Recommendations for a Patent System of the Future

Report by a working group under the Danish Board of Technology

Revised edition

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Revised edition
This report was first written in Danish and then translated into English. A first translation was published in June 2005. Unfortunately, several flaws were discovered. They have been corrected in this revised edition.

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Preface

This report was prepared by a working group under The Danish Board of Technology. Its goal was to thoroughly review the patent system, discuss its implications, and provide ideas and recommendations to resolve the problems that were identified.

The members of the working group comprise:

- Erik Hoffmeyer, former governor of Danmarks Nationalbank (chair).
- Peter Lotz, head of department, associate professor, Department of Industrial Economics and Strategy, Copenhagen Business School.
- Knud Overø, former CEO of Ferrosan
- Jens Schovsbo, professor, Faculty of Law, University of Copenhagen.
- Tine Sommer, associate professor, Department of Law, The Aarhus School of Business.
- Christian Friis Bach, international director, DanChurchAid. Former associate professor, Department of Economics and Natural Resources, The Royal Veterinary and Agricultural University.

Christian Friis Bach is the commissioned writer of the report which contains contributions provided by working group members and the results of numerous working group discussions at Danish Board of Technology meetings. Articles and reports on the patent system were reviewed and speakers from various fields of expertise were asked to share their knowledge. A workshop was held in which 20 patent experts and stakeholders were invited to comment on a preliminary draft report. The Danish Board of Technology established the working group and defined the scope of the project, but the working group is solely responsible for the recommendations contained in the report.

Bjørn Bedsted, project manager
Janus Sandsgaard, project assistant
The Danish Board of Technology, October 2005

Executive Summary

Since its debut in the 19th century, the patent system has become fundamental to society. It is widely recognized as critical to the development of new knowledge in both private business and public research, and of great importance to growth and welfare. Throughout history, the patent system has represented an expression of difficult political compromise between inventors and users of new knowledge and/or between short-term interests (low prices to present users) and long-term interests (new technological development). Because it is a tool of political control, it merits greater public attention.

To meet societal objectives, social costs and benefits must be balanced in the patent system. Specifically, the costs incurred by society in granting an exclusive right must be justified by the benefits of enhanced technological advancement.

The general trend is a continuous strengthening and expansion of patent rights. More and more products and processes are being patented and more and more people can obtain patents. The term of protection has been extended, administrative burdens reduced, and the protection and enforcement of patents strengthened. While advances in technology leap forward at a rapid pace, amendments to the patent law move slowly. This imbalance may translate into a possible mismatch between the reward offered by the patent system and the social benefits gained.

Our knowledge of the effects of the patent system is far from complete. There has been a striking lack of economic analyses, and it is difficult to evaluate if the patent system benefits society. Some studies demonstrate that stronger patent rules promote economic performance, competition, and research, while others reach the opposite conclusion. For some industries, the patent system is the key to ensuring technological advancement. For others, it is doubtful whether the system contributes anything, and it may even negatively impact research and growth. Evaluation of the patent system is further complicated by the fact that it cannot be complete without taking into account additional rules and frameworks such as competition law, technology policy, and funding for research. There are no simple solutions.

A basic recommendation of this working group is, therefore, that rigorous analysis is necessary to determine if a more differentiated and flexible patent system should be designed. Such a system would contain different terms and scopes of protection depending on development time, costs, market conditions and product life.

The working group specifically recommends the establishment of a remuneration-based patent system in which a patent holder cannot prohibit the exploitation of his patent. This system can supplement the present exclusive-rights based system which permits such bans to be imposed. Implementation of this recommendation will facilitate access to licenses, lead to more efficient exploitation of patented knowledge, strengthen patent enforcement and encourage small and medium-sized enterprises, in particular, to acquire patents. It is also recommended that the utility model system (also known as the "petty patent regime") be replicated. This regime could function as an alternative to the patent system and could ensure increased flexibility in examination during the patenting process itself.

In relation to gene technology or gene patents, consideration should be given as to whether overbroad product patents should be replaced by use and/or process patents or by more restricted product patents in which only the core function of the invention is patentable. Regarding software patents, efforts to

guarantee interoperability with other software should not be blocked. In addition, all necessary knowledge needed to reproduce an invention should be specified in the patent.

It is also important to ensure that licenses for patents developed by public research institutions are designed to protect public interests and to guarantee access by public researchers. Towards this end, a clearer and more stringent definition of experimental use is needed to avoid future problems.

It is further recommended that university patent portfolios only obtain patents that encourage the diffusion of publicly-funded research results. Other considerations, such as income to the university, should be downplayed.

In the administrative area, the working group suggests that the quality of patent management be improved by, for example, increasing resources, establishing standardized guidelines for examination, conducting cross-sectoral investigations of patent practices by various administrative offices and authorities, and developing international databases and/or procedures for mutual recognition of examination results. In a future harmonized system, it is very important to maintain the present open and transparent Danish system of opposition. This would allow any interested party to oppose a new patent and would facilitate administrative re-examination.

The working group also recommends abolishing limitations that are motivated by ethical or moral considerations. Patent authorities are not equipped to conduct philosophical evaluations. Inventions viewed to be unethical or immoral should be patentable because this provides greater scientific insight. Ethical and moral considerations should be managed by other authorities who have the power to decide whether or not to allow the development, application and marketing of such inventions.

The working group endorses the use of a European Community Patent, but only in one, or at most, two languages. It also backs efforts to create a global patenting system which centralizes the issuance and enforcement of patents.

In light of the many unanswered questions regarding the effects of the patent system, one key recommendation is to develop a more rigorous basis for instituting reform. This could include investigating the effects of possible reforms on both competition and on the broader social interest. There is a clear need for greater knowledge and additional studies on the implications of the patent system. There is also a need for better methods of involving other actors in the decision-making process so that the system is examined and discussed from the perspective of a wider group of stakeholders. When instituting reforms, a kind of "precautionary principle" should be followed in which implementation proceeds only if it is ascertained that technological advancement will result.

These are just some of the recommendations contained in this report – recommendations that are targeted not only at the patent system itself, but also at the rules and regulations that supplement and balance it.

Any proposals for a patent system of the future need to be implemented internationally, particularly within a European framework. This is especially true because, in recent decades, patent law has been harmonized internationally through a series of agreements and treaties. Hence, the aims and recommendations of this report are meant to cover not only Denmark but, even more so, Europe and the world.

The working group´s conclusion is that it is no longer tenable to keep shoring up the old system without producing solid evidence of the need for doing so. In particular, advancements in biotechnology and information technology have put the system under pressure. Yet, the impact of these advancements has resulted in positive discussions about the fundamental nature of the system itself. We recommend slowing down and attempting to better control the patent system's evolution in order to promote the appropriate development and exchange of knowledge that is needed for future growth and welfare.

1. Introduction

We live in a knowledge society. Politicians, business leaders, researchers and citizens often make this remark. The growth and wealth of society are no longer products of natural resources or sheer work, but of education and innovation. Knowledge and its development are critical components of a welfare state. Indeed, greater competitiveness emerges from the knowledge and ideas found in the intellectual capabilities of our citizens.

The advancement of society also means that knowledge is used much more intensively. Production is increasingly based on the refinement and deployment of ideas rather than on physical products. The economy is becoming "weightless" and idea-based. More and more firms do not sell products. They sell knowledge through consulting services or through licenses to the patents they hold.

This evolution poses new demands on the administration of knowledge and ideas. It is here that intellectual property rights and patents enter the picture. Value is created through knowledge and ideas, and the patent system is a tool to capture this value. Intellectual property law contributes to the expansion and improved efficiency of the market for knowledge and technology.[1] The ever-faster development of the law (the regulatory framework), technology, the economy, business, politics and society poses new challenges, not only for firms that are dependent on the patent system, but also for the patent system itself.

Box 1: European Patent Regulation

According to the European Patent Convention (EPC), any person (or his successor in title) who has made an invention which has industrial application has the right, upon application, to be granted a patent for an invention and thereby obtain an exclusive right to exploit it commercially. The exclusive right conferred by a patent implies that no one, except the proprietor of the patent, may exploit the invention without permission. When 18 months have elapsed from the date of filing, the application is made available to the public, even if a patent has not been granted. The maximum term of protection is 20 years from the time the first application was filed.

1.1. The Patent System

A patent gives an inventor the exclusive right to commercially exploit an invention. An exclusive right means that the patent holder may prevent others from exploiting the invention. The patent right does not, however, automatically give the patent holder the right to exploit it. That right is often subjected to other rules. For example, drugs can not be marketed until they have been approved.

The exclusive right is the inventor's reward, which through his creativity and investment, imparts actual benefit to society as represented by the invention. Since an exclusive right shields the patent holder against competition from firms which may wish to copy the invention, an opportunity is provided to demand higher prices than would otherwise be the case. Viewed in isolation, such a result is undesirable for society. But increased earnings provide an incentive to invest in the production of new technology. Moreover, publication of the patent guarantees simultaneous dissemination of the invention's technical details which may contribute to a diffusion of the technology. The system of exclusive rights thus makes it possible to trade knowledge through patents, making it easier to exploit new technology.

[1] OECD (2004): Patents and Innovation: Trends and Policy Challenges. Paris.
http://www.oecd.org/dataoecd/48/12/24508541.pdf

To fulfill societal objectives, social costs and benefits must be balanced in the patent system. The cost that society incurs by granting an exclusive right must be justified by enhanced technological development.

Protection through the provision of exclusive rights is nothing new. It originated in fifteenth century Italy with the advent of book printing in Venice. In Denmark, King Frederik II granted the first printing privilege on 24 November 1565. But it was during the industrialization of the 19th century that intellectual property rights emerged as a universal and important legal discipline, with the fields of patent and copyright materializing in the forms we know today. By the end of the 19th century, most industrial countries had a fairly efficient patent and copyright system whose basic principles still operate. The basic foundation for the international regulation of intellectual property was laid down during this period by the Paris Convention for the Protection of Industrial Property (1883) and the Berne Convention for the Protection of Literary and Artistic works (1886).[2]

Box 2: The European Patent Convention (EPC), 1973

Effective as of 1 January 1990, Denmark joined the EPC which states that a patent effective in Denmark may be granted by both the Danish patent authority (a Danish patent) and the European patent authority (a European patent). The EPC system comprises 28 countries which means that, in principle, a European patent may be valid in all EPC states. Its legal effect is still subject to national patent legislation.

The geographical scope of a patent's legal effect is limited and depends on whether the application is for an international, a European or a national patent. Asia, the US and Europe are generally considered the most important patent markets. The requirements for obtaining a patent, and its legal effect, differ within these three areas, even though the basic rules which implement the international conventions are generally the same. In Europe, the law is increasingly being harmonized, especially after the conclusion of the European Patent Convention (EPC) to standardize patent requirements (see Box 2).

It is not yet possible to obtain a global patent on the basis of a single patent application filed with one of the leading patent authorities such as the European Patent Office (EPO), the Japanese Patent Office (JPO), or the United States Trademark and Patent Office (USPTO).

Box 3: The TRIPS Agreement

The TRIPS Agreement establishes minimum standards for the level of protection of intellectual property rights. A country may introduce even greater protection.

The TRIPS Agreement mandates that patents be available for any inventions, whether products or processes, in all fields of technology, provided that the invention is new, involves an inventive step and is capable of industrial application. Patents must be available and patent rights enjoyable without discrimination as to place of invention, the field of technology and whether products are imported or locally produced.

An initial step towards international patent protection was achieved with the conclusion of the agreement on trade-related aspects of intellectual property rights (the TRIPS Agreement of 1994 which was part of the Uruguay Round Agreement under the auspices of GATT, now the World Trade Organization (WTO)). The TRIPS Agreement sets a global standard for the development of intellectual property rights and ensures that the patent system is replicated in more countries. It includes requirements for the national administration and enforcement of intellectual property rights.

[2] Koktvedgaard, M. and Schovsbo, J. (2005): Lærebog i immaterialret, 7th edition. Jurist- og Økonomforbundets Forlag.

