles upon which a like monopoly of a new machine is granted to its inventor, and that of a new book to its author."

3 John Stuart Mill, *Principles of Political Economy* (1848), Book V Chapter X

> "The condemnation of monopolies ought not to extend to patents, by which the originator of an improved process is allowed to enjoy, for a limited period, the exclusive privilege of using his own improvement. This is not making the commodity dear for his benefit, but merely postponing a part of the increased cheapness which the public owe to the inventor, in order to compensate and reward him for the service. That he ought to be both compensated and rewarded for it, will not be denied, and also that if all were at once allowed to avail themselves of his ingenuity, without having shared the labours or the expenses which he had to incur in bringing his idea into a practical shape, either such expenses and labours would be undergone by nobody except very opulent and very public-spirited persons, or the state must put a value on the service rendered by an inventor, and make him a pecuniary grant. This has been done in some instances, and may be done without inconvenience in cases of very conspicuous public benefit; but in general an exclusive privilege, of temporary duration, is preferable; because it leaves nothing to any one's discretion; because the reward conferred by it depends upon the invention's being found useful, and the greater the usefulness the greater the reward; and because it is paid by the very persons to whom the service is rendered, the consumers of the commodity."

Voices opposed to invention protection were also heard. France's Simonde de Sismondi argued that the award of privileges to inventors would allow them to corner the market. As a result, while inventors would enjoy extremely large profits, consumers would gain very little from their inventions. Moreover, other producers would relinquish profits, and their employees would lose their jobs.[4]

1.1.2. The 19th Century Anti-Patent Campaign

The 19th century saw invention protection systems, which had hitherto been limited to certain parts of Europe, spread throughout Europe and beyond to the Americas and the Asia-Pacific region.[5] Monopoly rights in different countries sometimes became trade issues, and the view that invention protection systems obstructed free trade began to be articulated. Even in countries that had already adopted invention protection systems, there were cases where the system was not being implemented properly and situations in which it was having negative effects. As a result, the very idea of an invention protection system itself became a subject of debate, which manifested itself in a virulent anti-patent campaign that lasted from 1853 to 1883.

In Britain in 1851, the British Parliament and a royal commission began studying the operation of the patent system. After the completion of several studies, a reform bill was drafted to shorten the period of validity to seven years, implement a rigorous screening system, introduce a licensing system, and so on. This bill was approved by the House of Lords in 1872.

In Germany, meanwhile, a customs union came into being in 1832 with the participating nations concluding an agreement on common principles concerning invention patents and privileges.[6] This pact was aimed at eliminating as many restrictions on free trade between the states as possible. However, because the customs union included cities from the Hanseatic League, which had not had systems for protecting inventions, its members did not really move forward in a common direction. In 1863 the German Economic Association issued a statement declaring that patents harmed the general welfare.

In the Netherlands in 1854, the Dutch Industrial Promotion Commission issued a report pointing out problems with the Dutch patent system at the time. Debate concerning these problems continued, and the system only survived until 1869, when a bill to scrap it was passed.[7]

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[4] From J.C.L Simonde de Sismondi "Neouveaux d'Economie Politique ou de; a Tichesse dans ses rapport avec la population (Paris: 2nd edition 1827, vol. II pp.334-335 (F. Machlup "An Economic Review of the Patent System" (1958)

[5] Various studies have been conducted on the timing of the introduction of patent systems, and the generally accepted dates are as follows: Britain 1643, the Netherlands 1575, the U.S. 1790, France 1791, Austria 1810, Russia 1812, Prussia 1815, Spain 1820, Sardinia 1820, Bavaria 1825, Brazil 1830, Vatican City 1833, Sweden 1834, Portugal 1843, Chile 1840, Argentina 1841, New South Wales (Australia) 1852, and India 1859.

[6] Katsuya Tamai, "Historical Development from the Award of Privileges to Administrative Action" (in *The Development and Transformation of Administrative Law (Part 1)*, Yuhikaku, Tokyo (2001), pp.316-317) (in Japanese)

[7] Tadashi Ishii, "From the Anti-Patent Era to the International Patent System Era," *Patent* (2008), vol.61, no.1, p.31 (in Japanese)

The main argument used by those arguing for the abolition of the patent system was that the use of monopoly rights to protect inventions hindered free trade in much the same way as tariffs. Supporters, on the other hand, developed a number of theories denying this.

Of these, the most important were (1) natural law theory (property-rights theory), (2) reward-by-monopoly theory (reward theory), (3) exchange-for-secrets theory (disclosure-compensation theory), and (4) monopoly-profit-incentive theory (invention-encouragement theory).

These theories were not only vigorously rejected by groups calling for the abolition for the patent system, they were also subjected to fierce criticism from groups advocating rival theories for the justification of the system (see Table 1-1).

Table 1-1: Leading Theories of Invention Protection

Category	Theory	Description
Morality-based	Property-rights theory (natural law theory)	Ideas originating in the minds of individuals can, in accordance with natural law, be possessed by the creator. This right should be recognized and protected by society. Exclusive rights are a rational means of protecting property rights.
	Reward theory	Because inventors provide valuable services to society, they can demand payment for those services. Temporary monopolies are the optimal way of achieving this.
Public-interest-based	Disclosure-compensation theory	Society makes a contract with inventors. Inventors are awarded a temporary monopoly, and in return must make their invention public.
	Incentive theory (invention-encouragement theory)	The provision of the opportunity to earn a considerable amount of profit gives an incentive to inventors, corporate managers, and investors to develop new products.
	Excessive-competition-prevention theory	By awarding a monopoly to the inventor alone, excessive competition between companies and countries is prevented and disciplined competition is maintained.
	Intellectual-creation-cycle theory	The more the intellectual creation cycle (under which society protects, uses, and reinvests intellectual property) expands and the faster it revolves, the more powerful an engine it will be for economic and social development.

1.1.3. Classical Patent Protection Theory

American Fritz Machlup classified these arguments as either morality based, i.e. advocating the importance of justice and natural rights, or public-interest based, i.e. advocating the importance of promoting the interests of the public.[8]

■ Morality-Based Theories

(a) Natural Law Theory (Property-Rights Theory)

[8] Fritz Machlup "An Economic Review of the Patent System" Washington, U.S. Government Print Office (1958), pp.20-25. (This paper was produced for the U.S. Senate Committee on the Judiciary's subcommittee on patents, trademarks, and copyrights.)

Natural law theory is also referred to as "property-rights theory" or "natural-rights theory." The theory holds that just as fruit produced on land owned by an individual belongs solely to that individual, individuals also have "natural property rights" to ideas generated by their brains. It states that these rights should be accepted and safeguarded by society, and that the most sensible way of protecting property rights is by granting exclusive rights.

Many commentators have viewed this theory as being grounded in John Locke's labor theory of ownership, which holds that the fruits of a person's labor belong to that person, though a number of opposing views also exist[9]. This theory was a new, politically-motivated theory designed to meet growing demands from inventors and commercial and industrial people for the reestablishment of an invention protection system, given that all privileges had been abolished following the French Revolution of 1789.

In France, this view later became the theoretical foundation for that country's invention protection system. On December 30, 1790 the government declared that "all discoveries or inventions in all fields of industry are the property of their creators, and that the law shall afford full protection of the rights and interests of creators." Later, in January 1791, the French Industrial Property Act was passed, and its preamble provided that "when the realization or development of a new idea will be beneficial for society, the rights to it shall reside unequivocally with the person that thought of it." It also stated that "not regarding industrial inventions as the property of their creators constitutes a basic infringement of their human rights."

Legal scholars spent the next few decades painstakingly analyzing the concept of rights of ownership in relation to ideas, and "property rights" became the preferred term to refer to these rights among inventors and business people.[10]

Right from the start, natural law theory was criticized by numerous scholars. Critics argued that if natural property rights existed, and resided with people that invented technologies independently, then it was illogical for them to be limited to a period of 15 years. Other criticisms were that inventions did not result from the efforts of a single individual (and that it was therefore irrational for only the creator of the final version to obtain a monopoly) and that monopolies restricted the natural right of ordinary citizens to use inventions freely.

(b) Reward Theory

This theory is based on the idea that individuals who contribute to society should be rewarded by society for that contribution. It holds that invention is a useful service provided to society, and that inventors should therefore be able to demand payment for their inventions. It states that the size of the reward should depend on the degree to which the invention benefits society, and that the best way of achieving this is to award those who have produced useful inventions a temporary monopoly, enabling them to earn significant rewards through the market mechanism.

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[9] Yoshiyuki Tamura, "Initiatives in Intellectual Property Law and Policy," *Intellectual Property Law and Policy Journal*, vol.20 (2008) (in Japanese)

[10] Tatsuki Shibuya, *Patents and Economic Systems*, Nikkei Publishing (1979), p.22 (in Japanese)

This approach is said to be based on John Stuart Mill's view that inventors should be both compensated and rewarded. Although the theory was supported by a number of British economists, it also had its fair share of criticism.

Some critics questioned the need to reward inventors, while others doubted the rationality of conferring temporary monopolies as a means to this end.

Those that denied the need to reward inventors felt that the vast majority of useful inventions were realized more through social progress than individual contribution. They argued that there was no need to reward just those fortunate enough to be the first to come up with something that was required by society. They also condemned patents as often resulting in more losses than gains for the inventors, making them the ultimate in deceptive forms of reward.

■ Public-Interest-Based Theories

(c) Disclosure-Compensation Theory

This theory is based on the assumption that the public disclosure of inventions is essential for the development of society. From this it follows that if inventions with economic value are made public, numerous imitators may emerge, and the inventor may lose the chance to recover the money invested in developing their invention. This will result in inventors keeping their inventions secret.

The theory therefore recommends that society enter into contracts with inventors, under which the inventor has to make their invention public and is granted a temporary monopoly in exchange.[11]

The disclosure-compensation theory is also said to have been adopted by legislators during the French Revolution, who wanted to avoid using words like "monopoly" and "privilege."

Critics of this theory argued that if inventions were applied, they were automatically made public, making it practically impossible for inventors to keep their inventions confidential. This, they said, meant that there was no need to grant monopolies to ensure the disclosure of inventions. They also argued that even if an invention could be kept secret, there was still the possibility that a third party would come up with the same invention later, and that there was therefore no need for society to award monopolies.

(d) Incentive Theory (Invention-Encouragement Theory)

This theory is central to the industrial-policy theory, which views the patent system as existing for the development of industry.

It is based on the assumption that economic growth is good for society, and holds that the opportunity to earn considerable profits from inventions gives researchers, entrepreneurs, and investors an incentive to try to come up with them. This results in new inventions and makes industry stronger.

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[11] Louis Wolowski, Annales de la Societe d'Economie Politique vol. V111 1869-70 Paris p.126

Unlike the reward theory, this approach views the reward itself as being meaningless in reality. It accepts that of those granted patents, some will make money while others will not. It holds that because the incentive is the potential to amass enormous wealth from a single successful business undertaking, and that the greater these potential earnings are the more effective the incentive will be. It also states that the award of temporary monopolies is the easiest and least costly way of providing this incentive.

Various criticisms were directed at this theory. Some opponents argued that people pursuing inventions need no incentives. They said that the seeds of invention are floating in the air that we breathe and are ready to sprout at any time provided the right conditions exist. As a consequence, they argued, there is no need for the government to get involved by legislating them[12]. Criticism also came from people claiming that invention protection systems incurred a lot of costs, such as the expenses of those involved in the procedures for acquiring patents.

1.1.4. Later Views from Economists

Although the patent abolitionists initially garnered a lot of support, the 1870s saw their campaign suddenly lose momentum, and the movement finally ran out of steam in 1873. It is said that the cause of this was the massive and hard-hitting economic recession that engulfed Europe that year[13]. With their economies in the doldrums, European countries shifted sharply away from free trade towards protectionism. Other reasons put forward are the international moves towards invention protection that occurred at the time and the emergence of the U.S., which had achieved rapid economic growth while aggressively protecting inventions.

For over 20 years the debate had been positioned as one between legal scholars and professionals (i.e. lawyers, patent attorneys, industrialists, and inventors) on the one side and economists on the other, but it is not necessarily correct to say that the eventual maintenance of the patent system was the result of victory by the legal scholars and professionals.

With regard to the natural law theory, Fritz Machlup argues that the biggest bone of contention between economists and legal scholars, i.e. whether inventions or technological ideas constitute property, ceased to be an issue of debate after this.[14]

And with respect to the natural law theory, he contends that economists rejecting the theory also ceased to exist.[15]

With regard to the public disclosure theory, although it originally garnered support from only a small number of economists, what little support it did have disappeared almost entirely. Machlup

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[12] "Report of the 33d Meeting of British Advanced Science 1863," London (1864), p.111

[13] Tadashi Ishii (see Footnote 7) pp.31-32

[14] Machlup argues that modern-day economists have still not fully accepted the notion that inventions are property, but that "property rights" in the form of patents and the limited monopolies conferred in conjunction with them are obviously tolerated as part of the legal system. (Fritz Machlup (see previous footnote) p.26)

[15] Fritz Machlup (see Footnote 5) p.26

believes that the reason for this was that because inventions were also being protected as trade secrets, companies made it a point not to apply for patents for inventions they believed they could keep confidential. As a result, they did not apply to patent inventions that had the potential to be further developed in the future. Only when an invention was complete would they file for a patent. He also argues that decisions on patentability were never made from the perspective of the value of information, and that the fact that useful information was withheld and never disclosed also indicates that the theory is unrealistic.[16]

Ultimately, the theory behind invention protection systems that won acceptance among U.S. economists was that they create an effective, profit-based incentive for inventors, and that this can lead to technological progress.[17]

Each of Japan's industrial property laws prescribes its purpose in the first article.

The Patent Act states, "The purpose of this Act is, through promoting the protection and the utilization of inventions, to encourage inventions, and thereby to contribute to the development of industry." This indicates that the legislation is aimed at encouraging inventions and developing industry[18]. In addition both the Utility Model Act and the Design Act give their respective objectives as contributing to the development of industry by encouraging (the protection and utilization of) devices (Utility Model Act) and by encouraging the creation of designs (Design Act).

Many other Asian countries also prescribe similar provisions. South Korea's Patent Act, for example, states, "The purpose of this Act is to encourage, protect and utilize inventions, thereby improving and developing technology, and to contribute to the development of industry."

1.1.5. New Invention Protection Theories

One hundred and fifty years have passed since the anti-patent movement, and it has been more than 50 years since Fritz Machlup and others carried out their research. Economic activity has suddenly become globalized, society has become increasingly dependent on information, and technology is becoming more advanced and diverse than ever imagined. With society undergoing these kinds of changes, new debates have emerged in relation to invention protection.

- Excessive-competition-prevention theory

This theory holds that in this modern age of advanced technological innovation, there is no longer a need to award temporary monopolies to promote the disclosure or utilization of inventions. Even so, invention protection systems are still necessary because if they did not exist, the inevitable result would be unfair competition both domestically and internationally. To prevent this the

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[16] This does not mean that information disclosed under invention protection systems is of little value. Economists simply deny that a monopoly is compensation for invention.

[17] Fritz Machlup (see Footnote 5) p.33

[18] This provision was introduced for the first time in the 1959 act.

theory states that awarding monopolies only to inventors is a fair, powerful, and rational means of preventing excessive competition and maintaining discipline in competition.[19]

- Intellectual-creation-cycle theory

The Intellectual Property Policy Outline published by the Japanese government in 2002 articulates the significance of the intellectual-creation-cycle theory. This theory holds that there exists an intellectual-creation cycle, under which a mechanism for generating high-quality intellectual property is established, intellectual property is properly safeguarded, intellectual property is utilized by society as a whole, and more intellectual property is created through reinvestment. It states that the faster this cycle revolves and the more extensive it becomes the more benefits intellectual property will yield, and the more powerful an engine it will be for economic and social development.[20]

1.1.6. Debate on Invention Protection in the Era of Innovation

In August 2008 the Japan Patent Office's research unit on innovation and intellectual property policy issued a report revealing that with economic activity globalizing and technology becoming increasingly advanced and complex, a variety of debates are ongoing in various fields on the role of the invention protection system in generating innovation.[21]

a) Prospect Theory

Prospect theory enjoys the most support in the pharmaceutical industry. The theory holds that the award of a patent during the initial phase of the invention process results in researchers "expecting" patents, and that this spurs innovation.

b) Competitive Innovation Theory

The competitive innovation theory is frequently applied to patents for the invention of business models. It holds that even if business models are not protected with patents, a competitive environment will promote innovation.

c) Cumulative Innovation Theory

This theory is considered to be applicable to the software industry. It holds that inventions of this type are not singular. Rather, they are the cumulative result of past technology. As a result, innovation can be promoted by providing incentives for both basic inventions and improvement inventions.

d) Anti-Commons Theory

This theory, which enjoys support in the biotechnology industry, argues against invention

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[19] Kosaku Yoshifuji, *Introduction to Patent Theory* (Ninth Edition), Yuhikaku (1992), p.10 (in Japanese)

[20] Strategic Council on Intellectual Property, "Intellectual Property Policy Outline" (July 2002)

[21] Research Unit on Innovation and Intellectual Property Policy, Japan Patent Office, "New Intellectual Property Policy for Pro-Innovation - Intellectual Property System as Global Infrastructure (Draft)" (2008)
(Compiled by the Japan Patent Office based on a Japanese translation by Noboru Yamazaki of Burk and Lemley "Policy Levers in Patent Law" (2003), published in Intellectual Property and Policy, vols.14,15 (2007))

protection. It holds that in the case, for example, of DNA patents, even though the scope of each patent is narrow, the subdivision of technology through multiple patents poses an obstacle to innovation because, for example, it leads to higher licensing costs.

e) Patent Thicket Theory

This theory is argued to be applicable to the semiconductor industry, and also constitutes a counterargument to investor protection. It holds that multiple companies are simultaneously trying to develop the same technology, and that this results in numerous similar, overlapping patents. This leads to existing companies entering into broad-ranging cross-licensing agreements, which impedes innovation by effectively excluding new entrants.

h) Other Modern Problems

Another topic of debate is the abuse of rights, as typified by the "patent roll." The patent roll refers to individuals or groups who collect patents that have yet to be utilized, for which there is no intention to utilize, and in many cases, no plan to utilize. These individuals or groups then exercise the patents with the aim of earning large amounts of money from out-of-court settlements and licensing fees. These individuals and groups include companies that obtain patents for the purpose of exploiting (in negotiations) the rights they confer and agents and law firms who work on behalf of companies that have ceased operations in connection with all or most of the patented products they used to manufacture or sell to help them exercise their rights. The patent roll has become an issue particularly in the U.S., and has been cited as a hindrance to innovation because of the huge impact it has on business activities. This impact includes the large legal costs incurred in defending against actions, huge damages in the case of defeat, compliance with cease-and-desist orders, and so on.[22]

1.2. Economic Growth Theory and Technological Progress

Adam Smith titled the book he published in 1776 "An Inquiry into the Nature and Causes of the Wealth of Nations[23]". The themes at its heart were economic development and economic growth, subjects that economists have continued to study for the more than 200 years that have passed since then.[24]

The discussion below examines the role of invention protection systems in economic growth.