Patent rights have continued to be strengthened and developed over the years:

- Additional subject matters are being patented. The patent system has expanded to include a variety of new fields, including information technology and biotechnology. As a result, the number of patents has risen significantly.

- Many more inventors are granted patents. The patent system has spread to even more countries, and public research institutions are in a better position to patent their inventions.

- Protection terms have lengthened. International harmonization has resulted in a general extension of the term of protection in many countries. In addition, the introduction of supplementary protection certificates for pharmaceuticals and plant protection agents has extended protection terms beyond the standard 20 years.

- It is administratively easier to obtain a patent. Patent application procedures have been streamlined and harmonized, particularly at the regional and international levels, and the costs incurred have been much reduced.

- The protection and enforcement of patents is stronger. Use of the court system to enforce patents is widespread, and international enforcement have been strengthened by the WTO dispute settlement mechanism.

At least in the United States, advancement has been rapid and the patent system now embraces a number of new areas. The motto of the American patent system is that one can patent "everything under the sun made by man." In Europe, Japan and the US, there has been a total increase of patent applications of more than 40 per cent to 850,000 per year from 1992 to 2002. As Figure 1 shows, the US patent authorities (USPTO) receive approximately three times as many applications as do their European counterparts (EPO). But the growth rate is the steepest in Europe.

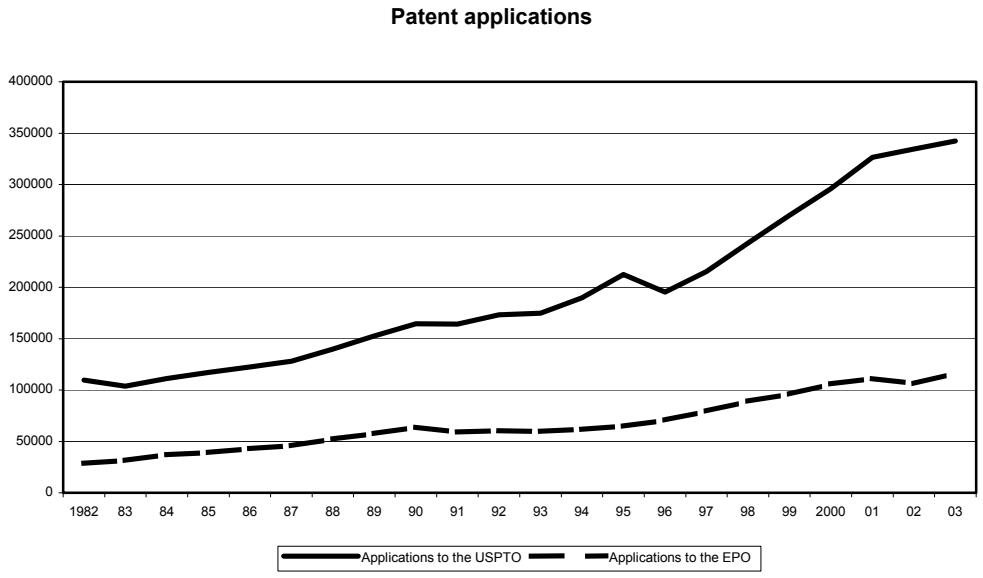

Figure 1: Patent applications[3].

[3] Source: OECD Patent Database, March 2005, and USPTO and EPO annual reports. Dates are recorded as the time of application. The EPO data for 2003 has been estimated by OECD.

Patent applications in the fields of biotechnology and information technology have particularly contributed to this increase.[4] Figure 2 shows the growth rate for three selected areas. Biotechnology, fairly narrowly defined, has multiplied nine times since 1982. Information and communication technology (ICT) has multiplied six times, whereas pharmaceuticals have only tripled.[5]

This growth is also seen in Denmark. Danish patent activities nearly tripled through the nineties, and Denmark is third on the global list of countries with the most rapid increase in patent activities.[6]

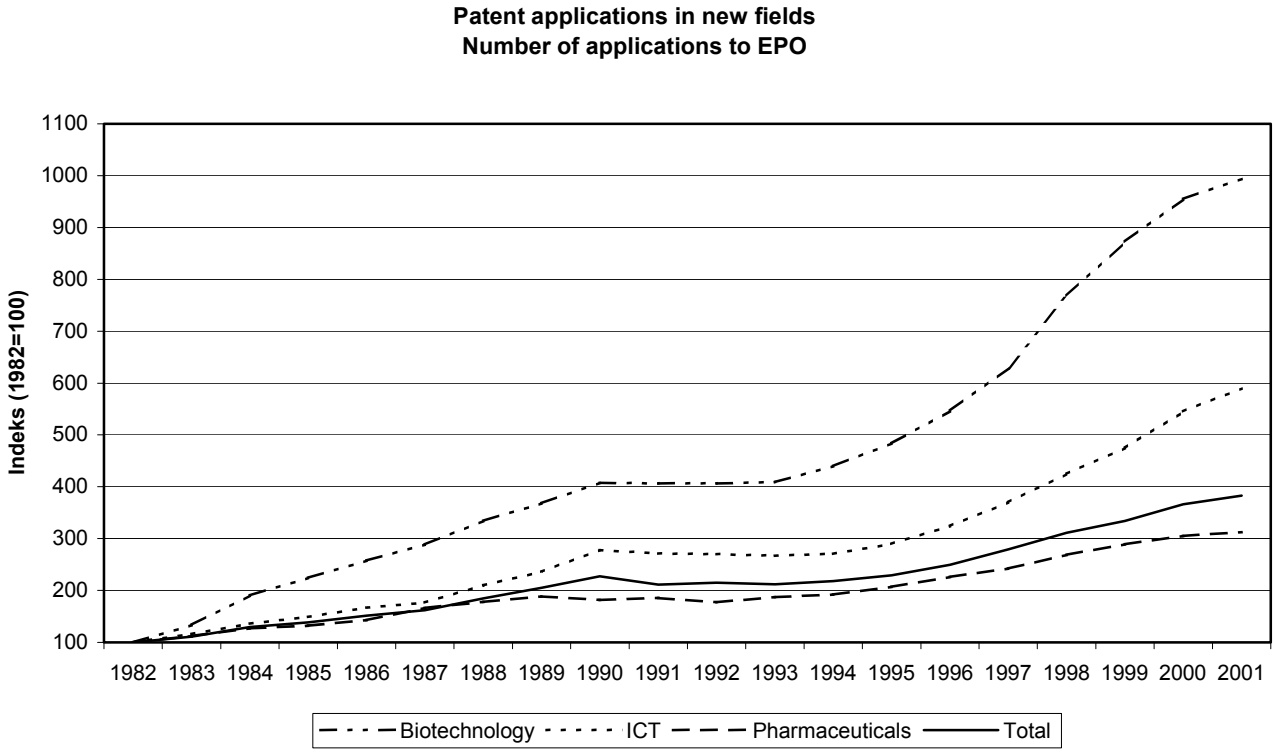

Figure 2: Patent applications in new areas. Number of applications to EPO[7]. Source: OECD, Patent database, March 2005.

1.2. The Patent Balance

Throughout history, the patent system's guiding principle has been to balance benefits to society against benefits to the inventor. The importance of maintaining this balance is expressed in Article 7 of the TRIPS Agreement:

[4] OECD (2004), ibid.
[5] As the Figure shows, drugs are defined as patent applications which are classified by at least one of a number of drugs-related technology codes (IPC codes). The raw data reveals that the number of new chemical compounds is growing slowly, while the number of completed chemical preparations is growing rapidly.
[6] Patent- og Varemærkestyrelsen (2005): Et forspring i vidensamfundet. Nye perspektiver på intellektuel ejendomsret i dansk erhvervsliv. Report.
[7] Figure 2 is based on the IPC codes of the applications which indicate the technology type of the patent. The definition of the categories of ICT and biotechnology follows OECD classifications (See OECD, "Compendium of patent statistics, 2004"). The drugs are defined on the basis of IPC classes A61K, C07C, C07D, C07F, C07G, C07H, C07J and C07K.
Because most patents have several IPC codes, it is very difficult to divide all patents into mutually exclusive technological classes. Double counts are thus inescapable. An extreme case is a bio-informatics patent which will have IPC codes from the categories of biotechnology, ICT and drugs.

> *The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and diffusion of technology, to the mutual benefit of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.*[8]

This broad declaration hides a number of theories and assumptions about the patent system[9] which often emerge in discussions about its costs and benefits. In particular, reforms in recent decades have fuelled a debate on the fairness and viability of the system. Such introspection raises a number of questions:

- Will the current patent system lead to increased economic growth, more robust competition and stronger research – or the reverse?
- Has the vigorous increase in the number of patents promoted or blocked innovation and economic performance?
- Have the increased possibilities for and use of patenting in public research institutions promoted or hampered the development of knowledge, particularly in basic science?
- Are the various protections available both within and outside the patent system adequate to counter any negative effects?
- Is the patent system sufficiently flexible and efficient to house the very different trends in innovation and technological advancement?
- Does the present regime ensure an efficient patenting process, high-quality patents and effective enforcement?
- Are there any limits to what can be patented and what can not?

These are pivotal questions in any debate about the future. This report was inspired by these questions, together with the continuing expansion of the patent system and the rapidly increasing number of patents. Clearly, there is a need to assess the ongoing development of the patent system, not only from the point of view of the firm, but also from a broader societal perspective.

The protection of intellectual property rights has become a fundamental institution in society. The system is a critical determinant of the behavior and development of both private business and, increasingly, public research. It is an expression of a historically difficult political compromise between creators and users of new knowledge, and/or between social short-term interests (low prices to present users) and long-term interests (new technological development). It is a political management tool and, as such, merits greater public attention.

The growth of increasingly comprehensive international agreements implies, however, limited national latitude to reform the law. Therefore, one assumption of this report is that the patent system and its basic rules should continue. But in our opinion, there is good reason to take a critical view of the ever-increasing protection that is being afforded. Indeed, the entire system needs thorough review. Though far from exhaustive, this report is an attempt to do just that.

[8] GATT (1994): Trade-Related Aspects of Intellectual Property Rights. http://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm

[9] Mazzoleni, R. and Nelson, R.R. (1998): Economic Theories about the Benefits and Costs of Patents. Journal of Economic Issues, Vol. XXXXIII(4): 1031-1052.

Our goal is to propose a number of ways in which the patent system can be reformed and improved. There exists a complex interaction between the protection of intellectual property rights and various other sets of rules and frameworks ranging from competition law to the funding of research. Some of our recommendations are, therefore, not about changes in the patent system, but rather about drafting legislation that complements and balances the system. Clearly, a holistic perspective needs to replace the current narrowly-focused one.

This report will discuss the patent balance, analyze possible reforms and provide recommendations for a patent system of the future.

1.3. Delimitations

This report concerns only the patent system and not other forms of intellectual property law. Other areas are considered, however, to the extent that they offer useful ideas for the purposes of this discussion.

There is no focus on a specific sector. But certain sectors, particularly information technology and gene technology, will be used to illustrate issues of patent law.

The perspective is economic. Ethical issues are included only where relevant.

The report concentrates on the situation in Denmark and Europe. The situation in other parts of the world is included primarily for comparison. There is no specific focus on developing countries, even though it is recognized that the problems there can be serious and of a different nature than those in industrialized countries.

Lastly, the law is not discussed in detail. Rather overall trends, problems and alternative solutions are explored. Hence, there is no explicit analyses of the specific contents of patent legislation and treaties.

1.4. Report Contents

This report contains evaluations of the current patent system and recommendations on how to best design a patent system of the future. Recommendations are presented at the ends of chapters 3, 4, 5, 6 and 7 and have been compiled in the concluding chapter. They are relevant primarily in a European context.

Following the introduction in chapter 1 which outlines the rationale of this report, chapter 2 describes some of the innovation trends and developments of the patent system that give rise to the need for a thorough review. Chapter 3 examines the connection between patents and innovation. This chapter is based on a variety of economic studies that contain different analyses and evaluations regarding this connection. Chapter 4 discusses what should be patentable and to what extent, with particular focus on gene technology and information technology, and public research patents. Terms of protection are discussed in chapter 5, and chapter 6 explores several options to balance the patent system through limitations on protection. Chapter 7 scrutinizes the administrative system and chapter 8 presents the conclusion.

2. Innovation Trends

The striking growth in the number of patents during the last decade is a reflection of the fact that innovation processes are changing. Innovation is more competitive, yet more cooperative at the same time. It is dependent on new, high-tech firms as well as on knowledge networks and markets. Today, more and more firms are competing through innovation. They are using global networks and partnerships, reorganizing their value chains and employing sub-contractors. A rising number of firms are being traded and priced according to their intangible assets.[10] These trends increase the need for a well-functioning patent system.[11]

The transition from an industrial society to a knowledge society and consequent technological advancement puts the patent system under pressure. Information technology makes it easier to acquire knowledge of the inventions and ideas of others. The life span of a particular technology is shorter. As the rate of technology turnover rises, the importance of the patent system becomes even greater because expenses for research and development need to be recovered.

The realities of the knowledge-based economy also spell high start-up costs for the research and development of new technologies. This applies to high-tech products such as drugs, computer technology, industrial aircrafts, telecommunications, genetic research and nanotechnology. This high cost structure can make patents important tools for the protection of investments and for the creation of a competitive edge.[12]

Heightened safety requirements for consumers and patients, rising ethical and moral considerations, and more stringent environmental concerns make the road from idea to production more difficult. This is most notable in the production of drugs where requirements for documentation, testing, control, approval and patient care have increased costs. Such a development may hamper innovation and expand the need for patent protection. Stricter requirements to develop even the cheapest drugs, stronger corporate market strategies and increased competition from generic producers also mean that pirated products challenge existing patents much more aggressively – even before they expire. This may decrease the financial benefit of a patent. On the other hand, the drugs industry is better at optimizing, and thus shortening, the process from idea to production. At the same time, pharmaceutical firms continue to find ways to extend the protection period through supplementary patents such as for derivatives and processes.

The challenges faced by the patent system are clearly illustrated by the software industry where the number of patents has risen dramatically. In the US before 1990, fewer than 5,000 software patents were filed annually with the US patent authorities, while in 2000 approximately 20,000 patents were filed.[13] At the time of printing, the EU is in the midst of discussing the conditions under which software should be patentable. Software patents are criticized for impeding technological advancement because they are often too broad and overlap with the exclusive rights of copyright. Critics also argue that the threshold of the inventive step requirement is often too low. In Europe, for example, patents were issued for tabs in

[10] Patent- og Varemærkestyrelsen (2005), ibid.
[11] OECD (2004), ibid.
[12] Sideri, S. and Giannotti, P. (2003): Patent System, Globalization, Knowledge Economy. WP. n. 136. Centro di Ricerca sui Processi di Innovazione e Internazionalizzazione.
[13] OECD (2004), ibid.

web browsers (EP689133) and for the concept of a shopping basket for website mail order sales (EP0784279). In the US, Amazon was granted an often condemned patent for their "one click technology"[14] (a system allowing a computer to remember the client identifier when purchasing books and other products on the Internet).

The introduction of business method patents in the US is also intensely debated. If the US definition of a business method is compared with patent applications to the EPO, almost 2,000 applications would fall within its category. Of those 2,000 applications, around 700 have been granted already.[15] The validity of some of these patents is doubtful and may even have a negative impact on the market. Patents can also block the efficient development of common standards and protocols.

The development of Open Source strategies can be viewed as a response to the growth in intellectual property protection.[16] Open Source technologies are typically protected by exclusive rights. However, license terms grant others free access only if the resulting products are available on the same, no-royalty conditions. This elegant concept of "copy-left" makes it possible for the copyright holder to force subsequent product developers to follow the same gratuitous policy. The nature of software development makes it difficult to avoid being caught in the copy-left "trap." This is because technological development typically occurs through improvements of existing software which already contain thousands of lines of software text, some of which could be open source and which would be impossible to re-write.

Open Source is well-known, most notably in the information technology field, where products such as the operative system Linux and the web server Apache, enjoy wide dissemination. For example, Apache's market share of web servers was almost 70 percent in May 2005.[17] Under an Open Source regime, free access is provided to the source code (the "software manual") through a user license that guarantees the right to study, apply and develop the code free of charge for any purpose under the condition that any derivative work must enjoy the same rights. An example is "The GNU General Public License" (GPL).[18]

In spite of the obvious problems of building a profitable business concept around Open Source, it has produced a wealth of good software, to the surprise of many. Under certain circumstances, traditional firms can also benefit greatly from Open Source. For example, IBM has embraced Open Source in specific areas and made 500 of the firm's patents available free of charge. Upon its release, IBM stated that "while ownership of copyright is an important driving force behind innovation, technological progress often depends on shared knowledge, common standards and cooperative innovation."[19] Evidently, the strong exclusive rights of copyright or patent and Open Source development are not necessarily incongruent. It is the terms of the license that count.

The Open Source concept has spread to biotechnology. CAMBIA, a non-profit biotechnology research group in Australia developed technology to insert new genes into plants and made the method available

[14] US patent No. 5.960.411 for "Method for placing a purchase order via a communications network." The US Federal Circuit Court of Appeals in a decision of 14.2.2001, Amazon.com v. Barnes and Nobel, found that the validity of the patent was dubious as similar technology was known at the time of application. The validity has not been decided by a court of law – the case was remitted and since settled – and the patent is still effective.
15 Wagner, Stefan (2005): "Business Method Patents in Europe and their Strategic Use – Evidence from Franking Device Manufacturers." Paper presented at 5th EPIP Conference in Copenhagen. http://www.epip.ruc.dk/Papers/Wagner_Paper.pdf
16 Cowan, R. and Harison, E. (2004): Revealing Obscure Sources: The Paradoxical Evolution of Software Appropriation Regimes. Paper presented at the Department of Industrial Economics and Strategy (IVS), Copenhagen Business School. http://web.cbs.dk/departments/ivs/events/harison.pdf
[17] Netcraft Web Server Survey, se http://news.netcraft.com
[18] http://www.gnu.org/licences/gpl.html
[19] Berlingske Tidende (2005-01-12): IBM udbyder patenter til fri afbenyttelse.

to others through an Open Source license.[20] Within the area of copyright, more flexible license terms have been developed by the Creative Commons movement.[21]

A more widespread trend is the publishing of a potential invention in order to keep others from obtaining a patent (defensive publishing). Examples are the development of large public genetic databases in which many universities and private firms disclose sequences of genes and other data to block future patents. For a long time, firms such as IBM also have used defensive publishing in software.[22]

Such trends reveal that innovation and technological development can be fostered without the use of traditional methods to protect intellectual property rights. This naturally leads to a questioning of the current patent system. A general concern is the rapid speed with which technology develops compared to the slow adaptation and development of patent regulation. The result could be a potential mismatch between the reward offered and the costs actually incurred by the inventor.

In gene technology, for example, the identification and basic characterization of genes – something that was regarded as revolutionary research only a few years ago – is now part of routine laboratory procedures in combination with large central databases.[23] The requirements and standard practices developed in relation to, say, the inventive step, may be disproportionate to this rate of technological development.

Another general concern is that the present system of protection is not well-suited to the many new technological advances and challenges. The basic foundations of the patent system – exclusive rights and territoriality – are therefore increasingly subject to pressure.

At the same time, technological development increases the need for a more differentiated approach to the protection of intellectual property. The Open Source movement points to completely new roads for innovation and development. Generally shorter patent periods may be necessary, as well as cheaper and faster patenting processes for products with a short life span and a high rate of turnover. On the other hand, a longer patent period may be desirable for products in which the law and other requirements increase costs for research and development. The balance between traditional exclusive rights and a more flexible right of remuneration should also be explored (see Box 4). An additional reform could be the development of faster and more efficient models, such as the utility model system, to register new inventions. We will take a closer look at these models later in the report. Of course, it may be difficult to administrate more flexible systems. Thus another supplementary strategy may be to reduce the negative effects of patent legislation through various limitations on protection. This possibility will be discussed in chapter 6.

Box 4: Remuneration

The difference between a "remuneration right" and an "exclusive right" is that the owner of a remuneration right is entitled only to receive fair remuneration for the use of his creation. The holder of an exclusive right, on the other hand, can prevent the use of his creation or make it conditional upon the payment of a fee determined by him or through negotiation with the user. Remuneration-based rights are widely used in copyright law where there is a need for broad access to the exploitation of works and where individual agreements are not possible in practice – such as in the case of photocopying by schools.

[20] The Economists (2005-02-12): The triumph of the commons, p. 55. and CAMBIA (2004): The CAMBIA BIOS Initiative: Biological Innovation for Open Society. CAMBIA, Australia, www.cambia.org.
[21] http://creativecommons.org
[22] Merges, R.P. (2004): A New Dynamism in the Public Domain. *The University of Chicago Law Review*, 71:XXX pp. 1-20.
[23] Sommer, T. (2004): Bilag 1: Patentret og det humane genom. I "Patent på menneskers gener og stamceller." Redegørelse fra Det Etiske Råd.

3. Innovation and Economic growth – Connections and Clashes

In recent years, many new studies have addressed the interaction between patents, research, economic growth and competition. This chapter will examine these studies and the connections they illustrate.

It is widely believed that patents are critical to the creation of new knowledge and to industrial development. This perception is supported by the simple fact that countries which have reached a high technological level also boast strong protection through intellectual property law. Studies indicate that market economy countries such as Denmark, can increase growth by expanding the use of exclusive intellectual property rights. Studies of firms establish a connection between firm performance and patents. However, this connection is only valid for traditional high-technology firms in market economy countries. Some studies point towards a positive connection between patent activities and a firms' market value. Still others disclose that the financial performance of firms which possess patents that are often publicly cited is much better than that of firms with patents that are rarely cited.[24]

On the other hand, a number of studies dispute a direct, positive and simplistic connection between strong patent protection, innovation and financial performance. These studies demonstrate that a number of countries managed to achieve a high level of economic development in a period with no strong protection of intellectual property rights.[25] This was particularly true for some Asian countries during the second half of the twentieth century. Similarly, several leading international food and drug companies developed their market position around 100 years ago precisely by exploiting the absence of patent rights.[26]

A study of Danish firms also yields inconsistent findings.[27] Of course, the firms most actively involved in patenting tended to generate the largest revenues. But the largest firms are by definition the ones who have the most patents. On the other hand, as compared to the control group, a larger share of firms with active patent portfolios had zero or negative growth during the period studied. But this larger share comprised smaller firms, not larger ones.

It is also shown that firms which do not conduct their own R&D activities but rather acquire exclusive rights profit more than firms that conduct their own R&D and protect their exclusive rights. Clearly, patenting and other forms of registration of exclusive rights are no guarantee to success.[28] These studies also demonstrate the need for a broader understanding of the barriers and opportunities offered by the patent system to small and medium-sized enterprises (SMEs).