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[22] Research Unit on Innovation and Intellectual Property Policy, Japan Patent Office (see Footnote 21)

[23] Adam Smith (see Footnote 2)

[24] Economic development and economic growth are fundamentally different concepts. Economic development is defined as the historical processes of economic progress and social modernization, while economic growth refers to the expansion of the economy. Therefore, whereas the extent of economic development is often expressed as per-capita GDP, economic growth is normally expressed in terms of the increase in total GDP. Nevertheless, economies cannot develop without sustained economic growth, so the two concepts are very closely related. For this reason, the discussion here does not make any clear-cut distinction between the two.

1.2.1. Early Theories of Economic Growth

For many years, economists defined land, labor, and capital as the three factors of production. It was believed that increases in these three factors would cause output to rise and the economy to grow.

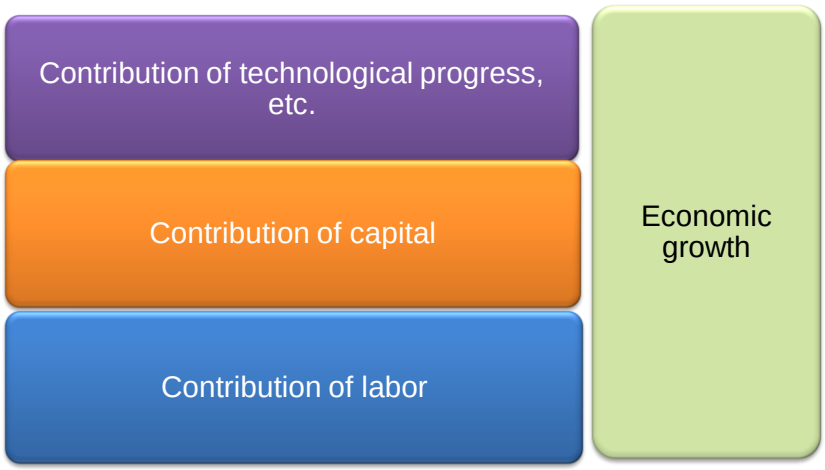
Most classical economists considered that of these three factors, land was constant, and that the expansion of labor as the population grew would lead to economic development. A lot of attention was therefore paid to technological progress, as this would increase labor productivity, a key driver for economic growth. This technological progress can be reworded as innovation, which is now considered to be the most important factor for economic growth.

Adam Smith recognized the importance of capital in relation to labor, and believed that capital and technological innovation would result in economic growth. Since then, various theories have emerged that position capital as central to economic growth.

1.2.2. Neo-Classical Growth Theory (Exogenous Growth Theory)

A 1956 paper by Robert Solow entitled "A Contribution to the Theory of Economic Growth" led to a renewed focus on technological change. The following year, in 1957, Solow published another paper titled "Technical Change and the Aggregate Production Function," in which he applied simple calculations to break down output growth into growth from capital, growth from labor, and growth from technological change (see Figure 1-1). He used the results to analyze the U.S. GDP and found that growth in per-worker GDP could not be explained by increases in labor and capital alone. He attributed this unexplained component of growth, which came to be known as the "Solow residual," mainly to technical progress.

Figure 1-1: Technological Progress in Exogenous Economic Growth Theory



The Solow residual (also known as "total factor productivity" (TFP)) is now used by governments and international organizations to analyze economic growth. TFP is seen as the component of increases in output that cannot be measured in terms of factors such as capital (increase in the capital stock × capital share) and labor (increase in labor input × labor share).

As we will see in Chapter 3 that even in Japan a variety of organizations use the TFP concept to analyze economic growth.[25]

Under this theory, technological change has the potential to increase output without changing the amounts of labor and capital used in the production process. With a fixed labor force and capital stock, technological progress can generate more output. One of the weaknesses of the theory, however, is that it does not provide a specific roadmap for delivering technological progress.

1.2.3. New Growth Theory (Endogenous Growth Theory)

During the 1980s, a theory dubbed the "new growth theory" (or endogenous growth theory) began to garner attention. This theory contends that technological change is included in new additions to the capital stock. It holds that technological change is induced by past economic conditions, and that economic growth is generated from within the system itself.

In 1990, Paul Michael Romer published "Endogenous Technological Change," in which he contended that the technological progress that underpins economic growth is an endogenous factor included in the capital stock.

The new growth theory did not consider growth to be a consequence of automatic, exogenous technological improvements that cannot be modeled. It focused on understanding the functions of the economic factors that support growth. Romer's economy comprises three sectors: the final goods sector (comprising firms that produce goods), the intermediate sector, and the research sector (comprising firms that produce ideas). The intermediate sector turns the ideas generated by the research sector into new types of capital goods. The research sector sells the monopoly rights to these specific types of capital goods to intermediate firms, which manufacture them exclusively. The intermediate firms in turn sell them exclusively to final goods firms, which produce the final goods.[26]

In other words, the theory holds that the knowledge (or inventions) generated by R&D activities leads to economic growth by increasing the types of intermediate goods used in the production of final goods.[27]

1.3. New Growth Theory and Invention Protection

One of the key aspects of the new growth theory is Romer's formulization of the relationship between ideas (i.e. inventions and technology) and economic growth[28]. He gives the following as distinctive characteristics of ideas (see Figure 1-2).

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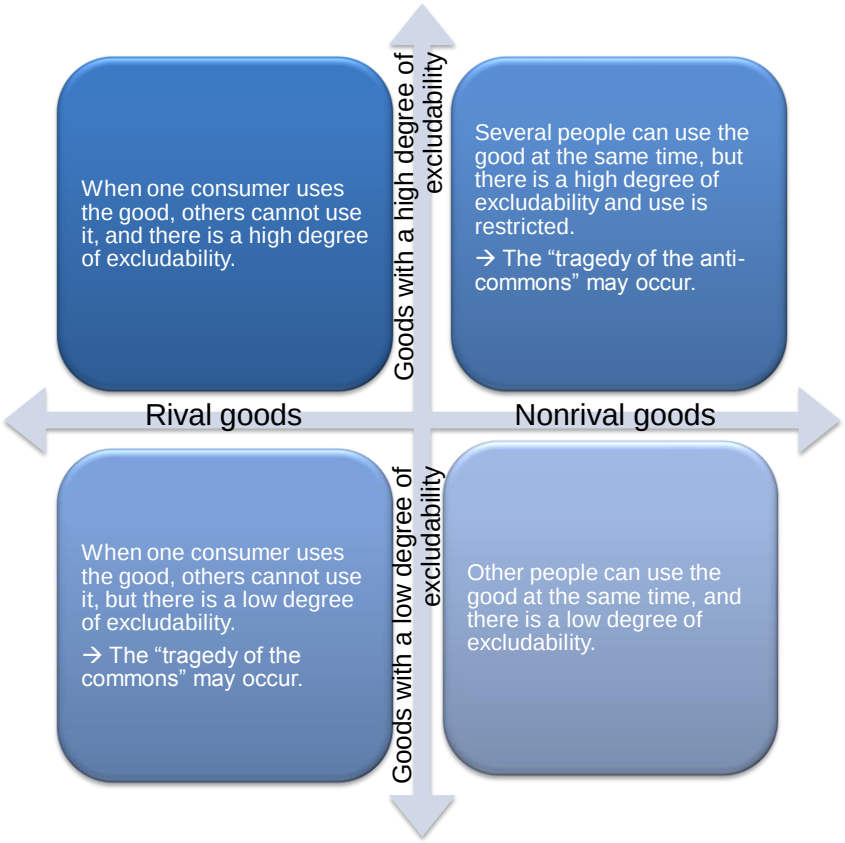
[25] See Figure 3-5 in Chapter 3.

[26] Charles I. Jones "Introduction to Economic Growth (Second Edition)" W. W. Norton & Company (2002), pp.101-107

[27] Kamil Idris "Intellectual Property, A Power Tool for Economic Growth" World Intellectual Property Organization (WIPO Publication No.888), Geneva (2003), pp.23-26

[28] J Charles I. Jones (see Footnote 26) pp.72-83

Figure 1-2: Economic Characteristics of Goods in New Economic Growth Theory



a) Non-rivalrous
b) Increasing returns
c) Imperfectly competitive

Whereas most economic goods are rivalrous, ideas are non-rivalrous. For example, a production line in a car factory is a rivalrous good because as long as the owner is using it others cannot do so. However, a technological idea for improving the manufacturing process, for example, is a non-rivalrous good that anyone can utilize simultaneously.

In addition, unlike other goods, ideas exhibit increasing returns. In other words, once an invention is created, it can be copied at low cost, so returns from it will expand infinitely.

The theory also holds that regardless of whether economic goods are rivalrous or non-rivalrous, there are big differences among them in terms of excludability, and researchers will have no motivation to develop non-excludable goods that require a large investment at the initial phase of the development process.

The theory concludes that the award of temporary monopolies under an invention protection system can generate such motivation. Invention protection systems are therefore essential for economic growth because they make it possible to provide continuous incentives for development.

The theory therefore creates scenarios for innovation through invention protection and economic growth (i.e. economic development) through innovation.

1.4. How the Invention Protection System Works

1.4.1. The Economic Benefits of Invention Protection

Various organizations analyze how the invention protection system is viewed by the companies, research organizations, universities, etc. that use it, how it is used, and what kind of impact it has on the national economy.

In 1994, the Institute of Intellectual Property (IIP) performed a study on fundamental issues concerning the economic benefits of intellectual property, for which it surveyed the opinions of Japanese users concerning the economic benefits of the system of intellectual property rights.[29]

52.9 percent of respondents said the intellectual property rights system "has benefits," a far higher proportion than those that said they "cannot perceive any economic benefits" or that it is "more harmful than beneficial" (see Table 1-2).

Table 1-2: Opinions of Users Concerning the Economic Benefits of the Patent System

	No. of respondents	Percentage of total
1. Has benefits	316	55.8%
2. Cannot perceive any benefits	138	24.4
3. Is more harmful than beneficial	19	3.7
4. Cannot say whether it is beneficial or harmful	89	15.0
5. Other	4	0.7
Total:	566	100.0

Source: Institute of Intellectual Property, "Report on the Results of a Survey Commissioned for the Purpose of Studying Fundamental Issues Concerning the Economic Benefits of the Intellectual Property System" p.382

When asked about specific benefits, 36.6 percent of respondents who felt that the system had "strong benefits" cited "increased income from licensing" as a strong benefit. 34.6 percent of such respondents cited the fact that "public information from other companies is a source of information for product development" as a strong benefit, while 28.4 percent cited the fact that the system is "advantageous for stopping the activities of infringers." In comparison, fewer than 20 percent of such respondents cited the "earning of royalties" or the acquisition of "resources for the exchange or cross-licensing of technology, etc." (See Table 1-3).

[29] Institute of Intellectual Property, "Report on the Results of a Survey Commissioned for the Purpose of Studying Fundamental Issues Concerning the Economic Benefits of the Intellectual Property System", Tokyo (1994) (in Japanese)

These results offer support to the view that the "expectation of success" provided by monopolies can trigger innovation. Nevertheless, innovation requires more than just incentives. If one's own technology is inadequate, it is efficient to utilize outside technology. It can be said that the fact that so many respondents felt that public information from other companies constituted an economic benefit is a reflection of this situation.

Table 1-3: Breakdown of Economic Benefits

	Strong benefit		Some benefit		Weak benefit		No benefit	
Increased income from licensing	115	36.6%	115	36.6%	80	25.5%	4	1.3%
Royalties can be earned	56	18.0	87	28.0	140	45.0	28	9.0
Resources for the exchange and cross-licensing of technology, etc.	58	18.8	129	41.7	97	31.4	25	8.1
Public information from other companies is a source of information for product development	109	34.6	160	50.8	44	14.0	2	0.6
Fewer risks involved in product development	66	21.4	168	54.5	68	22.1	6	1.9
Advantageous for stopping the activities of infringers	88	28.4	124	40.0	88	28.4	10	3.2
Advantageous for demanding damages from infringers	24	7.9	157	51.8	107	35.3	15	5.0
Number of patents obtained can be used as a measure of performance	23	7.4	117	37.6	147	47.3	24	7.7
Other benefits	2	15.4	4	30.8	1	7.7	6	46.2

Source: Based on data from Institute of Intellectual Property, "Report on the Results of a Survey Commissioned for the Purpose of Studying Fundamental Issues Concerning the Economic Benefits of the Intellectual Property System"

1.4.2. Incentives for Innovation

In 1974 the Munich-based "Ifo" economic think-tank carried out a study on the patent system and technological progress, for which it analyzed the backgrounds to numerous patented inventions[30]. The study involved the selection of 1,117 patents granted in West Germany in 1955, 1965, 1970, and 1975, with 208 of the patent holders being interviewed.

Ifo began by asking the interviewees whether the inventions would have occurred without the existence of a patent system. The interviewees concluded that 20.7 percent of the total "would not have occurred without the patent system." Even for inventions that the patent holders felt were "extremely important from an economic point of view," only 17.6 percent would have occurred (see Table 1-4). However, variation was seen from industry to industry. According to the patent holders, 44.2 percent of inventions in the chemical industry would not have occurred without patent protection, yet the figure for the machinery sector was only 3.0 percent.

[30] Ifo-Institut fur Wirtschaftsforschung " Patentwesen und technischer Fortschritt, Teil I: Die Wirkung des Patentwesens im Innovationsprozess" Göttingen: Verlag Otto Schwarz & Co. (1974)

Table 1-4: Inventions That Would Not Have Occurred Without the Patent System

Inventions by economic significance	No. studied	Inventions that would not have occurred without the patent system	
		No.	%
Extremely important inventions	319	56	17.6
Important inventions	411	58	14.1
Fairly unimportant inventions	95	24	25.2
Unimportant inventions	138	25	18.1
Once-important inventions	45	7	15.6
Inventions of which the significance is not yet known	157	66	42.0
Inventions for which patents were disclaimed or invalidated	74	22	29.7
Total	1,239	256	20.7

Source: Based on data from Ifo, "Das Patentwessen und Technischer Fortschritt" (1974)

In 1973 Christopher Thomas Taylor, Aubrey Silberston, and Z. A. Silberston of the University of Cambridge published research on the impact of the patent system.[31]

For their study, Taylor et al. focused on how R&D investment expenditure would change if the current patent system were scrapped and inventors wishing to patent inventions were forced to license them (with royalties). They estimated that of investment expenditure in research in Britain, 8 percent was dependent on the patent system, i.e. would not be made if the system were abolished (see Table 1-5).

Table 1-5: Impact of the Patent System on R&D Investment

Industrial field		(1) R&D spending in Britain (in millions of pounds)	(2) Patent-dependent R&D spending (in millions of pounds)	(2) As a percentage of (1)
Chemicals	Pharmaceuticals	4.9	3.1	63.3
	Chemicals for other purposes	7.1	1.8	25.4
	Basic chemicals	5.5	0.2	3.6
Machinery	Plant, machinery, and equipment	3.6	0.3	8.3
	Assembly and materials	2.1	0.1	4.8
Electronics		42.7	Can be ignored	Can be ignored
Total		65.9	5.5	8

Christopher Thomas Taylor, Aubrey Silberston, Z. A. Silberston, "The economic impact of the patent system: a study of the British experience" (1973)

[31] Christopher Thomas Taylor, Aubrey Silberston, Z. A. Silberston "The economic impact of the patent system: a study of the British experience," Cambridge University Press, UK (1973)

Their data revealed big differences between industries in terms of the proportion of patent-dependent R&D investment. This proportion was extremely high in the pharmaceuticals sector, for which they found that 63.3% of investment was only made because of the patent system. The next highest figure was from the machinery sector, yet that for the electronics industry was so low it could be ignored.

In 1981 the Japan Institute of Invention and Innovation carried out a study entitled "Technological Innovation and Patents." The study examined the power of incentives for R&D activities for individual researchers and companies.[32]

The largest number of individual researchers, 23.1 percent, cited "helping the company beat the competition" as an incentive at the R&D stage. The next most popular reason was an academic or technology-related interest in the field, with 17.1 percent of respondents choosing it. The "acquisition of patents," however, was selected by just 11.8 percent (see Table 1-6).[33]

Table 1-6: Incentives for Researchers at the R&D Phase

	No. of affirmative responses	Percentage of total
Helping the company beat the competition	706	23.1%
Interest in the field (i.e. the technology)	522	17.1%
Acquisition of patents	359	11.8%
Achieving goals (i.e. meeting targets)	343	11.2%
Enhanced status (promotions, etc.)	321	10.5%
Presenting results at academic conferences	209	6.8%
In-house awards	202	6.6%
Compensation money and prize money (including licensing royalties)	189	6.2%
Awards from outside the company	115	3.8%

Source: Japan Institute of Invention and Innovation, "Technological Innovation and Patents" (1981)

Among incentives for companies at the R&D phase, by far the biggest number, 29.7 percent, chose the "existence of the patent system." The next most cited incentive was "tax breaks" at 13.5 percent, less than half the figure for the top-ranked incentive (see Table 1-7).

These surveys show that the invention protection system provides companies, which are faced with intense competition, with stronger incentives to perform R&D than individual researchers, and it does this by encouraging them to invest in R&D and capture research personnel.