There are many ways in which firms can protect ideas and inventions and still recover their R&D costs. These include secrecy, the benefit of being first on the market, the establishment of marketing channels,

[24] Reitzig (2004): Litteraturstudie foretaget af lektor Markus Reitzig, CBS for Patent- og Varemærkestyrelsen , som citeret i Patent- og Varemærkestyrelsen (2005), ibid.
[25] Se eksempler i Bach, C.F. (2002): Intellektuelle ejendomsrettigheder og økonomisk udvikling - Konflikt eller katalysator? *Nordiskt immateriellt rättsskydd*, 71(3): 209-225. http://www.friisbach.dk/fileadmin/cfb/publicat/Patent-NIR/Patent-NIR.pdf
[26] Schiff, E. (1971): Industrialization without National Patents: The Netherlands, 1869-1919, Switzerland 1850-1907, Princeton University Press som citeret i Det Etiske Råd (2004), ibid.
[27] Oxford Research (2004): Analysereport – Eneretsredegørelse." Rapport fra Patent- og Varemærkestyrelsen https://www.dkpto.dk/nyheder/forspring/oxford.pdf
[28] Oxford Research (2004), ibid.

the advantages of early production, use of trademarks and branding, certification, and product approval. Various studies indicate that for many firms, patents comprise a minor part of research and development incentives.[29] Recent Danish and foreign studies indicate that a firms' perception of patents as the preferred method of protecting innovation is actually decreasing while other methods, primarily secrecy, are enjoying increased use.[30]

Another study involved 451 telephone interviews with small and medium sized producers in Denmark. Only 11 percent stated that patents are greatly valuable for protecting inventions against copying and/or exploitation. Many firms did not believe that a patent is worth the cost of acquiring and maintaining it. Protection strategies such as sustaining a technological edge, faster development and secrecy were increasingly being used, even though 38 percent of the firms still relied on patent protection.[31]

Another study with interviews of 75 Danish business executives, similarly reveals that many do not consider patents important. This is also true for knowledge-intensive, high-technology firms which are at the forefront of new, different and complex technological solutions that demand great know-how and are therefore difficult to copy. Exceptions are biotech and drug firms where protective measures are of critical importance to the firm's future.[32]

A recent Danish study focusing on innovative industries shows that only half of the firms filed and applied for intellectual property rights such as patents, trademarks, design trademarks, and utility models, within the last three years. The figure for actual R&D firms is, however, 69 percent. Forty-three percent of the total have no exclusive rights at all. Just above 40 percent hold patents, but for SMEs the figure is only 30 percent.[33]

These studies reveal a complex interaction between patent rights and market conditions which, to a large extent, is highly dependent on the individual industry and even on the individual firm. Clearly, the patent system is difficult to evaluate as an independent institution. It both influences and is influenced by specific market conditions.

An important aspect of the patent system is the publication and dissemination of knowledge about new inventions. Free access to public records provides a constant flow of information. This may inspire new research and development and may decrease redundancy and repetition.[34] Considerable research costs can be saved. The patent system can therefore make global research efforts cheaper and more efficient.

On the other hand, it is rare that two patent applications conflict, and there is no indication of redundancy and repetition problems. Competition in patenting is apparently relatively rare,[35] even though the number of disputes is rising. Just as important, the considerable amount of information

[29] Levin, R.C; Klevorich, A.; Nelson, R.R. and Winter, S.G. (1987): Appropriating the Returns from Industrial Research and Development. Brookings Papers on Economic Activity, 3:809;
Mansfield, E. (1986): Patents and Innovation: An Empirical Study. Management Science, 32(1):173-181;
Mansfield, E; Schwartz, M. and Wagner S. (1981): Imitation Costs and Patents: An Empirical Study. Economic Journal, 91:907-918;
Scherer, F.M and Ross, D. (1990): Industrial Market Structure and Economic Performance, Houghton Mifflin Company, Boston.
Cohen, W.M., Nelson, R.R. and Walsh, J.P. (2000): Protecting Their Intellectual Assets: Appropriability Conditions and Why US Manufacturing Firms Patent or Not, NBER Working Paper 7552. http://www.nber.org/papers/W7552
[30] IFO (2002): Undersøgelse vedr. virksomheders anvendelse af enerettigheder. Undersøgelse for Økonomi- og Erhvervsministeriet og Kulturministeriet gennemført af Instituttet for Opinionsanalyse; Cohen *et al.* (2000), ibid.
[31] Patent- og Varemærkestyrelsen (2000): Små og mellemstore fremstillingsvirksomheders barrierer for produktudvikling og patentering. Undersøgelse gennemført af IFO - Instituttet for Opinionsanalyse.
[32] IFO (2002), ibid.
[33] Oxford Research (2004), ibid.
[34] Sideri, S. and Giannotti, P. (2003), ibid.
[35] Mazzoleni, R. and Nelson, R.R. (1998), ibid.

flows inherent in today's patent system makes it difficult for smaller firms to exploit and manage the system.

3.1. Patents and Competition

Because a patent provides limited protection against a competitor's use of an invention, it can have an important effect on competition. The aim of patent law is to advance technological development for the benefit of society. Competition law has the objective of preventing monopolies, and restrictions on unhealthy competition can benefit society. Since patents create monopolies, they can conflict with competition law goals. In the short term, competition concerns can prompt a certain limitation on exclusive rights. In the long term, patent and competition law can complement one another.

Patents can have a positive influence on competition by making it easier for startups to gain a foothold on the market and to protect their market position. Patents may be a decisive factor in attracting venture capital to startups and in strengthening cooperation with other firms.[36] In addition, patents may facilitate the diffusion of new technology which in turn may encourage positive competition.[37] Studies show that some firms make extensive use of published patents as a source of information.[38]

To avoid undermining the incentive effect of patent rights, competition law respects exclusive rights and allows monopolies based on patents and other intellectual property. Patent owners determine how a patent should be exploited, including whether or not a license should be granted. Licenses typically do not reduce competition in comparison to situations where licenses are not used. Moreover, no competition problems arise if licenses are limited by geographical territory or by product area, so-called "exclusive licenses." In fact, exclusive licenses strengthen incentives to conduct R&D because they increase earning possibilities. But in cases where a patent holder attempts to "transfer" a monopolistic position in a product market based on a patent to one of the firm's other product markets, competition authorities have intervened. An example of such abuse is licensing a patent only if the licensee buys other services from the patent holder. In general, such "conditional licenses" may distort competition and invite intervention by competition authorities. Finally, the authorities have required licensing to third parties in merger cases where the two merging companies would otherwise acquire a dominant position based on the ownership of all relevant patents.[39]

Box 5: Competition Law

In Denmark, the main rules of competition law can be found in the Competition Act and in Articles 81 and 82 of the EC treaty. These rules prohibit anti-competitive agreements between firms ("cartels") and the misuse of power by firms holding a dominant position on the relevant market. Such misuse can include charging unreasonably high prices. Competition law contains specific provisions on patent licenses and on similar "technology transfer agreements." The prohibition against the misuse of a dominant position does not usually cause difficulties for patent holders because a patent does not automatically imply a monopoly as defined under competition law. However in special circumstances, such as where a patent covers areas totally closed to competition, it follows from the case law that competition law may be used as a basis for granting a compulsory license which forces the patent holder to issue a license to a competitor.

[36] Gans, J., Hsu, D.H. and Stern ,S. (2002): When Does Start-up Innovation Spur the Gale of Creative Destruction? The Rand Journal of Economics, Vol. 33, No. 4.
[37] OECD (2003), ibid.
[38] Sheehan *et al.* (2003), ibid.
[39] Shapiro, C (2002), Competition policy and innovation, STI Working Paper 2002/11, OECD.

In general, the presence of many interrelated patents makes it difficult for competitors to penetrate a market, particularly for new entrants. Fears that many patents hamper competition are particularly strong in the electronics and information technology industries. This negative impact is magnified by patents obtained solely to block access by competitors, which is a widespread practice in the semi-conductor industry.[40] In a study of information technology firms in the OECD countries, three fourths reported that today they would patent technology which they would not have patented a decade ago even if it had been possible.[41] The patents are used to strengthen their negotiation positions with competitors and to appropriate revenues through licenses. IBM takes out the most patents in the world, and they report annual revenues of more than US$1.5 billion from licenses.[42] Estimated revenues from licenses have risen globally from around US$10 billion dollars a year in 1990 to more than 100 billion in 2000.[43]

Competition law provides an emergency brake that may be pulled in rare instances in which the relationship between society's interest in effective competition conflict with the exclusive right of the patent holder. This occurs when the market effects of a patent are different than normal so that excessive market power is captured by the patent holder. In the US, it is suggested that analyses of possible negative competitive and other effects should be illuminated before new areas of technology are included in the patent system.[44]

3.2. Patents and Research

Supporters traditionally argue that patents create incentives for technological development. This contention should be evaluated. In fact, it is difficult to produce tangible evidence of this assertion. However, most studies point in that general direction. For instance, countries that are strong in research and innovation have a long tradition of protecting intellectual property rights. But studies do not provide a clear answer as to whether strong or stronger patent options trigger increased R&D.

Some studies even point in the opposite direction.[45] For example, patents are used increasingly for other purposes than to prevent copying. Within the chemical industry, patents are often obtained to impede competitors from developing substitutes. Patents in the telecommunications sector and the semi-conductor industry are sometimes used to force competitors into negotiations.[46]

In the wake of the patent system's success, a new problem is emerging: while the striking increase in patents can be taken as an expression of success, this increase could undermine incentives to research and development. It is a real possibility that certain fields of research will become saturated by patents. If a firm must constantly protect itself against potential claims from patent owners, the incentive to

[40] Hall, B.H. and Ziedonis, R.H. (2001): The patent paradox revisited: an empirical study of patenting in the U.S. semiconductor industry, 1979- 1995. RAND Journal of Economics, 32(1): 101-128.
[41] Sheehan, J., Guellec, D. and Martinez, C. (2003), "Business Patenting and Licensing: Results from the OECD/BIAC Survey", in Patents Innovation and Economic Performance, proceedings of the OECD conference on IPR, Innovation and Economic Performance, 28-29 August 2003, OECD.
[42] OECD (2003), ibid.
[43] OECD (2004), ibid.
[44] Federal Trade Commission (2003): To Promote Innovation: The Proper Balance of Competition and Patent right and Policy. http://www.ftc.gov/opp/intellect/index.htm
[45] Bessen, J. and Maskin, E. (2000): Sequential Innovation, Patents and Imitation. Working Paper n. 00-01, Department of Economics, Massachusetts Institute of Technology;
Lerner, J. (2002): " 150 Years of Patent Protection," American Economic Review Papers and Proceedings, 92 (May 2002). http://www.people.hbs.edu/jlerner/publications.html;
Sakakibara, M. and Branstetter, L. (2001). Do stronger patents induce more innovation? Evidence from the 1988 Japanese patent right reforms. RAND Journal of Economics, 32(1), pp. 77-100. http://www.rje.org/main/nber.html
[46] Cohen *et al.* (2000), ibid.

conduct any research whatsoever may be reduced. Many interrelated patents divided among different rights owners can reduce the incentives and opportunities for further research and development.

This problem is described in the biotechnology field as "the tragedy of the anticommons:"[47] intellectual property rights for the individual can discourage cooperation and research.[48] More specific examples are found within genetic research;[49] within computer hardware development where tens of thousands of overlapping patents are reported;[50] and within the software industry where patents with excessively broad claims are reported[51] and where the introduction of patents apparently has not increased research, development or productivity.[52] The problem is exacerbated when individual patents are of poor quality.[53] One study even found that the use of strategic software patents can be linked to less R&D.[54] Other studies, however, point to the opposite conclusion that software patents generate more innovation.[55]

In biotechnology, patenting options can result in closed research environments and in efforts to use patents in a detrimental manner in order to optimize earnings.[56] For example, there are cases where access to patented methods is limited and reports that the rise in patents slows research and makes it more costly.[57]

There is particular scrutiny of the overbroad product patents that are granted in gene technology. Observers fear that these patents block further research and competition. For example, problems are reported with research tools, and particularly with gene-based diagnostic tests.[58] But others argue that the increased patenting of research tools does not erect significant barriers to research, that these problems are surmountable and manageable,[59] and that even in cases of market dominance penetration is still possible. Finally, there is an argument that research is not stymied by multiple patents. This is because research and development can be conducted on the basis of existing patents as long as the results are not commercially exploited. Although this type of research is possible, it is clear that research incentives are weakened when unrestricted product patents impede new commercial exploitation.

On the other hand, there are also instances where the alternative to a product patent, such as a use or process patent, does not give the patent holder adequate protection. This will negatively impact R&D

[47] The concept of "the tragedy of the commons," describes how common resources, such as water, air and grasslands, are being overly exploited because nobody can be kept away from using them , and because the individual has an incentive to overconsume.
[48] Heller, M.A. and Eisenberg, R.S. (1998): Can Patents Deter Innovation? The Anticommons in Biomedical Research. *Science*, 280(5364): 698-701. http://www.sciencemag.org/cgi/content/full/280/5364/698
[49] Bar-Shalom, A. and R. Cook-Deegan (2002): Patents and Innovation in Cancer Therapeutics: Lessons from CellPro. The Milbank Quarterly, Vol. 80, No. 4.
[50] Federal Trade Commission (2003), ibid.
[51] OECD (2004), ibid.
[52] Bessen, J. and Maskin, E. (2000): Sequential Innovation, Patents and Imitation. MIT Department of Economics, Working Paper No. 00-01. http://www.researchoninnovation.org/patent.pdf
[53] Federal Trade Commission (2003), ibid.
[54] Bessen, J. and Hunt, R. (2003): An Empirical Look at Software Patents. Working paper no. 03-17/R. Federal Reserve Bank of Philadelphia. http://www.researchoninnovation.org/swpat.pdf
[55] Sheehan *et al.* (2004), ibid.
[56] Etiske Råd (2004), ibid.
[57] OECD (2004), ibid; Biosam (2003): Patent på mennesker. Biosam informerer no. 16, December 2003.
[58] OECD (2002), ibid. OECD (2002): Short summary report of the workshop on genetic inventions, intellectual property rights and licensing practices. Held in Berlin, Germany – 24 and 25 January 2002. http://www.oecd.org/dataoecd/7/42/1949083.pdf. See full report at http://www.oecd.org/dataoecd/42/21/2491084.pdf
[59] Walsh, J.P., Arora, A. and Cohen, W.M. (2003): Effects of Research Tool Patents and Licensing on Biomedical Innovation. In: Cohen, W.M. and Merrill, S. A. (ed.) /2003): Patents in the Knowledge-based Economy, the National Academies Press, Washington, DC. http://books.nap.edu/catalog/10770.html; OECD (2002), ibid.; Nuffield Council on Bioethics (2004): The use of genetically modified crops in developing countries – a follow-up Discussion Paper. London. www.nuffieldbioethics.org. See comments to the article by Heller and Eisenberg (1998), ibid, at http://www.sciencemag.org/feature/data/980465.shl;

because circumvention of a particular patent may be too easy, and because it could promote the use of secrecy as an alternative protection strategy.[60]

In the pharmaceutical industry, patents for drugs are increasing, but fewer and fewer of them are product patents. This may indicate that the speed of innovation is falling, while the use of blocking patents as a marketing strategy is on the rise. Another explanation could be that the increased use of patents is a result of minor improvements of existing products.[61]

The literature on the issues discussed here has grown vigorously in recent decades and extensive analyses in both national and international organizations is being conducted. Still, it must be recognized that no simple connections exist between stronger patent rules, greater economic development, healthy competition and increased research. This invites caution and highlights the critical balance that must be maintained between the patent system and other rules and frameworks such as competition law, advances in technology and information, and funding for research. It also points to the need to develop a more rigorous basis for instituting reforms and extensions of the patent system. This could include investigating the effects of possible reforms on both the competitive situation and on the broader social interest. Finally, it indicates a clear need for improved methods of involving other actors in decision-making processes so that the patent system is examined and discussed from the perspective of a wider group of stakeholders. At the same time, a kind of "precautionary principle" should be established. According to this principle, future reforms should take place only if they benefit technological development.

3.3. Recommendations

1) Make a targeted effort to balance the patent system by using other measures such as competition policies, price controls, information technology and funding for research.

2) Establish a "precautionary principle," to ensure that future reforms and expansions of the patent system will be implemented only if they can be shown to benefit technological development.

3) Ensure more comprehensive and exhaustive analyses of the possible national and international effects of future reforms and expansions of the patent system.

4) Conduct a rigorous analysis of the problems and options that the patent system presents to SMEs.

5) Ensure that these analyses are included in the political decision-making process by increasing contact and improving communication between analysts and politicians.

6) Promote greater transparency in the administration of the patent system and more representative hearing processes by involving other actors, including consumer groups, trade unions, environmental groups and development organizations.

[60] OECD (2004), ibid.
[61] Lars Kellberg, Novo Nordisk.

4. Protection

A key discussion concerning the design of a patent system for the future is what can be patented and what should be required to obtain a patent. In recent years, there has been debate on whether the requirements for "a patentable invention" have eroded (see Box 6).

Some researchers indicate that nearly everything that can be specified in appropriate technical terminology – and paid for by the necessary application fees – can be patented.[62] They state that the requirement of novelty is increasingly formal, that inventions must merely not be identical, and that the requirement of an inventive step is modest. As Mogens Koktvedgaard expressed it, "*the required leap in technology or the requirement that it should be surprising to an expert ... has been watered down to a tiny hop – maybe just a slight lifting of the heel – and the expert, who should be taken by surprise, has hardly a better chance on the labor market.*"[63] The same criticism is leveled against the patent system in the US.[64]

In a study of 75 Danish business executives, great skepticism was expressed in relation to developments in the field of patents, particularly that it is too easy to obtain a patent. In addition, confidence in the enforcement of rights was lower in step with increasing globalization, competition, and widespread copying. This state of affairs, combined with faster product development and a shorter product life, reduces a firm's desire to exploit patents.[65] However, such a conclusion is contradicted by the steady rise in the number of patents and by stronger enforcement, especially internationally.

Box 6: Conditions of Patentability

According to international conventions, patents are granted only for inventions which are capable of industrial application, are new, and which involve an "inventive step." It must also be possible to describe and reproduce the invention. Industrial application means that the invention must have at least one practical application. The requirement of novelty is strict and refers to an objective, global criterion. The inventive step includes a requirement that the invention must differ essentially from what has been previously known. The requirements of novelty and of an inventive step include a criterion of expertise which refers both to the expert's immediate knowledge and to his combinatory ability.

It is very difficult to measure if the inventive step requirement actually is lower. The relation between the number of patent applications and grants both in Denmark and under the European Patent Office, does not indicate that it is easier to obtain a patent. Nor is the number of oppositions against issued patents on the rise, which would signal a lower threshold for the inventive step or lower patent quality.[66] The relation between R&D costs and the number of patents also seems to be relatively unchanged. As shown in Figure 3, there seems to be no clear trend over the last 20 years. For example, it "costs" almost US$2 million for a US firm to obtain a US patent. "Patent productivity" may be on the increase in Europe, but it could also be a reflection of the increased awareness by European firms of the importance of patenting. Based on this background, it

[62] Koktvedgaard, M. (2001): Hindrer en effektiv eneretsbeskyttelse den frie konkurrence? Kapitel i "Facetter af industriel retsbeskyttelse", Udgivet af Patentagentforeningen.
[63] Koktvedgaard, M. (2001), ibid.
[64] Merrill, S.A.; Levin, R.C. and Myers, M.B. (editors) (2004): A Patent System for the 21st Century. The National Academies Press, Washington, D.C.
[65] IFO (2002), ibid.
[66] Økonomi- og Erhvervsministeriet (2004): Patenters opfindelseshøjde. Økonomi og erhvervsministerens redegørelse om patenters opfindelseshøjde.

cannot be rejected that the requirements of the inventive step have been lowered. But a more thorough analysis is needed to prove such an allegation.

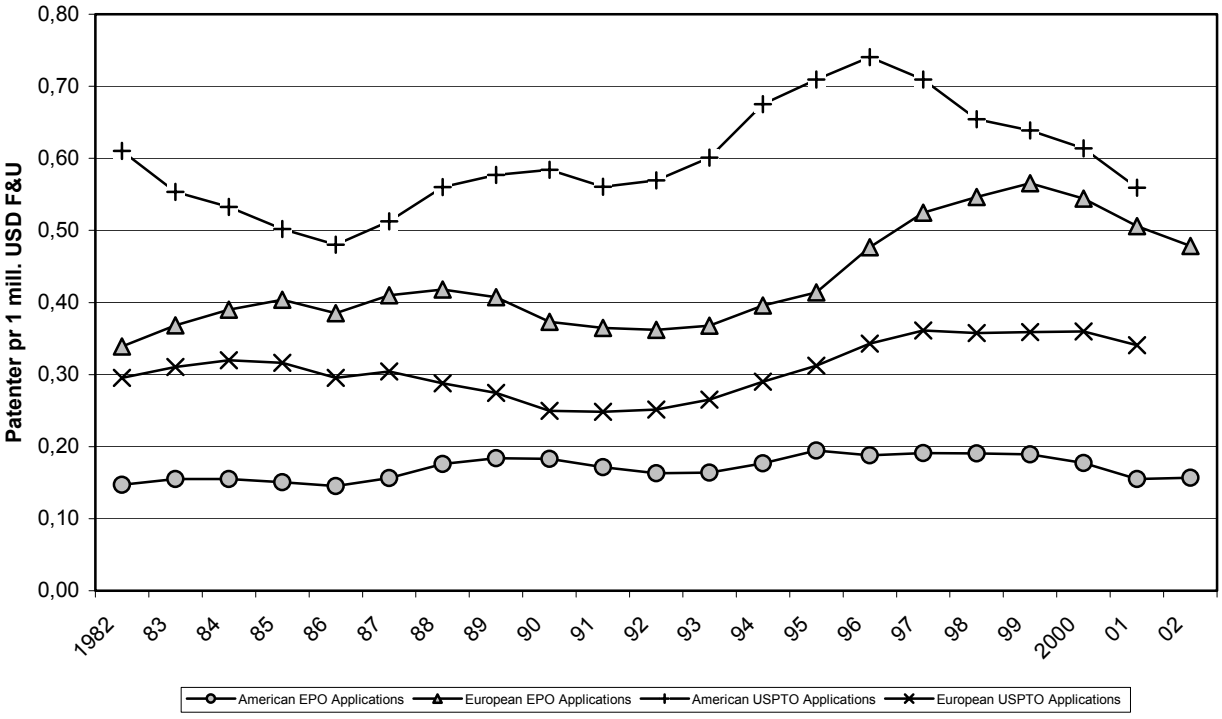

Figure 3: Patents (grants and applications) and R&D costs[67]. Source: OECD, Patent and R&D databases, March 2005

In the US, the share of grants in relation to applications is somewhat higher than in both Japan and Europe. Critics assert that the USPTO is attempting to offset funding shortfalls by increasing revenues through more patent grants.[68]

It is obvious that patent requirements fluctuate. For example, the granting of patents tends to be more lenient in the early phases of new technological development than it is once a technology has matured. This phenomenon calls for a procedure that would make it possible to reconsider patents for new technology which are issued at a time when the scope and the results of the patents are not fully understood. An alternative and perhaps better tactic could be to remedy any problems through supplementary measures such as licensing strategies (see chapter 6).

In the following pages, we will take a closer look at both genetic technology and information technology because, in these fields in particular, the number of patents has risen in recent years. This development has resulted in the strongest criticisms against the patent system.

[67] Figure 3 shows the number of patents (applied or filed) for an area (Europea/EU15 or the US) in relation to private R&D funding (GERD) from the previous year. GERD is measured in real terms for 2000 and PPP currency rates have been used. EPO patent data for 2002 and 1999-2001 USPTO patent data are OECD estimates.
[68] Økonomi- og Erhvervsministeriet (2004), ibid.

4.1. Gene Technology

Gene patents are hotly debated. Before the advent of biotechnology, it was generally unacceptable to grant patents for higher life forms. This was partly due to ethical considerations and partly due to the fact that patents for natural "discoveries" are typically stronger since alternatives are difficult to develop. Long ago, however, patents of micro-organisms and of microbiology processes and products were accepted. In 1873, for example, Louis Pasteur patented isolated yeast in France, the US, and other countries. Patents have been issued for vitamin B12 and the hormone adrenaline. Clearly, the boundary between what is and what is not patentable is difficult to define.

Gene technology has seriously changed the concept of patentable subject matter. In genetics, many so-called inventions are merely demonstrations of certain causal relations or information processes in the cell – and, as such, are discoveries.[69] As it becomes easier to map and document natural processes, problems may arise. Excessive patenting may block further utilization and invention. To avoid any detrimental effects, patent rights should be restricted and balanced with other measures. The granting of excessively broad product patents in which the patent holder obtains exclusive rights to several possible gene functions should be avoided. Such patents should be replaced by either use and/or process patents or by narrowly circumscribed product patents in which only the specific function and the intended use of the invention is patented.[70] In other words, a precise definition is needed of the scope of a patent and what it can be used for.[71]

According to the EU Directive on the Legal Protection of Biotechnological Inventions, an invention is patentable - that is, it fulfils the claims of novelty, an inventive step and industrial application - even if it pertains to a product consisting of or containing biomaterial or a method of producing, processing or utilizing biomaterial.