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[32] Source: Japan Institute of Invention and Innovation, "Technological Innovation and Patents," Tokyo (1981)

[33] Patterns in applications for patents in Japan also highlight the weak incentive that the acquisition of patents provides to Japanese inventors. The number of patents filed by independent Japanese inventors has been plummeting, and stood at just 3.5 percent of all applications in 2009. (Japan Patent Office Annual Report 2010 (Statistical Data p.47))

Table 1-7: Incentives for Companies to Conduct R&D

	No. of affirmative responses	Percentage of total
Existence of the patent system	711	29.7%
Tax breaks	322	13.5%
Subsidies	302	12.6%
Awards and prizes	207	8.7%
Helping the country realize its long-term vision	200	8.4%
Participation in big government projects	183	7.7%
Legal regulations (governing pollution, etc.)	154	6.4%
Public investment	93	3.9%
Other	218	9.1%

Source: Japan Institute of Invention and Innovation, Institute of Intellectual Property, "Study of Fundamental Issues Concerning the Economic Benefits of the Patent System" (March 1994)

1.4.3. Contribution to Technology Transfer

The role played by technology transfer in the mechanism through which invention protection spurs innovation is also impossible to ignore. Technology transfer under an invention protection system is believed to take the following forms:

a) Technology transfer through licensing or transfer of patents, etc.
b) Technology transfer through the sale or local production of patented inventions
c) Technology transfer through patent information

In its 1977 white paper on science and technology, Japan's Science and Technology Agency (now part of the Ministry of Education, Culture, Sports, Science and Technology) analyzed sources of information for technology transfers.[34]

Although the largest number of respondents cited "business relationships," this was closely followed by information on patents disclosed under the invention protection system, with 52.1 percent choosing it. This indicates that patents represent an important information source. When this analysis was conducted in 1977, a lot of technology transfer was going on in Japan. It was a time in which technology transfer was helping to drive economic growth, and the findings show that patent information was making a major contribution to the growth of the Japanese economy (Table 1-8).

[34] Science and Technology Agency, "1977 Science and Technology White Paper Part 1 Chapter 3 Section 2: Current Situation and Issues with Technology Transfer"

Table 1-8: Sources of Information for Technology Transfers

Source of information	Percentage of respondents citing it
Business relationships	54.6
Patent information	52.1
Related companies	45.4
Industry and professional magazines	38.8
General trading companies (*sogo shosha*)	37.9
Group companies	25.0
Public advisory organizations	21.3
Academic journals	17.9
Trade fairs	13.8
Product catalogs	9.6
Newspapers	8.3
Domestic information services	7.1
Overseas information services	6.3
Other	17.5

Source: Science and Technology Agency, "1977 Science and Technology White Paper Part 1 Chapter 3 Section 2: Current Situation and Issues with Technology Transfer"

The aforementioned survey on the views of users on the economic benefits of the patent system conducted by the Institute of Intellectual Property (Table 1-3) duplicated these results. 85 percent of respondents felt that public information from other companies as a source of information for product development constituted either a "strong benefit" or a "benefit" of the intellectual property system. This percentage was higher than for any of the other economic benefits.

The study performed by the Ifo think-tank[35], mentioned earlier, also involved an analysis of "inventions that would not have been made public without the patent system."

According to their analysis, 25.5 percent of inventions would not have been made public without the patent system. They found that 22.6 percent of inventions regarded as "extremely important" by the patent holders would have been kept confidential, while 21.1 percent of those deemed "important" would have been. There were also big differences depending on the category of invention. For example, 55 percent of "method inventions" would have been kept secret (see Table 1-9a and 1-9b).

In 1998 the Japan Institute of Invention and Innovation's IP Research Center conducted a "Survey of Japanese Companies' Use of Patent Application Systems in Foreign Countries," for which it analyzed the relationship between the opinions of companies, etc. on technology transfer and patent filings in foreign countries.[36]

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[35] Ifo-Institut fur Wirtschaftsforschung (see Footnote 30)

[36] Japan Institute of Invention and Innovation, IP Research Center, "Survey of Japanese Companies' Use of Patent Application Systems in Foreign Countries" (1998) (in Japanese)

Table 1-9a: Inventions That Would Not Have Been Made Public Without the Patent System

Inventions by economic significance	No. studied	Inventions that would have remained confidential without the patent system	
		No.	%
Extremely important inventions	319	72	22.6
Important inventions	411	88	21.4
Fairly unimportant inventions	95	19	20.0
Unimportant inventions	138	40	29.0
Once-important inventions	45	16	35.6
Inventions of which the significance is not yet known	157	62	39.5
Inventions for which patents were disclaimed or invalidated	74	19	25.7
Total	1,239	316	25.5

Based on data from Ifo, "Das Patentwessen und Technischer Fortschritt" (1974)

Table 1-9b: Inventions That Would Not Have Been Made Public Without the Patent System

Inventions studied	No. studied	Inventions that would have remained confidential without the patent system	
		No.	%
New products	312	59	18.9
Improved products	556	82	14.7
Use/application of existing inventions	25	10	40.0
New methods	174	71	40.1
Methods of improvement	172	94	54.7
Total	1,239	316	25.5

Based on data from Ifo, "Das Patentwessen und Technischer Fortschritt" (1974)

The survey found that the biggest reason that Japanese companies and organizations file patents in developed countries was to help their local production and sales activities run more smoothly, with 71.3 percent of respondents citing this as a reason. This objective was also seen in developing countries, with 69.6 percent of respondents choosing it as a reason for applying for patents in such countries. These findings indicate that the acquisition of local patents is seen as a prerequisite for shifting production overseas (see Table 1-10).

In a 1988 paper entitled "Multinationals and Industrial Property," G. Bertin and S. Wyatt of Britain analyzed patents filed in foreign countries by Japanese, American, and European multinational companies.[37]

[37] G.Y. Bertin and S. Wyatt "Multinationals and Industrial Property, The Control of the World's Technology," UK: Harvester-Wheatsheaf and USA: Humanities Press International (1988)

Table 1-10: Reasons Japanese Companies Apply for Patents Overseas

	Applications in developed countries	Applications in developing countries
Make production and sales activities in foreign countries run more smoothly	71.3%	69.6%
Prevent one's products from being imitated in foreign countries	62.2%	82.9%
Prevent other companies from patenting similar inventions	51.6%	38.1%
Establish resources for cross-licensing	49.5%	13.8%
Earn royalties	40.4%	32.0%
Technology partnerships in foreign countries	35.1%	31.5%
Make sales activities in foreign countries run more smoothly	24.5%	19.9%
Establish a patent map	21.8%	15.5%
Future plans to expand overseas	18.1%	28.7%
Operating overseas as an independent company	13.8%	17.7%

Source: Japan Institute of Invention and Innovation, "Survey of Japanese Companies' Use of Patent Application Systems in Foreign Countries" (1998)

The most interesting finding of the paper was the existence of big differences between industries in patent applications. In the automobile industry, 41.2 percent of patents were filed in "countries in which the company has or is considering having production facilities," which demonstrates that local production is a major reason for filing patent applications. In the electrical equipment industry, however, 33.3 percent of patents were filed in "countries in which the company has or wishes to have licensing agreements," implying that licensing is what motivates companies in that industry to make patent applications in foreign countries. In the pharmaceutical, chemical, and machinery sectors, meanwhile, the export of products is the primary objective (see Table 1-11).

Table 1-11: Countries in Which Multinational Companies Apply for Patents

	Pharmaceuticals	Chemicals	Electrical equipment	Machinery	Automobiles	Resources and infrastructure
Countries in which the company has or is considering having production facilities	25.6%	30.1%	22.2%	24.3%	41.2%	29.2%
Countries in which the company has or wishes to have licensing agreements	15.4	20.5	33.3	29.7	23.5	37.5
Countries to which the company exports or is considering exporting products	30.8	30.1	27.3	32.4	23.5	16.7
Countries into which the company wants to prevent the entry of competitors	17.9	14.5	16.7	13.5	5.9	16.7
Other	10.3	4.8	0.0	0.0	5.9	0.0

Source: G. Bertin and S. Wyatt "Multinationals and Industrial Property, " (1988) pp.62-63

Table 1-12: The Relative Importance of Foreign Direct Investment (FDI)

	Inward FDI stock as a percentage of GDP			
	1980	1985	1990	1995
China	-	1.2	3.6	18.2
Malaysia	24.8	27.2	33.0	52.1
Singapore	52.9	73.6	76.3	67.4
Mexico	4.2	10.2	13.2	25.6
Brazil	6.9	11.3	8.1	17.8
Sub-Saharan Africa	3.1	6.8	11.9	16.8

Source: Carlos a. Primo Braga, Carsten Fink, Claudia Paz Sepulveda, “Intellectual Property Rights and Economic Development,” World Bank Discussion Paper No.412 (2000) p.21

2. The Historical Development of Invention Protection Policies

2.1. The Emergence of Invention Protection Systems

2.1.1. The Beginning of Privileges for Inventors

Many experts trace the roots of privileges for inventors to mining techniques. At least as far back as the 14th century various privileges were awarded to artisans in Venice and Germany who possessed skills in areas such as sewerage.[38]

15th century Italy was one of the wealthiest regions of the world both economically and culturally. The most developed states were the Venetian Republic, which built its wealth on trade with the Far East, and the Florentine Republic, which flourished as a financial center. These two states were both early movers in the introduction of policies to protect inventions, though their aims in doing so were quite different.

In the Florentine Republic, the first recipient of invention privileges was the artist and architect Fillippo Brunelleschi in 1421. Brunelleschi invented the cargo ship, but fearing that its secrets would be revealed if it was actually built, he refused to allow its construction. The Florentine government is believed to have responded by awarding him invention privileges for three years in exchange for him building the ship.

The Venetian Republic, on the other hand, awarded invention privileges as a means of importing technology from other countries. In 1416, Franciscus Petri, a citizen of the Greek island of Rhodes, was conferred a 50-year franchise for the water mill, while later, on September 18, 1469, Johann from Speyer (Speyer being in Germany) was conferred invention privileges for five years for his printing technology. Unfortunately, Johann, who immigrated to Venice with his family, died after printing only a few works and the technology reverted to Venice[39]. Technology freed from patent- or privilege-based monopolies was adopted swiftly throughout the Venetian Republic, and by 1482, just 13 years after Johann was awarded his privileges, the republic had become the center of Europe's printing industry.

It can be said that both the system for encouraging and licensing citizens' inventions that began in the Florentine Republic and the system of awarding privileges to provide domestic industry with cutting-edge technology that occurred in the Venetian Republic both represented moves along the same path towards the policy of invention protection that became established later.

2.1.2. Venetian Republic 1474 Patent Statute

On March 19, 1474 the Venetian Republic passed the world's first patent statute. This law, known as the Venetian Republic 1474 Patent Statute, is believed to be the world's oldest government-established

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[38] Katsuya Tamai, "Historical Development from the Award of Privileges to Administrative Action" (in *The Development and Transformation of Administrative Law (Part 1)*, Yuhikaku, Tokyo (2001), p.307 etc.) (in Japanese)

[39] Tetsuo Tomita, *The Emergence of and Changes in the Patent System*, "Outline ; The Early Years of Intellectual Property Rights," Ministry of Finance Publishing Bureau (1982) (in Japanese)

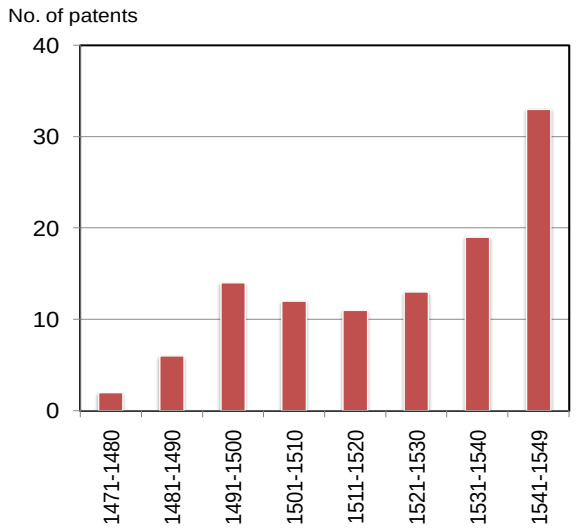
patent law. Other patent systems in operation during the Middle Ages were based on invention privileges provided by the government on a case-by-case basis.[40] The statute called for technologies that had not yet been utilized within the republic (i.e. new technologies) to be registered with the local authority (officio di nostri Prouededori de Comun). Following a hearing, a monopoly would then be awarded.

The statute contained the following provisions:

a) Persons eligible for monopolies: Venetian citizens and temporary foreign visitors
b) Inventions eligible for monopolies: Innovative inventions that have yet to be utilized within the Venetian Republic
c) Period of monopoly: 10 years
d) Penalties for infringers: Fines and the destruction of their products
e) Compulsory licensing: The government was excluded from monopolies and permitted to utilize the inventions.

The Venetian government can be seen as having introduced this system for two reasons: to identify inventions within the republic and to introduce foreign technology to domestic industry. Records of those granted monopolies provide support for this view, as they feature the names of visitors from places outside the republic such as France, Germany, and Pisa, as well as the names of Venetians who had brought in technology from abroad[41]. As Figure 2-1 shows, the number of patentees was small initially but gradually increased, until in 1549 alone seven monopolies were granted[42] (see Figure 2-1).

Figure 2-1: Number of Granted Patents in the Venetian Republic



Based on data from Giulio Mandich, "Venetian Patents (1450-1550)," Journal of Patents Office Society (March 1948)

[40] Katsuya Tamai (see Footnote 35)

[41] Mandich, Giulio "Venetian Patents (1450-1550)", Journal of the Patent Office Society (JPOS) 166 (1948)

[42] Mandich, Giulio (see Footnote 41)

This system is believed to have remained in place for at least another 150 years. In 1594, Galileo Galilei was conferred a 20-year monopoly for a machine he invented for pumping water to irrigate land. It is said that Galileo was interviewed by three examiners before being awarded this monopoly.

2.2. Encouraging the Development of Advanced Technology Through Invention Protection Policy

2.2.1. Britain's Technology Introduction Policy

The British Isles had fallen behind, so England actively deployed invention protection policies to introduce new technologies and develop new industries. The Crown issued letters patent, and this marked the beginning of the use of the term "patent." These invention privileges encouraged people from overseas who had new technologies to come to England.

The first letters patent was awarded in 1449 by King Henry VI to John of Utyman, a Flemish glassworker, and was for a period of 20 years. The invention privileges related to stained glass, which did not exist in England at the time and was to be used at Eton College.[43]

Invention privileges were also awarded during the reign of Queen Elizabeth I. The Queen's first letter patent was issued in 1561, and of the 50 letters patent awarded from then until 1599, 21 were granted to resident foreigners or for imported technology[44]. One of these was a patent for silk products awarded in 1595 to Huguenots fleeing from France.

The remaining patents covered such everyday products as soap, saltpeter, alum, leather, glass, and knives,[45] which put the Queen into conflict with Parliament.

It was claimed that the Royal Family were issuing large numbers of patents for financial purposes, and after the reign of Elizabeth I ended, King James I continued to award patents excessively.

James I often found himself in collision with parliament before the Puritan Revolution, which would accelerate later. During this period of conflict, the courts decided that the patents granted by James I went against the commercial freedoms protected by common law, and voided them. Spurred by this ruling, Parliament established the Statute of Monopolies in 1623, which prohibited the monarch from awarding all privileges except invention privileges.

The Statute of Monopolies comprised nine sections. Almost all its provisions prohibited the Crown from awarding privileges, so Section 6 was remarkable in that it allowed letters patent to be issued for inventions provided that certain conditions were met. Because of this, some

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[43] The United Kingdom Intellectual Property Office, "History of Patents" http://www.ipo.gov.uk/types/patent/p-about/p-whatis/p-history.htm

[44] Tetsuo Tomita (see Footnote 39)

[45] The Intellectual Property Office (see Footnote 43)

commentators describe the statute as the world's first patent law. The statute gave the following conditions for the issue of letters patent[46]:

a) Persons eligible to receive patents: Must be the first and true inventor
b) Period of patent: no longer than 14 years. Despite this provision, Parliament frequently extended patent periods, probably because of the large commissions it earned from such extensions.

The limitation of eligibility for a patent to the inventor alone made it impossible to continue to introduce technology from overseas, the original purpose for the issue of letters patent. The government responded to this problem by deeming "discoverers" (i.e. introducers of overseas patents) to be included in the interpretation of "inventors."

The award of invention privileges as a means of introducing technology is regarded as having had some success. At the very least, it can be said that by the time of the defeat of the Spanish Armada in 1588, England was technologically on a par with other countries.

2.2.2. Technology Introduction Policies in France and Germany

The establishment of policies for bringing in advanced technology from overseas to develop and strengthen domestic industry was also an important issue in other European countries. France and Germany (the Holy Roman Empire), expounders of mercantilism, were particularly aggressive in introducing technology.

France had been awarding invention privileges since as early as the 16th century. One of the characteristics of France's invention privileges was that they included not only temporary monopolies, but also pensions, bonuses, or rewards.

In 1536, the city of Lyon, with the permission of the Crown, granted privileges for the production of silk to an Italian from Piedmont. The privileges enabled him to earn royalties, but it took longer for monopolies to be awarded. The first monopoly granted was said to be one for glass production awarded by the monarch to a glassworker from Bologna, Italy in 1551.

In the Holy Roman Empire, invention privileges were granted for mining, coin-minting, and deforestation. At the time, Germany was an agricultural country, so the award of privileges for technological inventions was limited to those relating to fields such as mining. In the mid-16th century, however, invention privileges came to be conferred as a matter of course.[47]

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[46] The text of Section 6 of the Statute of Monopolies 1623 is as follows:

6. (*a*). Provided also, that any declaration before mentioned shall not extend to any letters patents (*b*) and grants of privilege for the term of fourteen years or under, hereafter to be made, of the sole working or making of any manner of new manufactures within this realm (*c*) to the true and first inventor (*d*) and inventors of such manufactures, which others at the time of making such letters patents and grants shall not use (*e*), so as also they be not contrary to the law nor mischievous to the state by raising prices of commodities at home, or hurt of trade, or generally inconvenient. (*f*):the same fourteen years to be accounted from the date of the first letters patents or grant of such privilege hereafter to be made, but that the same shall be of such force as they should be if this act had never been made, and of none other (*g*).