Box 7: Types of Patents

There are three general types of patents: product, process and use patents. The scope of protection is determined by the patent type. A product patent grants protection of the actual invention. It provides maximum protection because it prevents all conceivable potential applications of the particular invention. A process patent protects the particular process by which an invention is produced. Finally, a use patent protects a specific industrial use or application of the invention. A patent application can contain claims for two or more patent types at the same time.

Patents for biological material may be formulated as product patents, use patents and/or process patents. The Directive has been implemented in the Danish Patents Act and the European Patent Convention. However, requirements for the patentability of gene sequences are higher. The patent applicant must state specifically how a sequence or partial sequence of a gene can be industrially applied.

This heightened requirement arguably signifies that when it comes to gene product patents, the claims must be narrow and more precise. This could be decisive in defining the scope and limitation of an exclusive right. Fortunately, patent guidelines are moving along this road, also in the US.[72] A British study from 2004 demonstrates that rules and guidelines for gene patents by and large fulfill the needs of those who are active in genetic research both at private and public research institutions. Patent guidelines for gene patents have become more circumspect, and there is no indication that gene patents block R&D or

[69] Etisk Råd (2004), ibid.
[70] Sommer, T. (2004-07-19): Patentering af det humane genom. Ugeskrift for Retsvæsen, no. 25.
[71] Etisk Råd (2004), ibid.
[72] OECD (2004), ibid.

access to licensing, though some licenses are very expensive. However, the study also reveals a need for better information on both the patent law and gene patents.[73]

A number of studies highlight examples where access to licenses is difficult and product patents are overbroad. In most cases, however, these studies show that private industry and universities find workable solutions to facilitate access and reduce negative effects.[74]

4.2. Information Technology

Critics claim in other fields as well that the inventive step requirement is lower and that it is easier to patent even minor advances. This fear has been triggered by the patenting of computer-related inventions. However, it is extremely difficult to evaluate if the inventive step threshold has been lowered in any new technological field because there are no inherent precedents with which to compare. In the software arena, for example, the path of development has been different in the US and Europe.

Even though the US has allowed software patents for some time, it was not established inconclusively that software was patentable until several court decisions by the US patent court at the end of the nineties.[75] Moreover, US legal practice does not unambiguously point to a lowering of the inventive step requirement. In order to be patentable, software must meet the ordinary requirements of US patent law. Computer programs themselves cannot be patented. But if the software expresses a functionality which is new, has an inventive step and is capable of industrial application, then it can be patented irrespective of the actual software code. Because the code is not critical to patentability, it does not have to be disclosed. This practice makes it difficult to determine the basis upon which a patent has been issued. It also imposes a risk that patents in this field will become very general and overbroad so that they include technology that is very far from what was originally intended. This could have a negative impact on later generations of products.

In US law, a discrepancy exists between the relatively high requirement of novelty (non-obviousness) imposed by the courts and the low or lower requirement used by the patent authorities.[76] As a consequence, the validity of many patents already granted in this field is subject to question. If the courts maintain a high novelty requirement, but at the same time do not require software text to be specified in patent claims , the outcome may be a relatively small number of very general patents. Such patents are dubious within a branch of technology which is characterized by rapid, but minor technological changes. Broad patents are inconsistent with such technological developments which need quite precise and well-defined rights such as exist for hardware.

The fact that in the computer-related field, and in software in particular, there was already lively technological development before patenting existed demonstrates that patents incentives may not be needed to promote technological advances. R&D costs for new functionalities in software, excluding programming and trouble shooting, seem to be modest compared to other fields of technology.

[73] Intellectual Property Institute (2004): Patents for Genetic Sequences: the competitiveness of current UK Law and Practice. A study on behalf of the Department of Trade and Industries. http://www.dti.gov.uk/5397_DTi_Patent_Study.pdf
[74] OECD (2003), ibid.
[75] Burk, D.L. and Lemley, M.A (March 2005): Designing Optimal Software Patents, Stanford Law School, Public Law & Legal Theory Working Paper Series, No. 108 and University of Minnesota Law School, Legal Studies Research Paper Series, No. 05-11 (downloaded from www.ssrn.com)
[76] Burk, D.L. and Lemley, M.A (March 2005, ibid.

Disclosure is another problem in US legal practice. If software code is not considered relevant to a patent, there is no requirement of publication. This may cause problems for other actors who wish to "reproduce" an invention. In other technological fields, specifications must enable production of the invention. No such requirement seems to exist for software in US patent law which inflicts reproduction costs on other actors.

While an invention in the US must be new and useful, it must be proven sufficiently technical in nature in Europe. This difference has been discussed particularly in connection with the proposed EU software patent directive. One question is whether it is or should be possible to patent business methods such as the mail order firm Amazon's "one-click," which is patented in the US but not in the EU.[77] This focus on "sufficiently technical in nature" in the European patent system may impede the diffusion of the patent system to other areas. Hence, accounting software or financial software for currency transactions, which may be of substantial financial value but which do not make any "technical contribution," would not be patentable in Europe whereas they would be in the US and Japan.[78] The precise meaning of "sufficiently technical in nature" is uncertain. There is hardly any doubt that in practice the requirement helps to limit the patent right, including in areas such as business methods, and that, without this requirement, an unlimited expansion of patents would occur.

Box 8: Technical in Nature

One of the most heated areas of debate is the requirement of the European Patent Convention that patenting is not possible for computer programs "as such." There is no doubt that an apparatus containing software is patentable. In evaluating whether such a unit can be patented, it is possible to include information about how the computer uses its software. Such product claims do not give rise to any patent problems. A physical product is always technical and can be patented if it meets the requirement of an inventive step. The controversial issue is whether the prohibition against patenting computer programs as such makes it impossible to patent computer software that is separated from a computer. According to EPO practice, patents are possible if the computer program has the potential to produce a "further" technical effect beyond the fact that the software may be stored on a disk or can be run on a computer. The fact that the computer "starts" when a disk is fed into it is not enough to patent the software on the disk. Something more is needed, and this should be of a technical nature – that is, it should involve something physical, such as more efficient storage of files on the hard disk or the amplification of a signal. If the software produces something considered not technical in nature, such as the calculation of an interest rate or the display of pictures (a computer game), it cannot be patented.

There is concern that software in particular increases the risk of technological lock-in effects which are detrimental to market competition. A possible solution is "open standards" for the exchange of data between software. Open standards sharpen competition and facilitate the access needed to introduce new software solutions. Today, the existence of many secret filing formats and exchange standards make it difficult for start-ups to penetrate the market. If users cannot use their old files, their incentive to switch to new software packages drops.

Some observers believe that common and open standards will automatically develop over the next few years. Others believe that common standards will not emerge by themselves, which is why they argue that open and common standards should be required in the patent system or at least that patents should not block interoperability.

[77] The fate of an invention from a patent law perspective in Europe is at present rather uncertain. When the Amazon patent application was filed at the EPO, it was divided into two parts. One part has been patented, whereas the other is still being reviewed.

[78] EU-kommissionen (1997): Patentering som innovationsfremme. Opfølgning på grønbogen om EF-patentet og det europæiske patentsystem.

There are, however, different perceptions of what an open standard is.[79] From a societal point of view, it is desirable that technological standards be developed, including standards determined by the market (de facto standards) and standards determined by the law (de jure). This puts demands on patent law, or on competition law, regarding the patent holder's opportunity to prevent the development of standards which include patented technology or the possibility of taking out patents for the improvement of standards. One requirement before adopting a compatibility standard could be that owners of patents (or copyrights) that are necessary for the design of the standard either renounce their right to prevent others from using the patent and charge a fee or at least declare that they want only fair, reasonable and non-discriminatory royalties.

Another problem for software has been the overlap between patents and copyrights. A patent protects computer-implemented inventions and thus targets the functionality of the software. A copyright protects software code. Copyrights do not have to be registered and can protect potentially all software.

In practice, copyright offers the most important type of protection available in this field. It secures the specific design of the code and can be employed to prevent copying by others, including "translation" from source to object code or vice versa ("(de)compilation"). The combination of copyrights and patents may impede the production of compatible products/software.[80] An attempt has been made to solve this problem in Danish EU-harmonized copyright law through a special rule which aims to advance the development of compatible products including software.[81]

Ensuring product compatibility requires knowledge of the interfaces of existing software. When the interface is not disclosed by the owner or cannot be discovered in any other way, the software must be decompiled. Such an act entails, however, the production of a copy which falls within the scope of copyright and can be illegal. The decompilation of software interfaces is legal in the EU under copyright law if it is necessary to produce compatible hardware or software. This limitation is intended to prevent monopolies of accessories and software on the market.

Box 9: Copyright and Software

Software is protected by copyright law if it is "original," which means it is the author's own intellectual creation. Copyright protection of the function of a software program or, for example a method, is not possible. The general structure of software or its programming principles ("mathematical algorithms") also falls outside the scope of copyright.

Patent law does not contain any specific rule on de-compilation to promote compatibility. The development of compatible products or software can involve commercial exploitation of a patent, say, through de-compilation, which is not covered by an exemption in patent law such as experimental use. In such cases, a patent can be used to prevent the development of compatible products.[82] The proposed directive on computer-implemented inventions (see discussion below) does not contemplate special patent rules on interoperability. It is noted in the proposal that a patent of an invention which is contained in software does not obstruct copyright law if that software is copyright protected. Thus, decompilation is allowed. It could also be possible to rely on a compulsory license or on

[79] Could, for example, a file format be regarded as an open standard if it is well-documented and can be used by all, or does it have to fulfil the requirement that an open standard must not contain patents, such as was the case with the popular graphics format GIF?
[80] OECD (2004), ibid.
[81] The legal position is different in the US. See Graham, S. and Somaya, D. (2003): The Use of Patents, Copyrights and Trademarks in Software: Evidence from Litigation. In Patents Innovation and Economic Performance, proceedings of the OECD conference on IPR, Innovation and Economic Performance, 28-29 August 2003, OECD.
[82] Burk, D.L. and Lemley, M.A (March 2005) ibid., p. 94f.

competition law to provide access. In light of the importance of producing interoperable products, a more proactive provision is desirable in this area.

Copyright law is generally interesting and should be taken into account. However, decompilation of software is very costly and difficult. Rules that permit decompilation should not prevent the use of other legal measures such as those mentioned above. For example, it also can be an infringement of competition law ("abuse") if a dominant firm neglects to provide information on interfaces needed to develop compatible products.

To promote openness and the development of compatible products, patent rules that demand publication of the source code should be considered. [83] However, such a practice is relevant only in cases where the patent is based on a specific source code. This is often far from the case. Many software patents can be implemented by means of several different software texts. A requirement to publish the source code would therefore not remedy the problem, and any rules to this effect should be combined with other measures.

At present, the EU is considering a draft directive on patents for computer-implemented inventions. One of the most important objectives of the proposed directive is harmonization. Today, Member States operate under different rules according to which patent authorities issue software patents. On the basis of the existing law, the EPO has issued more than 20,000 patents on software-related inventions.

The proposed directive is fueling much debate. Critics warn against a recreation of "the US situation," which forwards a liberal patent model, and predict that the directive may hamper innovation by SMEs, as well as cause problems for Open Source developers. As pointed out above, it is unclear what "the US situation" is. Obviously, many patents are being issued, but legal practice may reveal an entirely different situation. Many SMEs regard patents for software as a threat. But it is unclear if the option to patent favors the development potential of large or small enterprises. There is no doubt that a multitude of patents is very costly to both large, and certainly small, enterprises which must acquire the necessary rights. This problem is discussed in section 7.2.

Finally, critics state that the Open Source model may be threatened by patents. However, it should be noted that Open Source is built upon the clearly defined rights of copyright and that no inherent conflict of interest exists between patents and Open Source. If patents are made available under the same conditions as copyrights, they also can be included in Open Source.

Proponents argue that software patents are critical to the EU's global competitiveness. This assertion builds upon an assumption that European firms will benefit from having the same regulation of their domestic markets as US firms do. Many regulatory processes, such as drug approval or marketing rules, are different in Europe than in the US. Therefore, it is not a general problem that patent legislation also differs in the two regions. A firm such as Microsoft might have to get used to the idea that certain products can be protected by patents in the US but not in Europe. But because the conditions are the same for competitors, neither Microsoft nor its competitors are favored. It is also evident that a global patent would reduce costs, and that the firms of one region will not be favored.

The fundamental question in the debate on the EU software directive is whether or not software is new and essentially different from other traditional technologies. If it becomes apparent that patents do not promote technological advances in this field, then the question should arise of whether software should

[83] Teknologirådet (2002): Patenter på Software. Executive summary og redigeret udskrift af seminar i Folketinget d. 20. februar 2002. Teknologirådets rapporter 2002/6. OECD (2003), ibid.

be patentable at all. Currently, the debate focuses on the implementation of the general European patent rules under which patents are available only for inventions which are sufficiently technical in nature (see the discussion above). The key question is how to define what is "sufficiently technical in nature" for software. This is a question of vital importance to a determination of the nature of the rights that will regulate competition and future technological advances in this field.

4.3. Public Research Patents

Public research institutions have increased their use of patents markedly over the last years. A university's mission is to produce knowledge and make it available to society. Patents may be a good tool in this respect, but they should be used cautiously. University research results are normally disseminated through publishing and teaching. Publishing in journals is usually the most effective way of communicating research findings because it ensures rapid and quality-controlled distribution. Universities typically do not receive income from publishing. Since published findings cannot be patented, others cannot obtain an exclusive right and appropriate revenue from the research results either. In most situations, it is assumed that these simple mechanisms satisfy the overall objective of university research which is to ensure the greatest possible utilization.

In specific instances, however, patenting enhances the diffusion of university research findings. There may be situations where the exploitation of research results requires massive investment in follow-up activities which may include developing production technology or securing government approval. If the outcomes of these follow-up investments can be protected by exclusive rights, an incentive is created to apply the research findings. But if they cannot be protected, there is no incentive to employ the results. In such cases, patenting the findings may remedy the problem. The litmus test for patenting should be whether the research findings can be used in practice without patent protection. If this is the case, the mission of university research is immediately fulfilled. If not, a patent should be sought to protect the findings if it will ensure their exploitation through follow-up investments necessary to market the product.

In specific cases, public research patents may increase the probability of findings being exploited for the benefit of society. But because a patented research result represents financial value to both the researcher and the university, observers are concerned that patents will influence the direction of public research and limit access. This could decrease the amount of freely accessible knowledge and increase the patenting of basic science which may hamper further innovation and development. This phenomenon is called "privatizing the commons."[84]

Patents do not necessarily create problems of this nature. In practice, it is the license terms that are crucial. Concern is expressed over the fact that universities, especially in the US, give exclusive licenses to private firms. This has contributed to the control by private enterprises of three-fourths of new biotech inventions in agriculture. If unlimited and free access is given to the exploitation of a particular patent, restrictions of this kind will cease to exist. The disadvantage of such "simple" licenses is that firms may not be interested in entering into agreements if they cannot obtain exclusive rights to the exploitation of a patent. There is a risk, then, that requiring non-exclusive agreements will block the development of important technology. A suitable balance needs to be found that safeguards the commercial interests of the firm and the interests of the research institution to ensure exploitation of the technology via a patent.

[84] This issue is the subject of a large number of empirical studies, but as of yet no fixed conclusions have been put forward. For a general introduction to the subject, see Richard R. Nelson (2004): The market economy, and the scientific commons, *Research Policy*, 33, pp. 455-471.

While it is difficult to blame a private firm for seeking the greatest possible profit from a patent, the attainment of such profit should not be decisive for patents which derive from publicly-funded research. For this type of research, the objective is to ensure the most rapid and extensive dissemination and application of the results. It must, therefore, be decided on a case-by-case basis if an exclusive license is better suited to facilitating this dissemination than a non-exclusive license. As a starting point, it must be accepted that the greatest diffusion of research is achieved if firms are willing to utilize a patent on non-exclusive terms. In cases where exclusive agreements are used, the institution should attempt to ensure that the agreement allows for certain forms of application with a view to non-commercial exploitation of the invention patented, including utilization in university research and teaching.

Developments in the US are ahead of Europe in several areas. While the issue of university research patents remains unresolved in Europe, in the US the Bayh-Dole law has provided clear guidelines since 1980. Previously in the US, public sources of financing such as research councils, had the right to patent – but they rarely exploited it. The Bayh-Dole law permits and encourages universities to take out patents, even when they are publicly funded. Income from licenses has climbed through the years, but reached a stable level of just over one billion dollars after 1999 (see Figure 4). This amount corresponds to three percent of externally funded research at universities and hospitals in the US.[85] Of course, a question arises of whether license incomes of that size divert university research away from unprofitable areas towards research for private business.

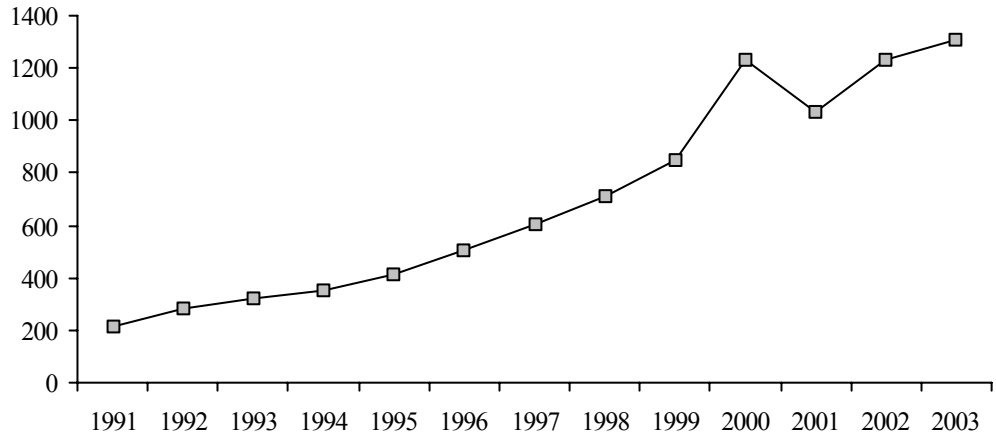

Figure 4: License income (US$ millions) in US universities, hospitals and research institutions. Source: AUTM Licensing Survey: FY 2003, the Association of University Technology Managers, 2004

Similar to the US, many European universities are establishing so-called "tech-trans" offices. It seems to be the rule rather than the exception that technology transfer activities are money-losers.[86] In reality, the measure of success should be the greatest possible diffusion of research findings, patent or no patent, not increased financial income for the research institution. Towards this end, there should be no requirement that these activities be financed by income from the sale of patents or licenses. The challenge is that universities inevitably may view technology transfer activities as either potentially income-generating

[85] *AUTM Licensing Survey: FY* 2003, The Association of University Technology Managers, 2004
[86] See for example "Evaluering af forskerpatentloven" udarbejdet for Videnskabsministeriet, maj 2004. (may be downloaded from www.videnskabsministeriet.dk)

or at least self-sustaining. If such logic is forwarded, the risk will increase that the "creative commons," - the foundation of knowledge upon which so many advances in technology rest - will be privatized and sold according to market conditions, and therefore will not be optimally exploited.[87]

It seems obvious that to enable optimal conditions for university research, patented material and other products should be made available on more lenient terms than that offered to other users such as private firms. Public research institutions are frequently permitted to use specific substances free of charge provided that the rights to the research results accrue to the owner of the substances used. Of course, this reduces incentives to conduct research with direct commercial applicability. But if public research institutions view their objective as developing marketable research results, they cannot reasonably demand lenient access to patented products.

Many public research institutions develop their own basic methods and tools which, if patented, could thwart use by other researchers. To allay any apprehension, several public research institutions in the US, among them the National Institutes of Health, make a conscious effort to refrain from patenting their research tools.[88] This practice is currently being emulated in other countries – though in Europe public research institutions lag behind in implementation.[89]

Supporters argue that public research patents and the income anticipated from them may draw university research into areas of greater immediate relevance to society. They state that the possibility of making a profit will drag research into areas and activities with more applications. However, this point of view overlooks the possibility that such an objective may not be appropriate. The role of universities is precisely to fill the "hole" in knowledge production by conducting research which is not profitable for private funders. If one wishes to steer research in a specific direction, then there exists far more direct and precise management tools to achieve this goal, including redirecting research funding.

4.4. Recommendations

1) Replace overly broad product patents for gene sequences by use and/or process patents or by product patents in which the scope is narrowed to only the core function of an invention.

2) Institute clearer criteria to evaluate whether the inventive step has been met – particularly for software patents.

3) Enact a requirement that software patents cannot block efforts to ensure interoperability with other software.

4) Establish licensing guidelines for patents developed by public research institutions so that they protect the public interest and guarantee access by public researchers.

5) Facilitate strong public research efforts to strengthen technological advancement in areas where the incentive for privately-financed research and development is missing even with the prospect of patenting.

[87] Because knowledge is not devalued by being used, society has no economic interest in restricting access. On the contrary, it is precisely this quality that warrants free access.
[88] OECD (2004), ibid.
[89] OECD (2002), ibid.

6) Work towards a more effective dissemination of publicly-financed technology and knowledge by only acquiring a patent when the largest possible diffusion will be ensured, but refraining from acquiring a patent when widespread diffusion will not be achieved.

5. Protection Terms

Another critical feature of the patent system is the term of protection which is 20 years after the time of application for all products. A patent may expire, however, if fees are not paid or if the patent is revoked due to an administrative examination based on new material. On average, a Danish patent remains valid for eight years - but this figure encompasses wide variation. For example, gene technology and drug patents are maintained for longer periods, while patents in the fields of space travel and electronics are maintained for a shorter time.[91]

New trends in innovation and patenting highlight the need to develop a patent system with varying terms of protection. Several studies show that the need for protection, and the requisite length of protection, varies considerably for different products.[92] Differences in costs, market conditions and the availability of other forms of protection put into question the use of a uniform approach. For example, should software and drugs patents have the same protection term given their very different technological and financial conditions?

Some experts suggest that shorter protection periods should be introduced in some areas. In others, particularly drugs, longer periods are proposed. To lengthen protection, one idea is to start the protection term from the day permission to market the product becomes effective. However, this can reduce incentives to move rapidly from idea to finished product. Instead, supplementary protection certificates have been introduced (see Box 11). This option is being increasingly utilized. On the other hand, it can be argued that effective protection is decreasing due to the continuously rising demands for testing and approval.

Box 10: The Fee System: Basic Fees and Annual Fees

The application fee is a basic fee in which the amount varies and depends on the number of patent claims and on whether the patent application is national, European (EPC) or international (PCT). Once a patent is granted, payment of an annual fee is required (see table below).[90]

1st year	DKK 500
2nd year	500
3rd year	500
4th year	1.100
5th year	1.250
6th year	1.400
7th year	1.600
8th year	1.800
9th year	2.050
10th year	2.300
11th year	2.550
12th year	2.800
13th year	3.050
14th year	3.300
15th year	3.600
16th year	3.900
17th year	4.200
18th year	4.500
19th year	4.800
20th year	5.100

(100 DKK ~ 13,4 EUR)

[90] Source: http://www.dkpto.dk/priser/alm_prisliste/prisliste_patent.htm
[91] Økonomi- og Erhvervsministeriet(2004), ibid.
[92] Mansfield (1986), ibid.; Levin et al. (1987), ibid.

Danish firms are among those who demand a more flexible system featuring patents with different scopes and protection periods depending on the cost, development period and product lifecycle.[93]

An argument against varying the terms of protection is that firms already pay to safeguard the continuing validity of their patents. In other words, the firm chooses its protection term. The fees to keep a patent in force rise through the protection period, and the patent is allowed to lapse once its value falls below a certain level. This flexibility could be strengthened through new fee strategies. Fee schedules could also be expanded to include a patent's scope.[94]

Box 11: Supplementary Protection Certificates for Drugs (SPC)

The principle behind this certificate is to extend the length of protection of a patent that is about to expire. The purpose is to remedy the often long period that lapses from the time of filing of a patent application, when the term of protection starts, to the time the drug is authorized for use on the market. A specific calculation model is employed to ensure that the certificate does not extend the life of the patent beyond what is normally permitted. By applying for this certificate, the patent owner can obtain effective protection for 15 years, which corresponds to the ordinary effective term of a patent for other products.