[47] Katsuya Tamai (see Footnote 35)

However, the award of invention privileges in this way led to conflict between the Crown and new inventors on the one hand and merchant and craft guilds on the other, as the latter had previously enjoyed monopolies on distribution and production.

2.3. Invention Protection Policy and the Industrial Revolution (Britain)

U.S. Economist Douglass C. North has analyzed the history of economic growth and concluded that sustained growth only emerged following the industrial revolution, and that the development over several centuries of the patent system made modern economic development and growth possible. He also contends that the expansion of the patent system from the 18th century onwards succeeded in convincing inventors that they could earn large profits in the marketplace, and that this made sustained innovation possible[48].

The 1623 English Statute of Monopolies did not represent an active call for the creation of innovations, nor was it established to provide tools for industrial policy. Nevertheless, because it remained in force for the next 200 years with only minimal changes, it provided the numerous inventors who underpinned the industrial revolution with strong expectations of business success, and served as a powerful engine for driving the world's first industrial revolution.

As mentioned earlier, England had already managed to take its industrial technology to a high level by, for example, pursuing a policy of introducing technology from abroad. In addition, the power of the guilds, which presented an obstacle to the industrial revolution, had been weakened by the Puritan Revolution in the 1640s and the Glorious Revolution in the 1680s.[49]

Against this backdrop patents were actively acquired not only by scientists with educational backgrounds in advanced technology, but also by new inventors, particularly technicians. That such people were granted patents and achieved success with their inventions became an incentive for the inventors that followed them.

Nevertheless, many inventors behaved highhandedly in exercising their patent rights, and as the anti-patent campaign gathered momentum, many people argued that patents were impeding innovation and further progress with the industrial revolution in England.

For example, the precursor to the steam engine, which made a great contribution to the industrial revolution, was invented by Thomas Savery. Although his invention was patented in 1698, the steam engine he developed featured neither pistons nor cylinders. In other words, it was completely different from the steam engines that would appear later. Even so, Thomas Newcomen, who developed the first practical steam engine 14 years later in 1712 had to pay large amounts of royalties to Savery. This was because the patent Savery had obtained was extremely broad and because Parliament had extended it until 1733.

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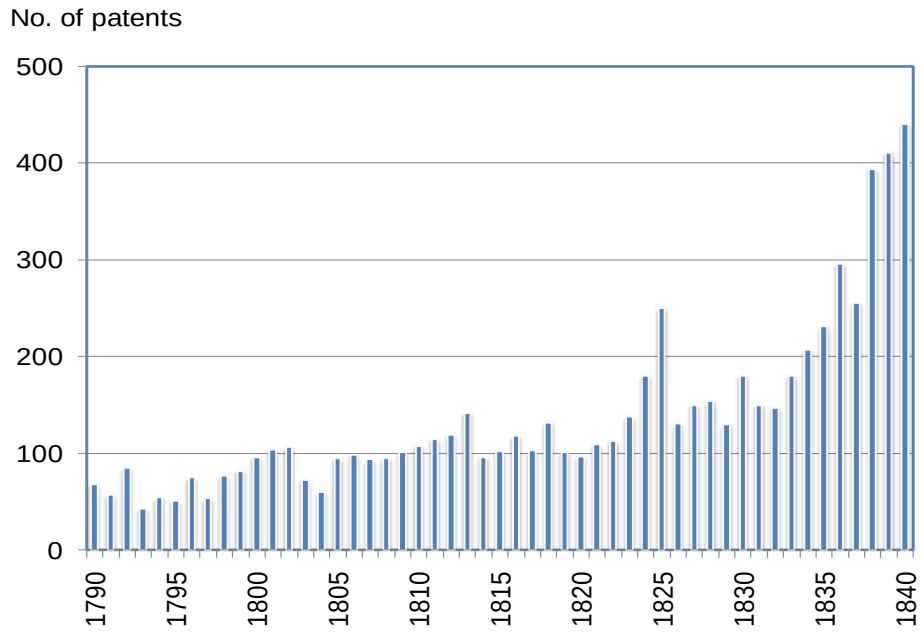
[48] Douglass C. North, "Structure and Change in Economic History," Norton, New York (1981), p.164

[49] Some commentators regard the presence of guilds as being one of the reasons France's industrial revolution occurred later.

James Watt, who improved Newcomen's steam engine, obtained a patent for it in 1769. Watt and his benefactor Matthew Boulton succeeded in business by not allowing others to use the patent and by earning large royalties from users of their steam engines. And as times changed and the need for rotative power and high-pressure steam engines emerged, they used their old patent strategically to eliminate this demand. To begin with, they succeeded in extending the patent, which was set to expire in 1784, to 1800. They also refused overtures to cross-license from James Pickard, the inventor of a steam engine with a crankshaft for generating rotative power, thereby blocking him from manufacturing steam engines.

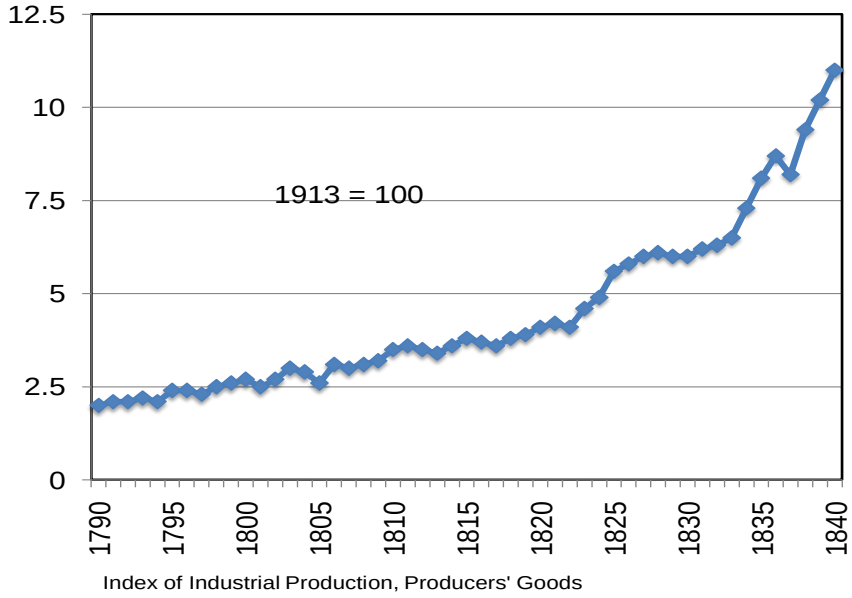
Figure 2-2 shows the numbers of patents granted in Britain during the industrial revolution. Although patents and innovations are said to have driven the industrial revolution, only around 100 patents were awarded each year during these few decades, and the numbers conferred did not change very much from year to year. The number of patents granted only exhibited a clear upward trend after 1835, by which time the pace of the industrial revolution had slowed.

Figure 2-2: Number of Granted Patents in Britain During the Industrial Revolution



Little change was seen in industrial production, either. Figure 2-3 shows figures for the index of industrial production in Britain, with the index set at 100 for 1913. Only after 1935 did the index increase.

Figure 2-3: Index of Industrial Production in Britain



The process of applying for patents under the 1623 Statute of Monopolies was extremely complex, and also involved the payment of large fees. Until the law was revised in 1851, the issuance of a patent in England required the approval of seven government officials, including the Lord Chancellor and the Attorney General.[50] A fee also needed to be paid to each of them, and these fees totaled 350 pounds, around 12 times the annual income of the average citizen at the time. And if the patent was also to be valid in Scotland and Ireland, another 24 pounds needed to be paid, while any parliament-approved extension of the patent period cost 700 pounds.[51]

The system made it difficult for inventors to acquire patents on their own, and encouraged them to forge ties with industrial capitalists. This is one of the reasons James Watt obtained support from John Roebuck and Matthew Boulton, yet such partnerships did not stop at patents. They were also important for perfecting innovations.

2.4. Encouraging Innovation by Entrepreneurs (U.S.)

2.4.1. Laws to Promote Progress in Useful Technology

The United States is sometimes said to be a nation founded by three inventors: Benjamin Franklin, George Washington, and Thomas Jefferson.

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[50] The United Kingdom Intellectual Property Office (see Footnote 43)

[51] Charles Dickens described the procedure in exaggerated form, somewhat derisively, in his spoof, “A Poor Man’s Tale of a Patent”. Dickens’ inventor visits 34 offices (including some abolished years before).

Franklin, a member of the "Committee of Five" that drafted the U.S. Declaration of Independence, invented such things as the lightning rod, the Franklin stove, the rocking chair, and the armonica. Washington, who later became the first U.S. President, invented the barrel plow, while Jefferson, who became the third President, invented the cipher machine, the portable copier, and the lie detector.

It is easy to understand how the U.S., under the leadership of inventors like these, became a nation built on inventions.

In 1641, during the British colonial era, the North American continent saw the invention of the water-powered mill by J. Jenk, a citizen of the Massachusetts Bay Colony, who obtained a patent for it. At the time of the founding of the U.S., a debate ensued on whether to put the power to confer patents in the hands of the federal government or state governments. It has been reported that Jefferson, who would later define the spirit of the U.S. patent system, was opposed to the addition of invention protection to the list of matters under the jurisdiction of the federal government. Later, however, he changed his attitude, and invention protection was made one of the functions of the federal government.

The U.S. Constitution, which was passed in 1789, carried the following provision concerning the powers of the Congress:

"To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries[52]."

The Act to Promote the Progress of Useful Arts, i.e. a federal patent law, was established in 1790 to implement this provision.

This act was based on the principle of aligning the wealth of society and the wealth of inventors. It therefore prescribed various mechanisms for protecting inventors' inventions and providing them with financial reward.

a) Persons eligible to receive patents: Initially, the true inventor. The definition of this was as is, but introducers of inventions from foreign countries were, provided they were eligible for a patent, excluded from this requirement.
b) Nationality of inventors: Initially limited to U.S. citizens or persons who had pledged to become U.S. citizens. This provision drew criticism from foreign governments, and was removed when the law was revised in 1883. However, foreign nationals were required to utilize their invention with 18 months of their patent being granted.
c) Procedures for obtaining a patent: All inventions had to pass a screening process. The examinations were performed directly by the Secretary of State, the Attorney General, and the Secretary of Defense. It is said that this was partly because Jefferson, who was Secretary of State at the time, owned a large number of science- and technology-related books from overseas.[53]

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[52] U.S. Constitution, Article 1, Section 8 (Powers of Congress)

[53] U.S. Patent Office, "Development and Use of Patent Classification System" (1996)

Between 1790 and 1792 only 47 patents were registered[54], which indicates that the screening process was extremely tough.

d) Fees: Applicants only had to pay 3.70 dollars and a copying fee[55].

e) Models: Based on Jefferson's belief that an invention had to be a real object, filers had to provide a model and diagram of their invention with their application. From 1831, these models were made available to the general public, instantly reducing the sense of distance between citizens and inventors.

The examinations by the senior government officials created a lot of work for them, and three years later they were scrapped. However, the 1835 act resurrected the screening system, this time with the examinations being performed by dedicated examiners.

The 1835 act also contained new measures for encouraging inventions by safeguarding the rights of inventors. A patent office was established and the application process was simplified. And in response to increasing emphasis on the global public domain, the patent office also contained an open-to-the-public science library filled with science- and technology-related books, journals, etc. from around the world.

During the 19th century, the number of inventions increased exponentially throughout the U.S.[56]. Robert Fulton developed steamship technology, and Charles Goodyear invented vulcanized rubber. Oliver Evans invented the high-pressure steam engine, Samuel Finley Breese Morse the telegraph, and Thomas A. Edison, the so-called king of inventors, was born. Talented technologists such as Alexander Graham Bell also moved to the U.S.

The U.S. policy of using its invention protection system to stimulate entrepreneurship began to bear a lot of fruit at this time.

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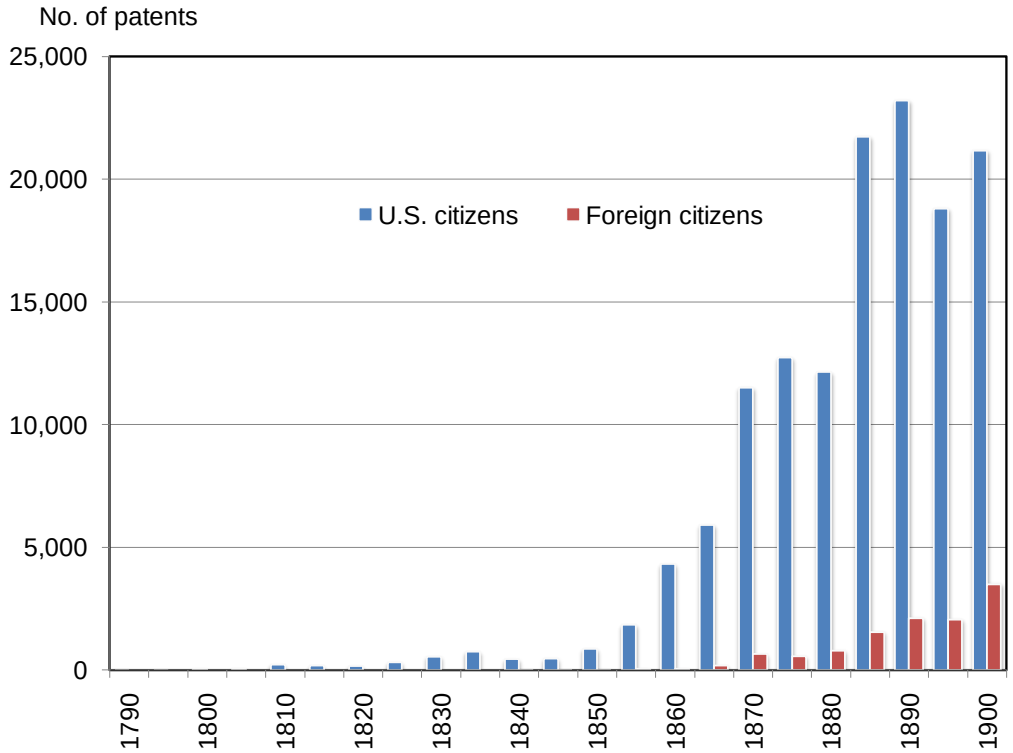
[54] U.S. Patent and Trademark Office, "U.S. Patent Activity Table of Annual U.S. Patent Activity Since 1790"

[55] This fee was increased to 30 dollars under the 1793 act, and the fee remained unchanged until 1860. In its decision to raise the fee to 35 dollars in 1861, the U.S. patent office looked at the fees charged by other patent offices around the world. Even so, Britain, France, and Russia charged 450 dollars, Belgium 420 dollars, and Austria 350 dollars, so the U.S. fee was still a tenth or less of those of other countries. However, after patent applications from foreign nationals were permitted, those foreigners were required to pay 10 times the regular fee. British subjects were particularly hard hit, having to pay almost 20 times the regular fee. (annual report of the director of the U.S. patent office)

[56] John Jewkes, David Sawers, Richard Stillerman, "The Source of Invention Second Edition" Macmillan and Co. Ltd, London (1969)

Figure 2-4 provides information about U.S. patent issuance in the 19th century. Despite the economic turmoil caused by the Civil War, the numbers of patents issued climbed sharply from the 1860s onwards (see Figure 2-4).

Figure 2-4: Number of Granted Patents in the U.S. in the 19th Century



Source: U.S. Patent and Trademark Office, "The Technology Assessment and Forecast Seventh Report," (March 1977)

The U.S. economy also developed strongly. Per-capital GDP in 1930 was three times what it had been in 1900, and the U.S. became the biggest economy in the world with a GDP double that of Britain's.[57]

Abraham Lincoln, the U.S. President at the time, declared in a speech that the patent system had "added the fuel of interest to the fire of genius."[58] This was also an era in which invention protection policy provided incentives to innovators.

2.4.2. France's Industrial Property Rights Act of 1791

Science and technology also made great progress in France during the 17th and 18th centuries.

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[57] From Angus Maddison, "Historical Statistics for the World Economy: 1-2003 AD" (2009)

[58] "Next came the Patent laws. These began in England in 1624; and, in this country, with the adoption of our constitution. Before then, any man might instantly use what another had invented; so that the inventor had no special advantage from his own invention. The patent system changed this; secured to the inventor, for a limited time, the exclusive use of his invention; and thereby added the fuel of interest to the fire of genius, in the discovery and production of new and useful things." Abraham Lincoln (1859)

In 1666 the Academy of Sciences was founded, and when it began to receive large amounts of funding from the Royal Family, scientists from neighboring countries started moving to Paris.

The first French recipient of invention privileges was the writer, scientist, and theologian Blaise Pascal, who in 1649 was credited with the invention of the mechanical calculator. Invention privileges in France included more than just temporary monopolies. Privileges could be chosen from a list including pensions, cash bonuses, subsidies, and peerages. To begin with, the screening was carried out by the Maison du Roi (royal household), but in 1699 these functions were handed over to the Academy of Sciences, which performed rigorous and systematic examinations.

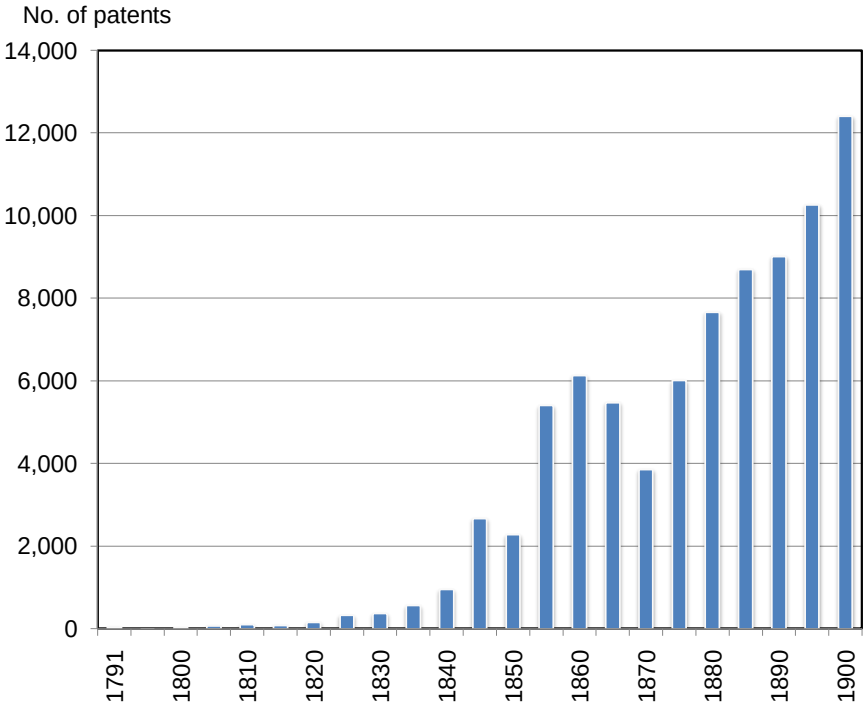
The French Revolution of 1789, however, turned France's invention protection system upside down. Previously awarded privileges were withdrawn, and a new industrial property rights act based on natural law theory was passed in 1791.

Although this act positioned the right of creators to receive patents as a natural right, it also contained politically-motivated provisions designed to facilitate the introduction of technology from abroad and prevent the overseas outflow of domestic technology. While it is normally difficult to justify giving persons introducing technology from overseas property rights as inventors, the drafters of the act got around this by claiming that introducers of inventions patented overseas also possessed natural rights. They also introduced "patents of importation," which were being issued across Europe at that time.

The act also included measures to prevent the overseas outflow of inventions by French people. A provision was included to the effect that if someone who had received a patent in France also acquired one for the same invention abroad, their French patent would be revoked.

Although the new French system initially featured physical examinations of inventions, this was because the number of applications was small to begin with. Physical examinations stopped being employed in the second half of the 19th century, when the number of patents filed increased sharply (see Figure 2-5).

Figure 2-5: Number of Granted Patents in France in the 19th Century



Source: Khan, B. "An Economic History of Patent Institutions," EH.Net Encyclopedia, edited by Robert Whaples (March 16, 2008)

2.4.3. The British Patent Law Amendment Act of 1852

In Britain the Patent Law Amendment Act was established in 1852 to provide a new system of invention protection to replace the Statute of Monopolies, which had been criticized for impeding innovation. This change in the law was designed for the benefit of the Great Exhibition of 1851.[59]

In accordance with the new law, Britain's first patent office was established, meaning that applicants no longer had to visit several different government offices. Also for the first time, the patent office hired "examiners." The main job of the examiners at the time was not to investigate similar, already invented technologies or pass judgment concerning the novelty or inventiveness of the technology. Instead, their most important task was to check that the information presented in the patent specification made it easy to understand the nature of the invention and was written in specific terms.[60]

Another first for the new law was that it stipulated that the patent specification be printed and distributed.

The new system officially abandoned the notion of invention privileges, adopting a new role as a creator of innovations by inventors.

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[59] British Intellectual Property Office (see Footnote 43)

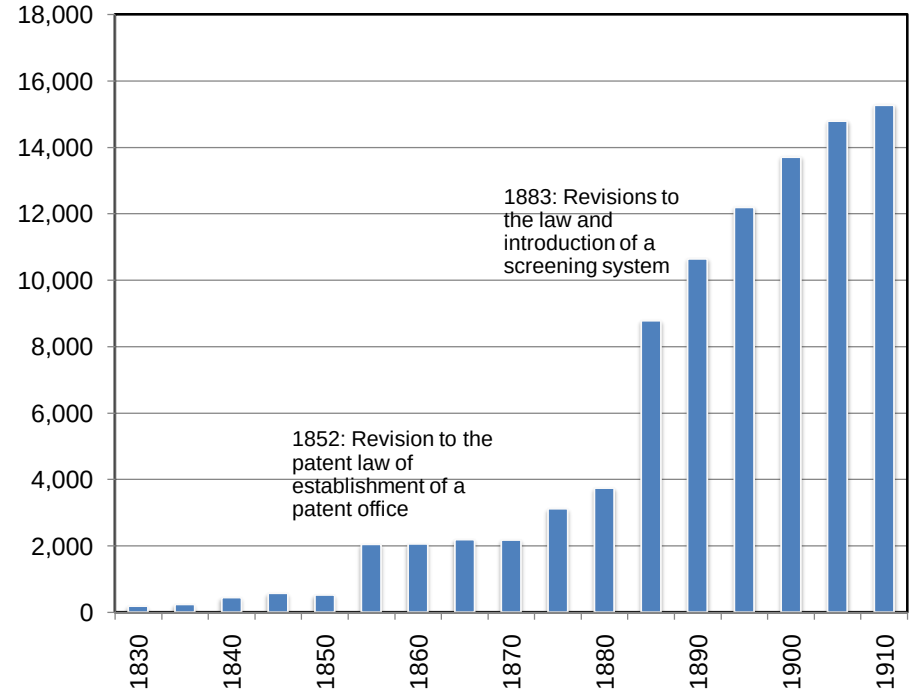
[60] Examinations of novelty (known as "U.S.-style examinations) were introduced in Britain following a change in the law in 1902. Even so, the scope of investigations was limited.

British invention protection policy in the 19th century led to numerous successful innovations by scientists and inventors.[61]

These innovators included Michael Faraday, who developed the theory of electromagnetic waves, Richard Trevithick, who invented the high-pressure steam engine and the steam locomotive, Henry Maudslay, who invented the slide-rest lathe, Charles Wheatstone, who invented a telegraph-based communication system, Charles Parsons, who invented the steam turbine, Henry Bessemer and William Siemens, who invented a low-cost method of producing steel, Joseph Wilson Swan, who invented an incandescent lamp featuring a carbon filament, and C.H. Stearn and F. Topham, who invented a method of manufacturing fibers for medical purposes.

Until the severe depression that began in the 1870s, Britain led the world.

Figure 2-6: Number of Patents Granted in Britain in the 19th Century



Based on data from Khan, B. "An Economic History of Patent Institutions," EH.Net Encyclopedia, edited by Robert Whaples, March 16, 2008 and others

2.5. A Systematic Innovation Policy (Germany)

2.5.1. The German National Patent Act of 1877

Following the Thirty Years' War in the 17th Century, Germany split into numerous kingdoms, principalities, and the city states of the Hanseatic League, and each of these entities pursued its own policies on invention protection.

[61] John Jewkes et al. (see Footnote 56)

In 1815 the King of Prussia in northern Germany issued an edict concerning the granting of patents[62], while in 1825 the Kingdom of Bavaria in the south established a business law that included protection for inventions.

Prussia was initially negative about making patents property rights, and the screening system it employed was extremely rigorous. Alsace-Lorraine, on the border with France, protected inventions based on French-style natural rights. The Hanseatic cities of Bremen, Hamburg, and Lubeck, meanwhile, did not adopt a system of invention protection based on the granting of monopolies.

Efforts to integrate these different systems and create a new, integrated invention protection system began in the southern German states in 1832. These efforts started with talks on harmonizing their own patent systems. However, with the launch in 1834 of a German customs union, which included northern Germany, the customs union became the new forum for the negotiations.

In 1842, with the aim of eliminating restrictions on freedom of trade between the states of the customs union, the members concluded a treaty based on common principles for invention patents and privileges.[63]

In January 1871, a unified Germany emerged under the name "German Empire." In April of the same year, the Constitution of the German Empire was promulgated, and the provisions of this constitution gave jurisdiction over matters relating to invention patents to the Empire and its legislature[64].

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[62] Katsuya Tamai, "Historical Development from the Award of Privileges to Administrative Action" (in *The Development and Transformation of Administrative Law (Edition to Commemorate the 70th Birthday of Prof. Hiroshi Shiono)*, Yuhikaku, Tokyo (2001), p.315) (in Japanese)

This system featured examinations for novelty conducted by a technical council, and required patents to be exercised within six months of them being conferred. Patents were awarded for periods of anywhere between six months and 15 years.

[63] Katsuya Tamai (see Footnote 62), pp.316-317

[64] Constitution of the German Empire, Article 4, para. 1, item 5

Article 4
The following matters shall be under the supervision of the Empire and its Legislature:-

1. Privilege of carrying on trade in more than one place; domestic affairs and matters relating to the settlement of natives of one State in the territory of another; the right of citizenship; the issue and examination of passports; surveillance of foreigners and of manufactures; together with insurance business, so far as these matters are not already provided for by Article 3 of this Constitution (in Bavaria, however, exclude of domestic affairs, and matters relating to the settlement of one State in the territory of another); and likewise matters relating to colonization and emigration to foreign countries.

2. Legislation concerning customs, duties, and commerce, and such imports as are to be applied to the uses of the Empire.

3. Regulation of weights and measures, and of the coinage, together with the emission of funded and unfunded paper money.

4. Banking regulations in general.

The anti-patent campaign that swept through Europe earlier than this, in the 1850s, also triggered a fierce debate in Germany between the German economists' council on the one side and the German engineers' association and patent protection federation on the other. Although there were a lot of voices in the government that were ambivalent about introducing a unified patent system, the efforts of Werner von Siemens and others saw the enactment, six years after the promulgation of the constitution, of the first patent law covering the whole of Germany: the Unified Patent Act of 1877.

In terms of its modernization, Germany at the time was far behind other European countries, which had already completed their industrial revolutions. The Unified Patent Act was aimed at promoting the growth and proliferation of innovation in certain industries in order to facilitate economic development, and brought in new policies that had never been seen before.

To begin with, the procedures for obtaining patents were made much tougher. This was based on the basic view of the technical evaluation committee that inventions could best be encouraged by minimizing what could be patented and providing strong protection for those inventions that did manage to be selected.[65] In addition, steps were taken to prevent German industry, which was finally beginning to emerge, being kept down by foreign patents. A screening system was adopted, and patents had to be not only novel but also inventive. Moreover, a system was introduced under which applications were made public and third parties had a chance to register objections before a patent was granted. This approach was also reflected in the policy on fees, which were set high in order to discourage applications for patents with little economic value. Patent fees (i.e. annual maintenance fees) were set on a sliding scale whereby the amount payable increased year by year, which helped inventions enter the public domain.

A provision for technologies that could not be patented was also included as a means of directly preempting any adverse impact on domestic industry. Although such rules also existed in a number of other countries, what was unique about Germany was the non-patentability of pharmaceuticals, chemicals, and food products, industries that were still not competitive by international standards.

The system's emphasis on filers can be seen as indicative of its objective of stimulating innovation by companies rather than encouraging and protecting inventions by entrepreneurs. Until then, patent systems had been based on the principle that only the true and first inventor could receive a patent. German's new system, however, adopted the first-to-file principle, i.e. a patent could only be awarded to the first person to apply for it[66].

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5. Patents for inventions.
(Rest omitted)

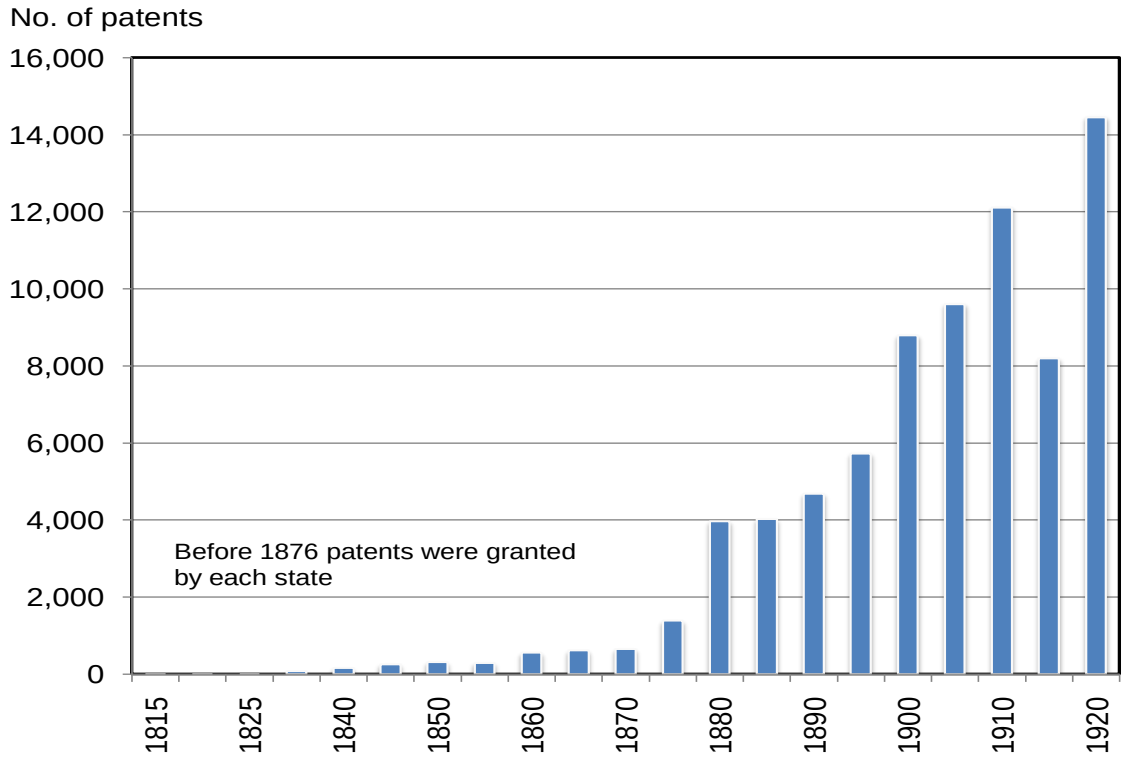
[65] Voight Technology Committee

[66] Article 3, para. 1 of the German Empire Patent Act

Pure first-to-file systems are aimed at ensuring that hidden inventions, whoever their inventors may be, are swiftly unearthed by society[67]. The Unified Patent Act, however, is viewed as having been designed to encourage filers to file their applications (and thereby make the inventions public) quickly, and to thereby accelerate the pace of innovation.[68] There was no need to include the name of the inventor on the application, and the inventor's name did not feature in the patent specification, either. Having said that, the rights of inventors were not ignored completely, as the act included a provision that in the case of applications made without the consent of the inventor, the rights of the filer would not be recognized[69].

Figure 2-7 shows the numbers of patents granted during this period. Although the numbers were small in comparison with the figures from Britain and France, they exhibited a sharp increase, with the number of patents issued in 1910, just before World War I, topping 10,000.

Figure 2-7: Number of Patents Granted in the Early Years of the German Nation



Source: Khan, B. "An Economic History of Patent Institutions," EH.Net Encyclopedia, edited by Robert Whaples (March 16, 2008)

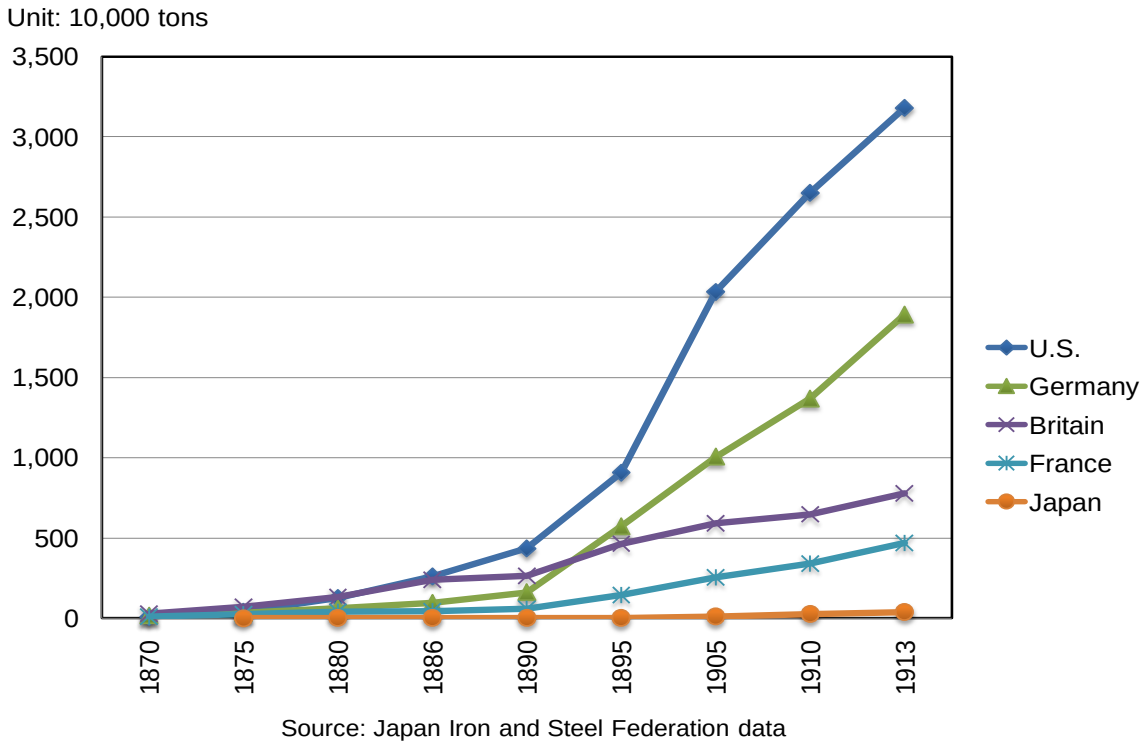
[67] Katsuya Tamai, "The Focus on Inventors in Patent Law," Law Society Journal, vol.111, no.11 (1994), p.1603 (in Japanese)

[68] Katsuya Tamai (see Footnote 67)

[69] Article 3, para. 2 of the German Empire Patent Act: If the crucial aspects of the application have been borrowed without permission from another person's writings, drawings, models, tools, or devices, or the methods used to produce them, the rights of the applicant requesting patent rights shall not be recognized.

Figure 2-8 compares crude steel production in different countries during the same period. Although Britain was the biggest producer for many years, it was surpassed by the U.S. in the 1880s, and then overtaken by the new Germany in the 1890s, which indicates that the German invention protection system succeeded in nurturing heavy industry.

Figure 2-8: Crude Steel Output



Source: Japan Iron and Steel Federation data

Numerous German inventors also emerged at this time. Among them, Karl Benz and Gottlieb Daimler invented the gasoline-powered automobile, Rudolf Christian Karl Diesel invented the diesel engine, and Wilhelm Conrad Röntgen discovered X-rays. These inventors were not engineers with little education, but were organizational researchers who had already been educated about the theories of science and technology.[70]

2.5.2. From Individual Inventors to Organized Innovation

Joseph A. Schumpeter, in his paper on the relationship between economic growth and innovation, argued that innovation by entrepreneurs could only be sustained if they were given monopoly power to some extent.[71]

Later, however, Schumpeter published a new prediction: that economic growth would make entrepreneurs extinct, and that they would be replaced by R&D and innovation taking place at large companies.[72]

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[70] John Jewkes et al. (see Footnote 56)

[71] Joseph Alois Schumpeter "Theorie der wirtschaftlichen Entwicklung" 1911 (Translation: "The Theory of Economic Development: An inquiry into profits, capital, credit, interest and the business cycle," Harvard University Press, Cambridge, MA (1934))

In the U.S., too, the 20th century became an era in which innovation by organizations caught up with that by individual inventors, and then outstripped it. Wallace Hume Carothers, who invented nylon in 1935, worked in DuPont's research department, where he worked with 230 specialists and an R&D budget of six million dollars.[73]

The inventions of the 20th century required massive amounts of funding and an organizational approach to R&D.

This change led to the emergence of a new issue: how to handle inventions by employees[74]. Although huge bonuses for employee inventors might lead to superb inventions, they also reduce the company's competitive edge. Small bonuses, on the other hand, sap the motivation of researchers to invent, and thereby impact adversely on the firm's competitiveness.

Germany, which had led the way in adopting the first-to-file principle, established the Göring-Speer ordinance in 1942 for dealing with inventions by employees. Later, in 1957, it passed the Employee Inventions Act to make the legal foundations clearer.

Even after this, though, the countries that had introduced invention protection systems relatively early, continued to only allow the inventors themselves to hold patents. In Britain, a law established in 1949 enabled persons to whom inventions had been transferred to apply to patent them for the first time. A provision was also included allowing employees and employers in dispute concerning an invention to receive a ruling by the director of the patent office on how to allocate the profits from the invention between them.

In France, a 1978 law included a provision on employee inventions, which stipulated that rights concerning inventions originally reside with employers.

2.5.3. The U.S.'s Pro-Patent Policy

The U.S., which had endeavored to make individual inventors the drivers of the development of its economy, also saw a gradual decline in the proportion of patents registered to individual inventors. In 1880, inventions by individuals accounted for 93.8 percent of all inventions, but by the 1930s, more patents were held by companies than individuals.[75]

A small number of companies came to oligopolize key patents. They used these patents to forge partnerships with each other, and started to control markets.

For example, in the case of the most famous inventions of the 1930s, polyethylene and nylon, a U.S. company and a British company inked a tie-up and attempted to monopolize the markets. In 1944, however, the U.S. Department of Justice claimed that the firms were in breach of the Sherman Antitrust Act, and in 1951, a court ruled that the companies' actions constituted a scheme to carve up

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[72] Joseph Alois Schumpeter, *Capitalism, Socialism and Democracy*, Harper Brothers, New York (1942)

[73] John Jewkes et al. (See Footnote 56)

[74] So-called "employee inventions"

[75] Tom Nicholas "The role of independent invention in U.S. technological development, 1880-1930" *Journal of Economic History* 70 (1) p.58 (2010)

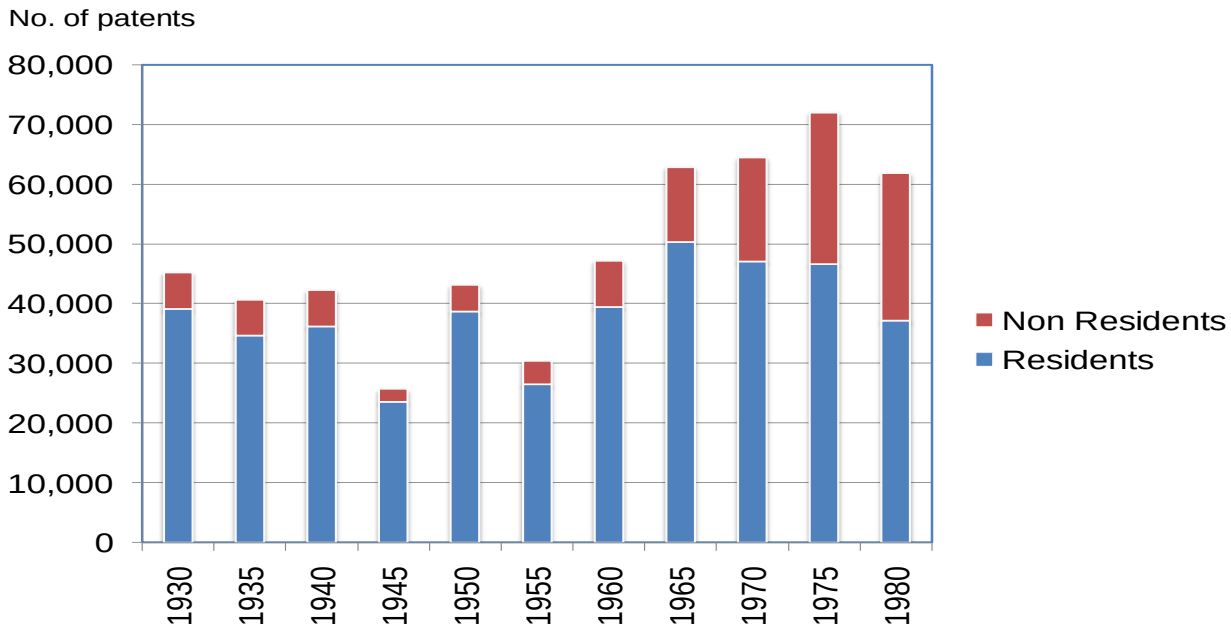
the global market between themselves.

The debate on whether limits on patent rights in antitrust law should be viewed as unreasonable restrictions on rights or measures to address the abuse of rights aside, the next 50 years, i.e. until the 1980s, came to be known, in Japan, as the "anti-patent era."

During World War II, the U.S. came to realize that science and technology was an effective means for it to maintain and strengthen its power as a nation. In 1945, Vannevar Bush, Director of the Office of Scientific Research and Development and an advisor to President Roosevelt, produced a report (known as the "Bush Report") for President Truman on policies for developing science and technology in the U.S. This report led to the U.S. investing huge amounts of money in science and technology even after the war was over. As result, U.S. science and technology raced ahead during the 1950s and 1960s, and the U.S. became the world's top scientific power, replacing Europe, which had held that position before the war[76].

Companies and other organizations maintained their ravenous appetite for obtaining patents. Apart from a brief lull following the war, there was no noticeable decline in the numbers of patents awarded (see Figure 2-9). Total factor productivity (TFP), which is believed to reflect technological innovation, also remained at the high level of 1.9 percent during the 1960s and 1970s (see Table 2-1).

Figure 2-9: Number of Patents in the U.S. in the 20th Century (1930-1980)



[76] Science and Technology Agency, "2002 Science and Technology White Paper," Part 1, Section 1: Changes in the U.S. Innovation System, (2002) and Japan Patent Office, "Report from the Panel on Intellectual Property Research and Training," Chapter 1: Background to Investigations (1997)

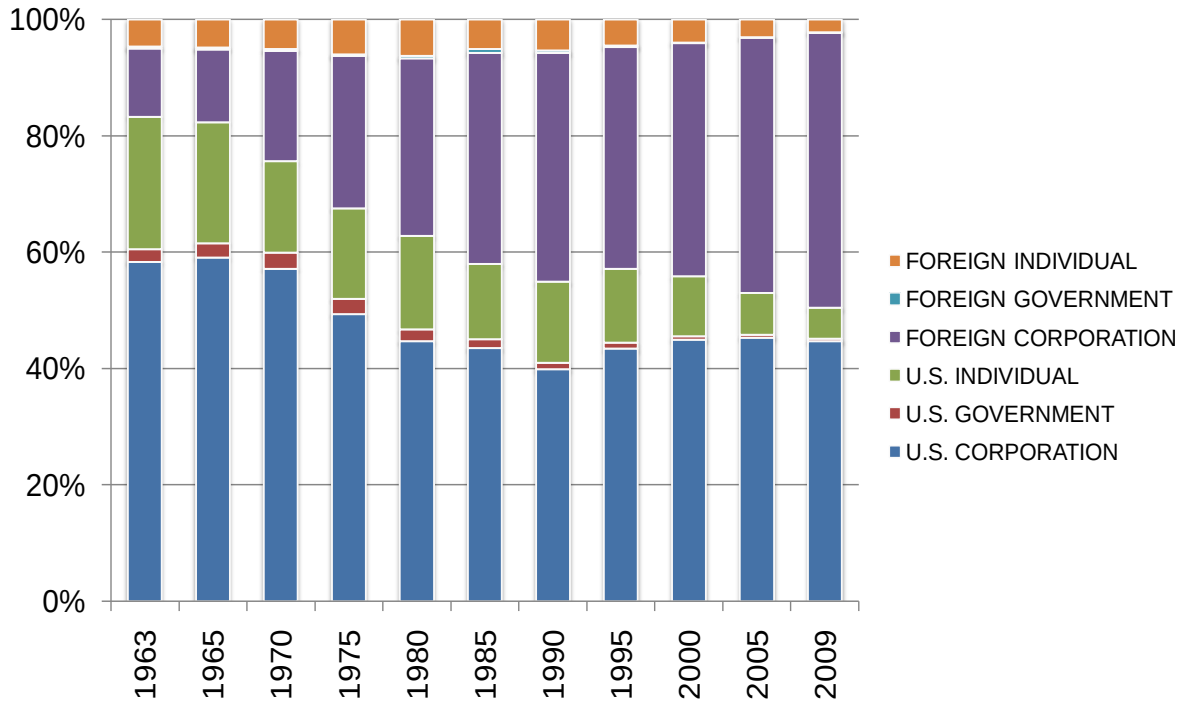
Table 2-1: U.S. Economic Growth in the Late 20th Century (1960-1990)

	GDP growth rate	Contribution to growth rate		
		Capital	Labor	Total factor productivity
1960-1970	4.0	0.8	1.2	1.9
1970-1980	2.7	0.9	1.5	0.2
1980-1990	2.6	0.8	0.7	1.0

Source: Charles I. Jones "Introduction to Economic Growth (Second Edition)" W. W. Norton & Company (2002)

By the 1970s, however, productivity improvements in Europe and Japan resulted in a loss of competitiveness for U.S. manufacturing, including steel, automobiles, and electrical goods, and a debate ensued on why the U.S., the world's leading science nation, had seen its manufacturing sector fall behind those of Europe and Japan.[77] Compounding the sense of crisis was the fact that the proportion of patents being acquired by foreign companies, which had hitherto remained at under 10 percent, was increasing sharply, eventually topping 30 percent in 1980 (see Figure 2-10).

Figure 2-10: Holders of U.S. Patents



Source: U.S. Patent and Trademark Office, Patent Technology Monitoring Team (PTMT)

[77] Science and Technology Agency (see Footnote 76)

Against this backdrop, the U.S. government began to follow a "pro-patent policy," with the aim of beefing up the protection of inventions by U.S. companies.

Among the measures taken were the enactment in 1980 of the Bayh-Dole Act, which covered the ownership of intellectual property arising from university research, the establishment in 1982 of the CAFC (Court of Appeals for the Federal Circuit), which specializes in patent- and tariff-related cases, and the enactment in 1999 of the American Inventors Protection Act. In addition, the Young Report of 1985 called for the elimination of infringements by foreign companies of the intellectual property rights of U.S. firms, and at the GATT Uruguay Round the U.S. lobbied for action with a strong focus on the protection of U.S. patent and other rights.

Economists are said to still not be agreed on the impact of this policy on the U.S. economy (see Table 2-2).[78]

Table 2-2: Achievements of the U.S.'s Pro-Patent Policy

Year	Achievement
1980	Protection of computer programs through changes to copyright law
1982	Establishment of the Court of Appeals for the Federal Circuit (CAFC)
1985	Publication of the Young Report (calling for the U.S. to strengthen protection of intellectual property rights)
1986	Start of GATT Uruguay Round and TRIPs negotiations
1988	Establishment of Omnibus Foreign Trade and Competitiveness Act (establishment of "Special 301" section of the Trade Act, revisions to Section 337 of the Tariff Act, revisions to the Patent Act)
	Issuance by the Department of Justice of Antitrust Enforcement Guidelines for International Operations (relaxation of antitrust law)
1989	Launch of the Japan-U.S. Structural Impediments Initiative
1994	GATT and TRIPs agreements reached

■ Acquisition of patents by U.S. inventors:
No. of patents filed by U.S. inventors: 1985 70,000 ⇨ 1994 140,000
No. of patents granted to U.S. inventors: 1985 43,000 ⇨ 1994 64,000
■ Expansion of technology trade surplus:
Technology trade surplus: 1985 5.5 billion dollars ⇨ 1994 16.8 billion dollars

Source: (Japan) Industrial Property Council " The Report of Planning Subcommittee" (November 1998)

In the 1990 Kodak vs. Polaroid case, the court order Kodak to pay Polaroid 909.5 million dollars in damages. Patent infringement lawsuits involving U.S. companies and Asian firms, which had made inroads into U.S. markets, also became more frequent, and the battle among foreign and

[78] For example, see Ichiro Nakayama, "Pro-Patents and the Anti-Commons – The Signifiance of, Benefits of, and Issues with Pro-Patent Policy as Revealed by Research on Patents and Innovation," RIETI Discussion Paper Series 02-J-019 (2002) (in Japanese) and Shinya Kinukawa, "What Effect Will a Pro-Patent Policy Have on Industry? Taking Lessons from US Patent Reforms," Fuji Research Institute Research Report No.222 (2005) (in Japanese).
Kinukawa used the results of empirical research conducted by Kortum and Lerner (1998), Hall and Ziedonis (2001), etc. to conclude that it had not been proved, at least by economists, that it was pro-patent policy that restored the U.S. to international supremacy and enabled it to register many years of economic growth.

U.S. companies to acquire U.S. patents became fiercer (see Figure 2-10, referred to earlier).

These developments resulted in the proportion of patents obtained by individual inventors declining even further to less than 10 percent.

2.6. International Invention Protection Policy

Issues with invention protection systems arising from the borderlessness of economic activity emerged as early as the 18th century. Among efforts to address these issues, the first success was the 1843 treaty on common principles concerning invention patents and privileges concluded by the German customs union, which came about due to the expansion of talks among the southern German states during the 1830s.

The worldwide, i.e. including the U.S., debate on international invention protection only got serious with discussions on the patenting of products exhibited at the Vienna's World's Fair in 1873. The U.S. and Britain took the lead at the first international conference held in Vienna.[79] At this conference resulted in three key recommendations: (1) protecting inventions through legislation, (2) enabling foreign nationals to acquire patents, not canceling patents by reason of them not being exercised, and (3) establishing an international treaty on patent protection.

At the time of the Paris World's Fair in 1878, another international conference on industrial property rights was held. The discussions there led to France playing a central role in the drafting of a treaty, and on March 20, 1883 at conference in Paris the "Paris Convention for the Protection of Industrial Property" was adopted.

The various treaties, pacts, and the Agreement on Trade-Related Aspects on Intellectual Property Rights (TRIPs) that were established based on this convention solidified the view that invention protection systems are not only there to protect inventions domestically, but are also crucial for international economic activity.

It can therefore be said that invention protection through patents and the like is no longer solely for the benefit of individual inventors. Its objectives have expanded to encompass benefits for regional economies and the world economy.

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[79] Tadashi Ishii, "From the Anti-Patent Era to the International Patent System Era," *Patent* (2008), vol.61, no.1, pp.33-34 (in Japanese)

3. The Experience of the Japanese Economy

3.1. Background to the Success of Invention Protection Policy

Joseph Straus of the Max-Planck-Institut für Geistiges Eigentum, Wettbewerbs-und Steuerrecht made the following remarks at a symposium held in Tokyo:

"Of course, equating patents or intellectual property with the accumulation of wealth or economic development in general or indeed with social stability is an oversimplified view, and it is only natural that objections will be raised. Even Japan had to learn that adopting a Patent Law is not sufficient and that further conditions are necessary to reach those goals."[80]. This indicates respect for those who create, acquire, and apply knowledge, and shows a broad understanding that such people should be properly rewarded and protected, and that this will ultimately benefit society.

Furthermore, in its Fiscal 2000 Annual Economic Report, the Economic Planning Agency contended that the Japanese economy had developed for the following reasons:

(a) An environment was established in which human resources are emphasized, resources are invested in education, and people can demonstrate their abilities

(b) Information from foreign books, journals, etc. was absorbed flexibly and improved to adapt it to Japanese circumstances.

(c) The economy was built to adapt to changing economic conditions and phases of development.[81]

The common thread running through these factors is that the policies employed at the time, i.e. the training of human resources to generate innovations and the aggressive adoption of patented technology and other foreign technology, made a major contribution to the development of the Japanese economy.

3.2. Developing Entrepreneurs

3.2.1. The Establishment of an Invention Protection System

Japan's modernization began with the Meiji Restoration in 1868.

Japan's government took the lead in engineering Japan's catch-up with the West through its policy of industrial promotion, and did so in various ways. Initially, it invited engineers (mainly from Europe and the U.S.) to Japan with the aim of nurturing modern industry through the transfer

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[80] "Proceedings of International symposium in Commendation of the 100th Anniversary of the Establishment of the Japan Institute of Invention and Innovation" (2005), p.68

"Of course, equating patents or intellectual property with the accumulation of wealth or economic development in general or indeed with social stability is an oversimplified view, and it is only natural that objections will be raised. Even Japan had to learn that adopting a Patent Law is not sufficient and that further conditions are necessary to reach those goals."

[81] Economic Planning Agency, "Fiscal 2000 Annual Economic Report," Chapter 2: Conditions for Sustainable Development (2000)

of technology. From 1875, however, the number of foreign instructors invited began to decline, with Japanese instructors taking their places.

In 1871, the government promulgated Japan's first system of invention protection: Provisional Regulations for Monopoly. However, operation of the system was abandoned the following year due to intractable problems with its implementation.

Nevertheless, these regulations served to awaken Japanese inventiveness from its slumber.

Tokimune Gaun was interested in developing a spinning machine and invested his own capital in the project. However, as soon as he exhibited the finished machine at a fair, it was swiftly imitated and sold by others in the same industry, leaving Gaun so poor he barely had enough to eat. Japan's patent system was established because of new ideas coming in from the U.S. and to satisfy calls from citizens to eliminate the unfairness that was causing inventors like Gaun to struggle to make ends meet.

Eventually, in 1885, the Patent Monopoly Act was promulgated.
The new law was based on the U.S. system, which had proved so successful in generating entrepreneurs, and therefore adopted the first-to-invent principle and a screening system. The following year, 1886, a patent office (bureau) was established within the Ministry of Agriculture and Commerce, putting in place an organizational framework for protecting inventions.

3.2.2. The Emergence of Entrepreneurs and the Introduction of Foreign Capital

When Sakichi Toyoda, the founder of the Toyota Group, heard about the passage of the monopoly law, he is said to have declared that the system would allow uneducated people to compete on an even footing with university graduates.

At the time, the textile industry was the driving force for the Japanese economy. 50 percent of exports were textile products, and the textile industry accounted for 40 percent of manufacturing output[82]. Toyoda's first product was a wooden man-powered loom, for which he obtained a patent in 1890. He continued to apply for patents, and managed to obtain 84 patents and 35 utility models during his lifetime. His patent strategy extended beyond Japan to other countries, and he acquired patents in 19 countries. The automatic loom he invented in 1924 was a prime example of this strategy. A British company coveted the patent, and ended up buying it from him for 100,000 pounds. He used part of the proceeds from this sale to launch a new business: developing automobiles.

Nevertheless, the early patent system still had two problems that needed to be solved. One concerned the granting of rights to foreign nationals and the other applications by companies.

Trade treaties until then had been extremely unfair to Japan, so during negotiations, the government made revising these treaties a precondition for awarding patents to foreigners. This led to treaties being revised one after another, and in 1896 it became possible for foreign nationals to obtain patents. A change in the law in 1899 also made corporations eligible for them.

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[82] Economic Planning Agency (see Footnote 81)

As the number of filings by foreigners increased, so did investment from overseas. NEC was founded in 1899 to manage patents held by Western Electric (WE) of the U.S. Later it began assembling telephones, and then manufacturing them, and went on to achieve great success. It no longer has any capital ties with WE, and has become one of Japan's most famous computer makers.

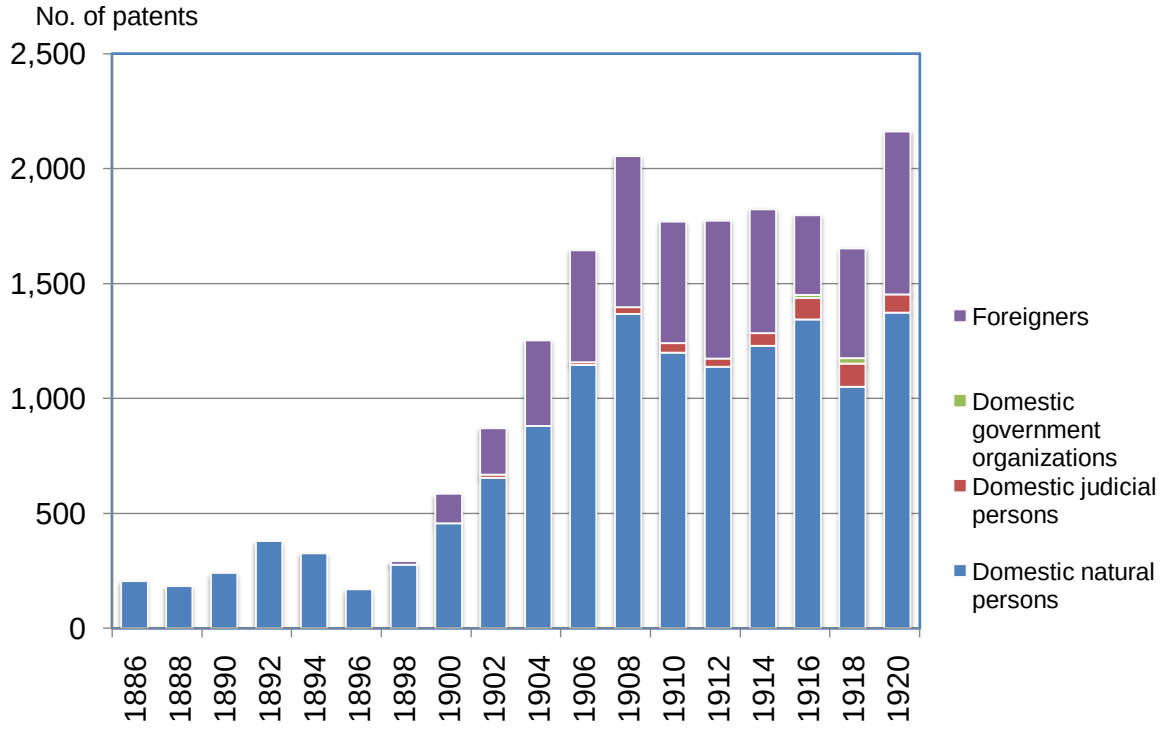
3.3. Raising Awareness in the World of Industry of Invention Protection

3.3.1. The Association for the Protection of Industrial Property

Even after the 20th century had begun, the driver for the Japanese economy remained light industry such as textiles. Large machines were gradually introduced, and industry rapidly modernized. The government also focused on developing heavy industry such as steel, and more and more companies (such as shipbuilders) with world-class technology emerged.

Although the 1899 changes in the law enabled companies to obtain patents for inventions that had been transferred to them by the inventors, actual acquisition of patents by corporations was limited (see Figure 3-1).

Figure 3-1: Holders of Patents in the Early Years of Japan's Patent System



Based on data from such sources as Japan Patent Office, *100-Year History of the Industrial Property System*

The government responded with various measures to raise awareness of inventions and encourage use of the invention protection system in industry, including among small and medium enterprises (SMEs). Among these measures was the establishment of the Association for the Protection of Industrial Property (now the Japan Institute of Invention and Innovation), which was set up in 1904 under the jurisdiction of the Minister of Agriculture and Commerce and the director of the patent bureau. Over a century has

passed since then, during which time the Institute has supported jet-setting corporate managers and R&D personnel from companies with world-leading technologies, and worked to foster awareness of inventions among the young people who will take the reins of Japan's economy in the future.

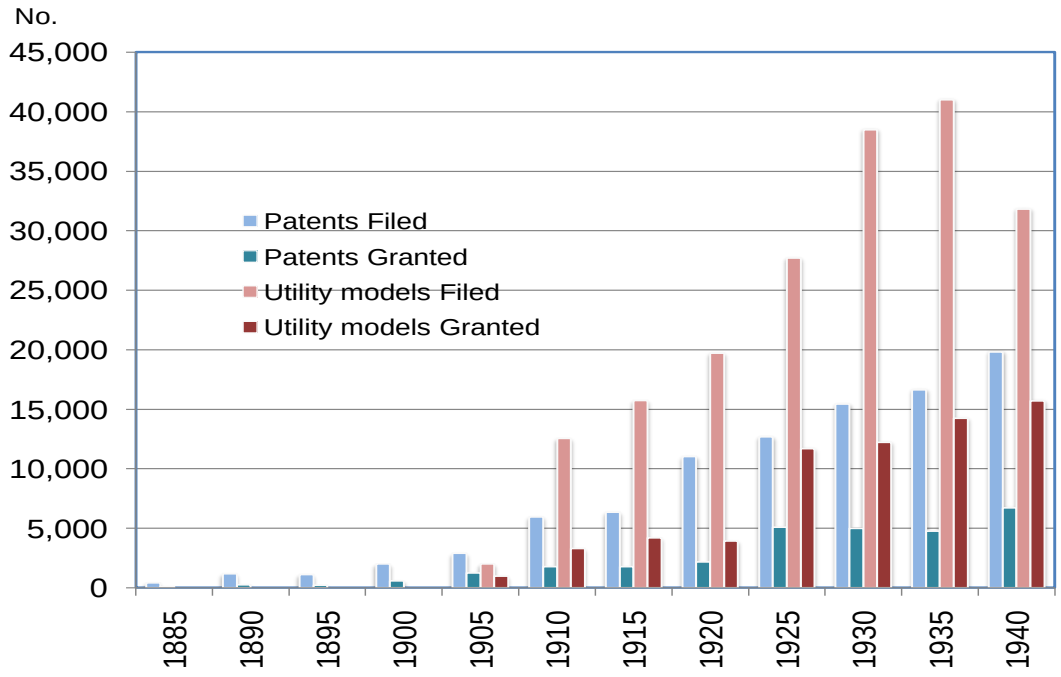
This systematic approach to fostering awareness of innovation and developing human resources can be said to have been a major driver for the subsequent development of the Japanese economy.

3.3.2. Introduction of the Utility Model System

With foreigners also becoming eligible for patents, the patent office's screening of inventions became a lot more rigorous. Because criteria for patent registration were the same for both Japanese and foreign nationals, it became harder for Japanese people to obtain patents. From around this time, attention turned to the invention protection system used in Germany, which had succeeded in modernizing in a very short space of time. Particular attention was paid to the new utility model system that had just been introduced there, and in 1905 the system was also adopted in Japan.

As soon as the system was introduced, the number of utility model applications outstripped the number of applications for patents by a large margin, and continued to do so for more than 70 years, until the 1980s. Some of the features of the Japanese utility model system were that like the patent system, it involved a screening process, and protected the rights of holders as inalienable rights. As Figure 3-2 shows, in the early years fewer than half of applications were approved, indicating that the examination criteria were extremely tough. This meant that use of the system expanded rapidly not only among individual inventors wishing to go into business, but also in the world of industry, particularly light industry (see Figure 3-2).

Figure 3-2: Patents and Utility Models Filed and Granted in the Early Years



Konosuke Matsushita, widely known as the founder of Panasonic, obtained his first utility model in 1917. He went on to acquire another 91 utility models and 8 patents, and used his utility models to transform his company from a tiny backstreet workshop into one of the world's leading multinationals.

As part of Japan's invention protection policy, the utility model system has proved an effective means of not only incentivizing inventors, but also safeguarding the peripheral technology that is essential for innovation.

3.3.3. A Change in Direction for Invention Protection Policy

Japan's invention protection system continued to align itself more with that of Germany's.

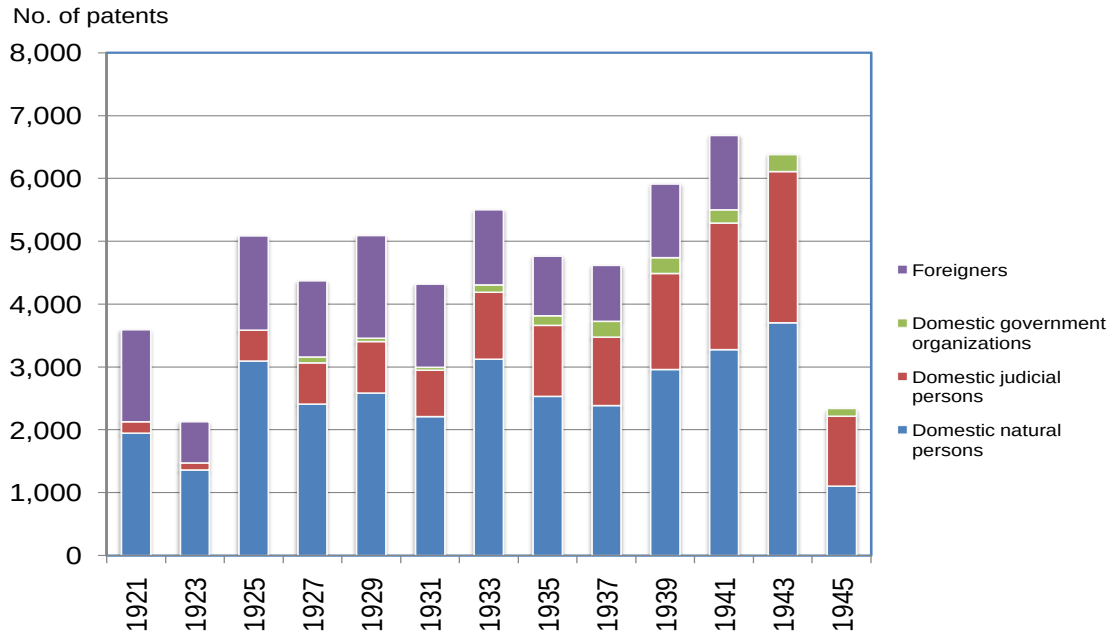
Changes to patent law in 1909 saw the introduction of a system for employee inventions.

The next revision, in 1920, marked a big shift away from the first-to-invent principle towards the first-to-file principle, under which rights are awarded to the first person to make the application. In addition, to make the awarding of rights more rigorous, applications were made public and people were allowed to register objections. The law also provided for compensation to be paid for employee inventions, with the aim of giving corporate researchers more incentives. These changes showed that Japan was moving away from protecting entrepreneurs' inventions in favor of developing industry by promoting organized, industrial innovation.

As a result of these legal changes, corporate filings by Japanese companies gradually increased. In 1938 the Japan Intellectual Property Association, made up mainly of personnel from corporate patent departments, was established, and the management of patents by companies became more organized.

As a result, patent filings by companies also began to rise gradually. Until then, the vast majority of applications had been made by individual inventors (see Figure 3-3).

Figure 3-3: Holders of Patents During Japan's Modernization



Based on data from such sources as Japan Patent Office, *100-Year History of the Industrial Property System*

This change in the structure of patent applications reflected changes in the structure of industry. In 1900, manufacturing accounted for just 15 percent of GDP, but by 1940 this figure had jumped 2.5 times to 37 percent (see Table 3-1).[83]

Table 3-1: Changes in the Structure of Industry During Modernization

	1885	1900	1920	1940	1960	1970
Primary industry (agriculture, forestry, and fisheries)	45.2	39.4	30.2	18.8	12.8	5.9
Secondary industry	14.7	21.2	29.1	47.4	40.8	43.1
Mining	0.8	1.8	3.4	2.7	1.5	0.8
Manufacturing	10.7	15.0	20.6	37.0	33.8	34.9
Construction	3.2	4.5	5.0	7.7	5.5	7.5
Tertiary industry	40.2	39.4	40.7	33.8	46.4	50.9
Wholesale/retail, finance/insurance, etc.	34.2	32.6	31.3	25.5	33	35.1
Transport and communications	2.5	3.7	6.5	4.9	7.3	6.7
Government services	3.5	3.1	2.9	3.4	6.2	6.1

1. Data for 1885-1940 is from Toyo Keizai, Inc., "Long-Term Economic Statistics;" data from 1960 onwards is from the national accounts produced by the Economic Planning Agency,
2. Figures for 1940 and earlier and figures for 1960 onwards may not match conceptually.

Source: Economic Planning Agency, "Annual Report on the Japanese Economy and Public Finance 2000"

3.4. An Economic Recovery Policy Based on the Introduction of Technology

World War II also dealt a near-fatal blow to the Japanese economy. During the war, 1.85 million Japanese were killed, 25 percent of the national wealth was destroyed, and industrial output plunged to a tenth of its pre-war level.[84]

To deal with the post-war turmoil, economic policy focused on tackling inflation on the demand side, and restoring basic production capacity (i.e. employing the "priority production system") on the supply side. In 1947, 83 *zaibatsu* conglomerates were dismantled and the Anti-Monopoly Act was instituted, establishing a competitive playing field to serve as a foundation for economic growth. The government endeavored to rebuild the economy through the introduction of foreign technology, and patents, utility models, etc. played a central role in this technology adoption.[85]

For the textile industry, an urgent task was to acquire the technology to produce artificial fibers, and technologies patented overseas were introduced one after another. By the 1960s, Toray had acquired 45 patents for nylon-related products it had developed itself. However, it decided that it

[83] Economic Planning Agency (see Footnote 79)

[84] Economic Planning Agency (see Footnote 79)

[85] *A Century of Industrial Property Rights (Volume 2)*, edited by the Japan Patent Office (1985), p.145

would be more advantageous to use inventions patented by DuPont, and in 1951 contracted to license these patents at a cost far in excess of its capital at the time.

Although Sony was a small company that had only been founded in 1946, it discovered that Western Electric was planning to disclose in New York the fact that it had received a patent for transistor technology developed by Bell Labs of the U.S. Sony immediately entered into negotiations to acquire the patent. With few foreign companies operating in Japan at the time, contracts to license overseas technology needed to be approved by the Ministry of Commerce and Industry (now the Ministry of Economy, Trade and Industry). It is said that many in the government were reluctant to authorize Sony, which had only been established a few years earlier, to introduce transistor technology when the company had not even decided on the products it would use the technology for. Nevertheless, in 1952 Sony concluded an agreement with Western Electric to license the transistor patent.

Because the contract did not extend to the provision of manufacturing knowhow, Sony had to do the development with its own technology. However, the techniques and approaches acquired during the development process would later lead to the Esaki diode, for which Reona Esaki received a Nobel Prize, and products such as the Walkman.

Table 3-2 provides information about the technology licensing agreements concluded during this period. It is clear that a lot of such contracts were signed, and that some industries opted for agreements centered on patents, while others preferred comprehensive agreements encompassing the provision of knowhow, etc. Later, the electrical machinery manufacturers that would drive the Japanese economy forward focused on acquiring technology through patent-only contracts, while the chemical and machinery industries went for knowhow, too (see Table 3-2).

Table 3-2: Patent-Only Technology Import Agreements during the Postwar Reconstruction Period

Sector	Total no.	Percentage of patent-only agreements	
Electrical machinery	246	132	53.7%
Oil refining	45	20	44.4%
Textiles	50	20	40.0%
Nonferrous metals	20	7	35.0%
Steel	70	21	30.0%
Chemicals	264	58	22.0%
Rubber and leather	24	5	20.8%
Mechanical machinery	281	39	13.9%
Transport equipment	86	9	10.5%
Other	62	15	24.2%

These figures are based on the results of a survey of agreements to supply class-A technology concluded between 1950 and 1960, published in “Current Trends and Issues with the Introduction of Foreign Technology” produced by local bureaus of enterprise of the Ministry of International Trade and Industry (1962).

This increase in the number of licensing agreements gave an international outlook to corporate intellectual property departments, which had hitherto only filed domestic patent applications, and served to transform them into key organizations for patent-using companies.

3.5.Promoting Japanese-Style innovation

3.5.1. The 1954 Patent Act

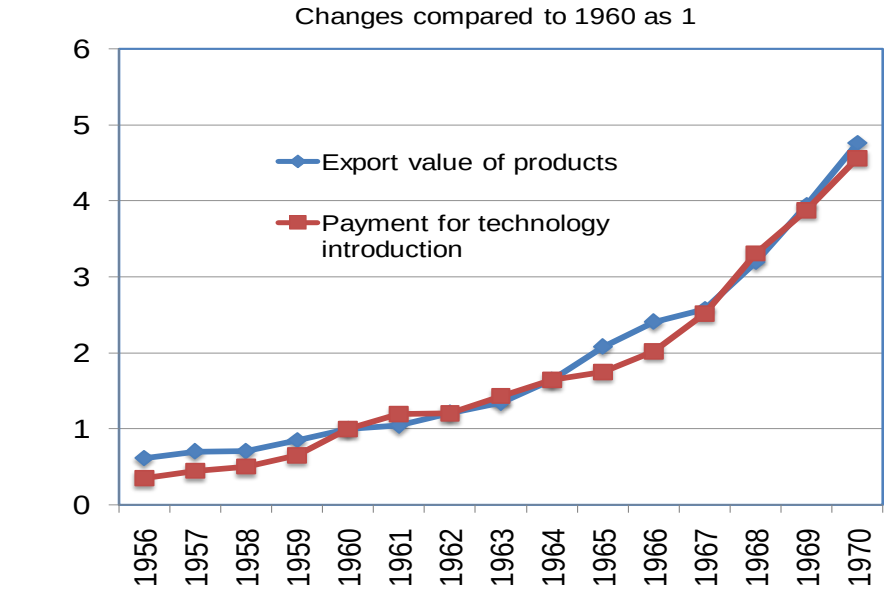
In 1955 the Japanese economy began a period of growth faster than anything it had seen before. For the next 17 years, until 1972, real economic growth averaged 9.3 percent per year, and in 1968 Japan overtook West Germany to become the world's second largest economy.[86]

This high-growth era is also said to be the period in which the Japanese economic system and Japanese-style rules and conventions were established[87]. The Japanese economic system is characterized by *keiretsu* corporate groupings, an employment system based on seniority-linked pay increases, a system of financial intermediaries dominated by main banks and lead underwriters, and intricate government regulation of the economy.

In the area of innovation, Japan soaked up the technology it brought in from overseas, developed original technologies on its own, and established a Japanese-style innovation system based on supplying technology overseas. The development of superbly designed, lightweight, and compact products became the number-one strength of Japanese companies.

Figure 3-4 shows changes in payments for technology introduction and exports of products since 1956, and reveals that technology licensing and product exports have expanded in concert with each other (see Figure 3-4).

Figure 3-4: Payment for Technology Introduction and Export Value of Products



Based on Bank of Japan's "Balance of Payments Monthly" and Japan Tariff Association's "Summary Report on Trade of Japan."

[86] It is now believed to have slipped behind China into third place.

[87] Economic Planning Agency (see Footnote 63)

To provide a firmer foundation for Japanese-style innovation, a new patent act was introduced in 1959. For the first time, the act had to "encourage inventions, and thereby to contribute to the development of industry" as its stated objective.

In practical terms, the new act adopted the concept of the global public domain and contained clear provisions on inventiveness, meaning that only really high quality inventions would be eligible for patents.

The provisions on employee inventions provided even more incentives for researchers. They clearly stated that when employee inventions were transferred to the company, the company had to pay the employee a "reasonable amount."

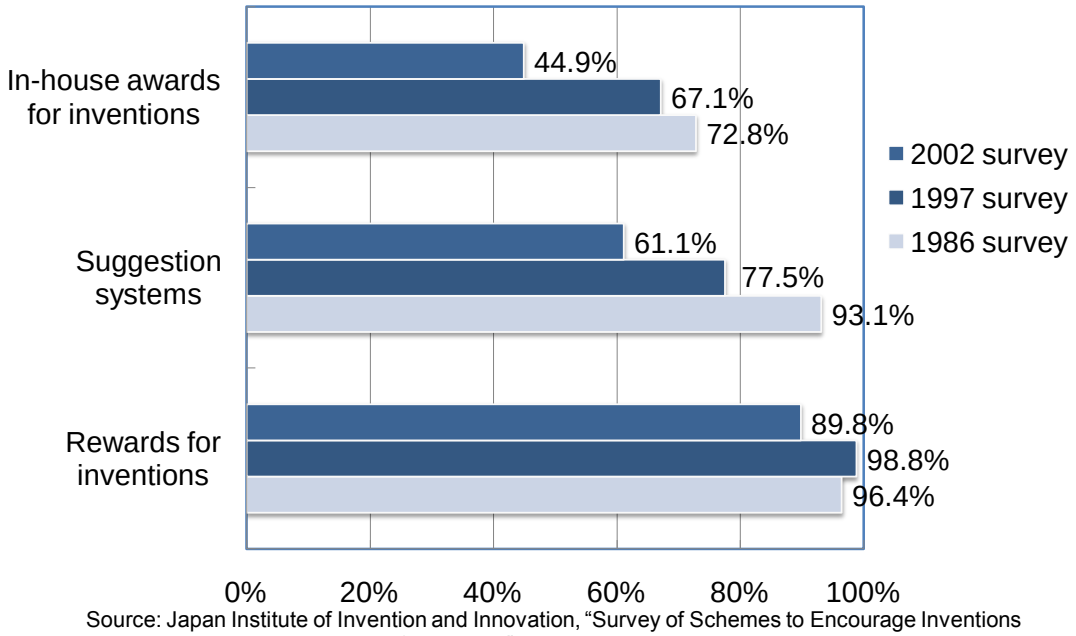
A ceiling was also established on patent periods, which were to be no more than 20 years from the filing date. This would prevent rights to old inventions suddenly being exercised, which had presented an obstacle to innovation.

3.5.2. Corporate Policies to Encourage Inventions

These provisions made Japanese companies do even more to encourage inventions, and established an infrastructure for generating innovations.

Figure 3-5 shows the measures employed by companies to promote in-house inventions (see Figure 3-5).

Figure 3-5: Schemes to Encourage Inventions Employed by Japanese Companies



Source: Japan Institute of Invention and Innovation, "Survey of Schemes to Encourage Inventions Employed by Japanese Companies" (2002 and 1997)

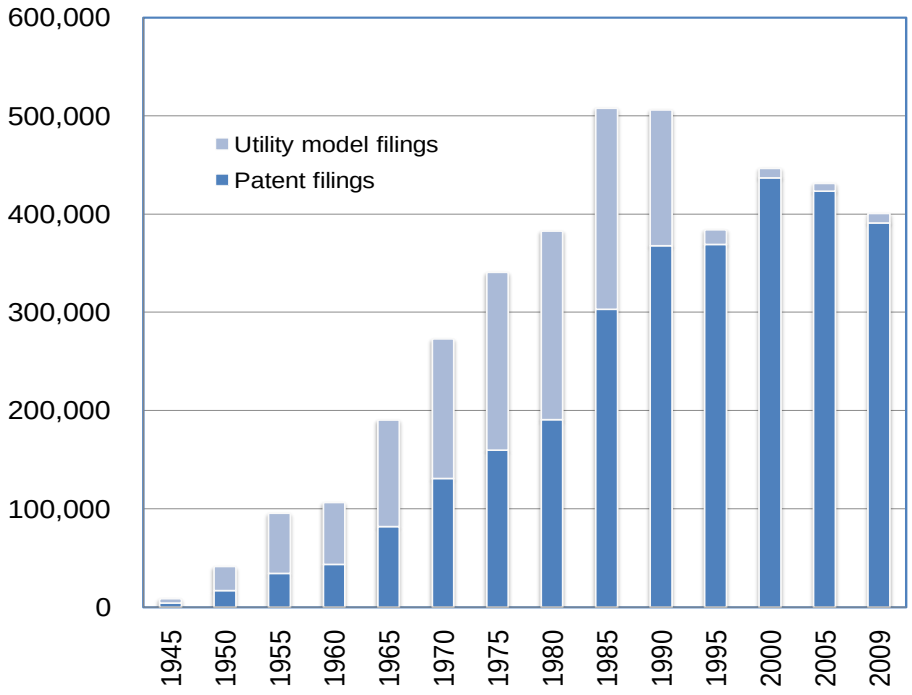
The data shows that to generate new innovations, Japanese companies make active use of rewards for inventions. The next most popular method is suggestion systems. Such systems, which encompass suggestions for making improvements, have achieved great success in raising the productivity of

Japanese companies and raising employee awareness of the importance of being inventive and creative. In-house awards, such as CEO awards, used to be employed by more than 70 percent of companies, though this proportion has now dropped to less than half. However, such awards can be replaced with applications for such awards as the national awards conferred by the Japan Institute of Invention and Innovation.

3.5.3. A Deluge of Patent Applications

In the 1960s, Japan was beset with pollution and environment-related problems, a negative side-effect of the country's rapid economic growth. In addition, the oil crises of 1973 and 1979 caused the hitherto stable price of crude oil to soar, dealing a severe blow to the Japanese economy. Besides introducing tough new environmental regulations, the government called on industry and the public to do more to reduce energy use and lessen the environmental impact of their activities. The targets the government set were considered difficult to achieve even by international standards, but to meet them companies, research organizations, etc. came out with one invention after the other that would come to be used all over the world. As a result, the Japan Patent Office was inundated with applications for patents and utility models (see Figure 3-6).

Figure 3-6: Structural Changes in Patent and Utility Model Filing



In 1988, the combined total of patent and utility model filings registered its highest figure ever: over 540,000.

The utility model system had already evolved from being a means of protecting minor inventions by SMEs and individuals into a key tool in corporate invention protection strategy. Most companies adopted a strategy of using patents to protect basic inventions and utility models to protect the peripheral inventions that are essential for innovation. As a result, corporate

applications for utility models increased, such that by the 1980s almost half were filed by large companies, with applications from individuals accounting for just 11.4 percent of the total.[88]

3.6. Policies to Strengthen International Invention Protection and Make Japan a Nation Built on Intellectual Property

3.6.1. The Emergence of International Friction

The sudden rise in patent filings resulted in severe delays at the Japan Patent Office, which was responsible for examining them all. This in turn led to pressure from overseas users calling for the swift protection of their inventions.

The Japan Patent Office responded in various ways, implementing a plan to make the process "paperless," outsourcing preliminary investigations, switching to a registration system for utility models (i.e. abandoning screening), and so on.

However, the aggressive expansion into overseas markets by Japanese companies, which garnered attention during the 1980s, resulted in frequent patent-related disputes between them and U.S. firms, which had been lobbying for robust government protection of their rights under the so-called "pro-patent policy." In 1984, Corning Inc. of the U.S. sued Sumitomo Electric for infringing its patents for optical waveguide fibers. The case was eventually settled out of court in 1989, with Sumitomo agreeing to pay Corning 25 million dollars. Meanwhile, in 1987, Minolta Camera got into a dispute with Honeywell over a patent for auto-focus camera technology, which led to a 1992 district court ordering Minolta to pay Honeywell 96.35 million dollars in damages. In the end, Minolta reached an out-of-court settlement with Honeywell, agreeing to hand over 127.5 million dollars.

These lawsuits woke Japanese companies up to the importance of giving their invention protection strategies an international perspective. One after another they moved to expand their management of patents overseas.

At around the same time, unauthorized imitations of products patented by Japanese companies began being manufactured and distributed in Asia. The invention protection activities of Japanese firms therefore expanded to prevent their products being copied in various locations around the world.

Problems with invention protection were no longer purely domestic issues, neither for the government nor for companies. They had now spread beyond Japan's national borders.

3.6.2. A Nation Built on Intellectual Property

In February 2002, the government recognized that to make Japan more internationally competitive and revitalize its economy, it was important to strategically protect and utilize the fruits of research activities and creative endeavors. It therefore established the Strategic Council on Intellectual Property, headed by the Prime Minister, to put together a national intellectual property strategy and push forward with implementation of the policies needed to execute it.

In July the same year, the Council published its "Intellectual Property Policy Outline." The document called for Japan to be transformed into a "nation built on intellectual property" through the development of value-added products and services based on intellectual property, in order to

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[88] Institute of Intellectual Property, "Report from the Research Committee on Legal Protection for the Results of Technological Development" (1992)

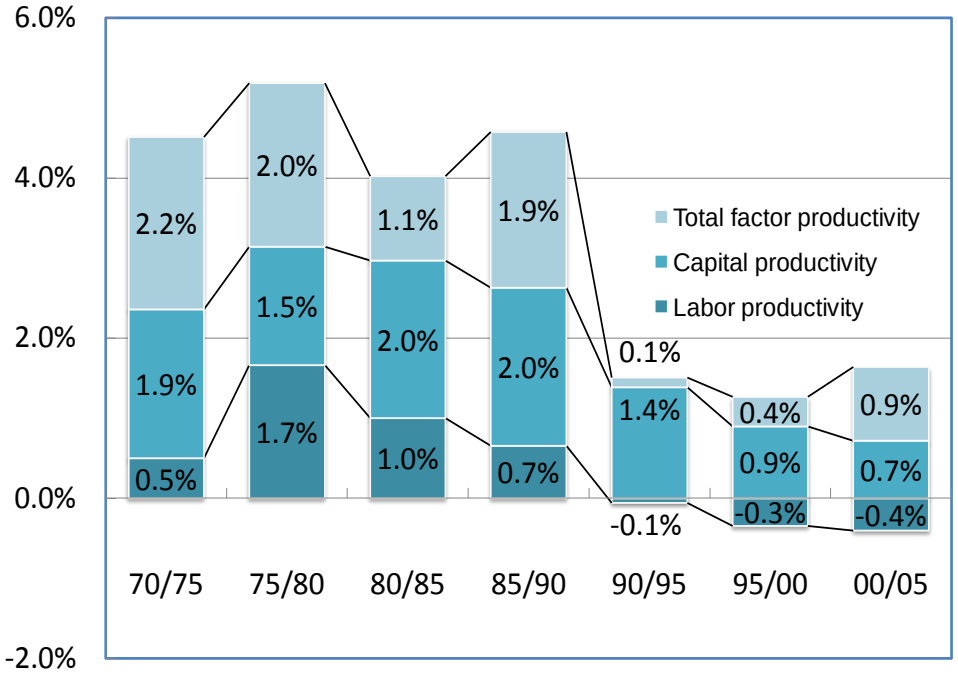
revitalize its economy and society, and contained a comprehensive range of measures comprising a creation strategy, protection strategy, exploitation strategy, and plan for expanding the human foundation.

Based on this policy, the Intellectual Property Basic Act was promulgated in December of the same year. Then in 2003, Japan established an "Intellectual Property Strategy Headquarters" to strengthen the international competitiveness of Japanese industry by intensively and strategically implementing measures relating to the creation, protection, and use of intellectual property. A variety of such measures have since been instituted, such as the establishment of an "Intellectual Property High Court."

No detailed empirical research has been performed on how the government's intellectual property strategy has benefitted the Japanese economy. Nevertheless, it is possible to get a rough idea by comparing economic growth during the period with the contribution of each sector to that growth.

The Ministry of Economy, Trade and Industry's Research Institute of Economy, Trade and Industry (RIETI) has analyzed the contributions of capital, labor, and total factor productivity to Japan's economic growth, and according to their analysis, three points can be identified (see Figure 3-7).

Figure 3-7: Contribution of Total Factor Productivity to Japanese Economic Growth



Source: Research Institute of Economy, Trade and Industry (RIETI), "JIP Database 2009"

First, until the so-called "lost decade" of the 1990s, economic growth topped 4 percent every year, and the contribution of total factor productivity (the broad definition thereof, i.e. the contribution of technological progress) was over 1 percent. Between 1990 and 2000, however, economic growth slipped below 1 percent, and the decline in total factor productivity was especially pronounced.

It was this situation that led to a new policy based on slogans like “nation built on intellectual property” and “nation built on innovation.”

That this policy began to bear fruit from 2005 onwards can be seen in the figures for total factor productivity. The increase in total factor productivity from that time indicates that innovation has really accelerated.

4. Conclusion

In his book *Introduction to Economic Growth*, Charles I. Jones declared technological progress to be the engine of economic growth[89]. He stated that the social benefits derived from new ideas would emerge as individuals endeavor to claim them for themselves in the form of profit. What new growth theory attempts to shed light on is the global mechanism that invention protection systems have established.

As we have seen, various debates have ensued concerning the theoretical rationale for invention protection. However, over 500 years of history has attested to the fact that for economic and industrial development to take place, effective government policy and administration is essential.

On the other hand, it is widely known that invention protection through the award of temporary monopolies also has a negative side: people often abuse their rights, which can hinder innovation. Be it the inventors who defined the industrial revolution, the companies that generated the key innovations of the 20th century, or the patent role of today, it is not so difficult to come up with specific names.

Careful studies need to be made to determine whether the encouragement of invention and the promotion of innovation requires that inventions be carefully screened before patents are awarded, as was once the case in the U.S., Germany, and Japan, or whether it is more effective to confer monopolies for all inventions, provided they meet some minimal criteria, and thereby provide equal incentives to all inventors.

The use of temporary monopolies to protect inventions is no longer just a "better" way of delivering economic growth, it is the "must" way. Perhaps the time has come to stop debating how this system contributes to economic development, and start carefully investigating how we can contribute even more to economic development.

Bibliography:

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- Kamil Idris, Intellectual Property, *A Power Tool for Economic Growth*, World Intellectual Property Organization (WIPO Publication No.888), Geneva (2003)

[89] Charles I. Jones (see Footnote 26)