Differentiation of the term and/or the scope of protection could create a number of problems. For example, in the software industry there is increasing interaction between software and hardware, including between the software and the technical inventions that support it. This fusion means that different patent rules could be misguided and create unintended effects.[95]

5.1. Recommendations

1) Analyze the costs and benefits of a patent system that features a more differentiated approach to protection terms.

2) Develop new strategies for the use of patent fees so that they depend not only on the term of the patent, but also on its scope.

[93] IFO (2002), ibid.
[94] OECD (2003), ibid.
[95] OECD (2003), ibid.

6. Protection Limitations

As is clear from the discussion above, both the term and type of patent protection depends on factors such as demand, spill-over effect, development costs, copying costs, effects on market structure and competition.[96] Therefore, an ideal policy for intellectual property rights would be to offer protection which varies in duration and scope for different products.

But such a system would be hard to institute and perfect because it is difficult, in advance, to calculate the market and societal value of an invention. It is equally challenging to establish exact guidelines for the management of such a system. Thus, it can be argued that uniform and global patent rules are the only practical solution.

Yet another approach could be to balance the patent system with various protection limitations.

6.1. Compulsory Licenses

One option is to use compulsory licenses (see Box 12) in cases of abuse of dominant position if a patent is not being commercially exploited, or in situations of important public interest such as with sudden epidemics. Most countries have compulsory license systems – but these systems do not play a critical role because they are too complicated and time-consuming. However, compulsory licenses do provide an incentive for the use of voluntary license agreements.[98]

Box 12: Compulsory Licenses

Patent law contains rules on compulsory licenses in cases of non-exploitation of a patent and when important public interests so require. The rules are based on the Paris Convention and on TRIPS. The law empowers the courts to decide if a compulsory license should be issued and what its terms should be. Until now, compulsory license rules have not played an important role in Danish patent law. In Denmark, cases start at the Maritime and Commercial Court and may be appealed to the Supreme Court. The courts have limited experience on whether to apply competition rules to patent rights and how to apply them. This means that there is much legal uncertainty. There are only a few examples when the compulsory license system has been used in Denmark. Particularly in the field of software, the system is too slow in comparison with the pace of technological development.[97]

The compulsory license system could be made more flexible and operational. This has been mentioned as a possibility for gene patents. In addition, the requirements for compulsory licenses could be expanded. In Norway, for example, a compulsory license can be issued if "patent rights are exploited in such a way as to limit competition substantially." Competition authorities are empowered to apply these rules. Implementation of such a requirement elsewhere could prevent the exploitation of a dominant market position which can be used to prevent others from developing new treatments.[99]

[96] Maskus, K.E. (2000): Intellectual property rights in the Global Economy. Washington: Institute for International Economics.
[97] Source: Etisk Råd (2004), ibid.
[98] Koktvedgaard, M. and Schovsbo, J. (2005), ibid.
[99] Etisk Råd (2004, ibid.

On the other hand, it may be unwise to try to prevent the abuse of the patent system through compulsory licenses because it requires authorities to determine which market conditions are reasonable. If there are any problems with, for example, abuse of a dominant position or unreasonable restrictions on access to licenses, it should not be a case for the competition authorities but rather for the patent system. There is a need for more information here.

6.2. Licensing Guidelines and Efficient Access to Licenses

In technology areas where there exist many interrelated ("petty") patents which in themselves cannot be commercially exploited, mechanisms may be needed to facilitate access to patent rights belonging to others. In a world with much "rights-protected" knowledge, the administrative burdens of acquiring rights to produce and market new products may be so heavy that technological advancement is impeded.

This situation already exists in many areas, including in the information technology and biotechnology fields. Private solutions based on licensing models are being used to solve the problem. One simple solution is cross-licenses in which firms exchange license rights which often include agreements on future patents. Cross-licenses are frequently used in the electronics field. They are advantageous because firms can avoid negotiating fees for every single license. However, startups find it difficult to attract existing firms as partners who wish to enter into such agreements. Therefore, cross-licenses are primarily an option for firms which already have a substantial patent portfolio. Another disadvantage is that cross-licenses may have a negative effect on innovation and competition through the exclusion of startups which enjoy no rights of access in such arrangements.

Box 13: Patent Pools

A patent pool is an agreement between patent owners to place their patents in a joint pool. The parties of the consortium will then have the right to exploit these patents without the usual license requirements. Such an arrangement reduces negotiation costs considerably and is assumed to promote technological advancement. However, patent pools may also lead to cartels, thus blocking access for startups in a specific technology field. When a patent pools triggers competition concerns, the EU Commission has stated its intention to base assessments on the following main principles: (a) the stronger the market position of the pool, the greater the risk of competition-limiting effects; (b) pools that have a strong position on the market should be open and non-discriminatory; and (c) pools must not unreasonably keep the technologies of a third party outside the market or limit the formation of alternative pools.[100]

A natural extension of cross-licenses is patent pools, in which more than two firms enter into an agreement on access to a number of patents often with the possibility of including future patents. Patent pools are a useful mechanism to calculate the costs of rights linked to certain standards ("one-stop shopping").[101] As mentioned in Box 13, they offer potential benefits for technological development, but they also can restrict competition. While such private solutions are expedient, they are costly to set up and are frequently inaccessible to startups. An effort is needed to facilitate a more efficient trading of patent rights which allows everyone to participate.

[100] See guidelines for group exemption schemes on technology transfer agreements (772/2004), item 224 and item 210-235. See Andreas Christensen et al "Konkurrenceretten i EU", 2.udgv., 2005 and the report "on Multiparty Licensing" of 22 April 2003 prepared by Charles River Associates Ltd. to be considered by the Commission.

[101] AT&T Corp., Coding Technologies, Dolby Laboratories, Fraunhofer IIS, NEC Corporation, Philips Electronics and Sony Corporation have contributed patents to a patent pool on which the new MPEG-4 standard is based, see www.vialicensing.com.

In the area of copyright, a similar problem was solved through administrative schemes based either on agreements between authors on the formation of administrative organizations or on various regulatory schemes based on compulsory licenses and/or extended collective licenses. This has "mechanized" the trade in rights in important fields such as public performance of music or photocopying of textbooks. It is critical in fields such as music where there are a large number of right owners. If a radio station has to negotiate licenses with the composer, artist and record company who helped to create a single piece of music, the administrative burden would be far too heavy. Irrespective of whether a copyright in a technical-legal sense is an exclusive right or a right of remuneration, it functions as a remuneration right in these instances. This is because the right owner cannot prevent others from obtaining a license and the level of payment is fixed in advance.

Even though patent rights differ far more in value, and therefore a price structure may be more difficult to establish, it is worth promoting "royalty schemes" as a supplement to traditional licenses based on exclusive rights. As is shown in Box 14, certain countries already offer the possibility of voluntarily allowing a patent to be included in an administrative license. It is important to consider the introduction of such schemes and whether they should be combined with other measures such as the formation of administrative bodies. A well-functioning system based on the payment of remuneration rights could lead to a more efficient exploitation of patented knowledge and encourage small enterprises in particular to acquire patents.

Box 14: Licenses of Right

This is a mechanism by which a patent owner can grant automatic access to the use of a patent in return for payment of a license fee. The patent owner must expressly state that his patent can be licensed in this manner. In Great Britain, where a license of right has long been in existence, the patent fee is reduced if the owner declares his intention of making the patent available. The parties then proceed to negotiate the terms of exploitation of the patent. If an agreement cannot be reached, the appropriate public authorities determine its use. The EC draft patent regulation contains a similar option.

6.3. Experimental Use

It is important to clarify and strengthen the experimental use exception for patents (see Box 15). The exception permits research to be conducted based on existing patents so long as there is no commercial exploitation. This is particularly important in areas where patents may directly thwart research, such as within the area of diagnostic testing. The administration of this exemption differs across countries in Europe, and the trend is towards a more restrictive interpretation of experimental use.[102]

In the US, unlike in Europe, there is no specific concept of experimental use. In fact, the US Court of Appeals for the Federal Circuit said that an exception should be applied only if the research is "for entertainment, satisfaction of curiosity or purely philosophical studies." In practice, however, the exception is administrated more leniently simply because researchers disregard patents, firms refrain from suing universities because universities do not patent their research tools, or because flexible licenses are negotiated.[103] However, the tacit agreement that university research will not be challenged in court was undermined by the US appeals court which held that universities are responsible for infringement.[104]

[102] OECD (2003), ibid.
[103] Walsh *et al.* (2003), ibid.
[104] Merrill et al. (2004), ibid.

The problem is not nearly as pronounced in Europe. In order to avoid future problems, a more lucid definition of experimental use is needed, especially for research tools. The scope of the ban on diagnostic methods patents in the EPC should also be clarified.

Box 15: Experimental use

The exclusive right does not extend to acts conducted for experimental purposes which relate to the patented subject-matter of the invention.
In other words, testing the use and potential of an invention is permitted even for commercial purposes. An example of a possible experimental, use is clinical tests of patented drugs. The exclusive right also exempts activities that are conducted for non-commercial purposes. This includes not only private activities but also production based on scientific research and teaching. The exemption does not apply to patented products such as research tools that are used for experimental purposes.

Lastly, the possible negative effects of patents on public research could be offset by various protection restrictions and requirements and by the development of new tools to facilitate the diffusion of ideas and technology among universities. For example, a transition period could be introduced for public researchers so that acquiring a patent before the publication of research results would be unnecessary. Another idea is that temporary patents could be granted for university inventions so that access to new research could be facilitated. Research institutions often include provisions in their licenses to protect public interests and to guarantee access by researchers for the use of inventions and the exploitation of patents.[105] These requirements should be supported. Another rule could be that licenses are automatically granted for basic scientific research.

6.4. Other Protection Limitations

In the drug industry, many European countries institute price controls to promote greater access to drugs. In Denmark, a reimbursement system is increasingly used to counteract high prices. These practices demonstrate that the patent system cannot stand alone. A reimbursement system could be extended to include diagnostic tests so that it can be determined whether a new patented product is of sufficient social benefit to be entitled to reimbursement. This requires a thorough technology evaluation.[106]

Limitations motivated by ethical or moral considerations are also being instituted. In the European Directive on the Legal Protection of Biotechnological Inventions,[107] unpatentable inventions include those in which commercial exploitation is contrary to the "ordre public" or to morality. Critics argue that such evaluations should not be left to the patent authorities, and that independent bodies should be established to make these ethical and legal judgments. This is already the case in Norway where the patent authorities must consult with an ethical council.[108]

In general, ethical or moral exemptions are difficult to manage, can result in attempts at circumvention, and involve complicated administration. It should be remembered that the patent system does not grant the right to use but only the right to prevent use by others. Another strategy is, therefore, to grant patents for inventions which some believe are immoral or unethical. It could then be left to other authorities to assess whether the invention should be exploited in practice.

[105] OECD (2004), ibid.
[106] Etisk Råd (2004), ibid.
[107] EU (1998): Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the legal protection of biotechnological inventions. Official Journal of the European Communities, L 213/13, 30.7.98. http://europa.eu.int/eur-lex/pri/en/oj/dat/1998/l_213/l_21319980730en00130021.pdf
[108] Etisk Råd (2004), ibid.

Ethical and moral questions could be better handled through the regulation of experiments, including their application and marketing. Patenting of an invention such as the Onco mouse could be permitted, for example. But experiments, and/or production of the mouse could be prohibited through other laws based on ethical grounds. The inventions would then be known to the public and government authorities and their utilization would be easier to prevent. All things considered, it is inappropriate for patent authorities to decide matters of an ethical and moral nature.

A particular concern is cases where the financial benefits offered by the patent system are insufficient to encourage production. This problem is particularly acute for drugs. Instead of extending patent protection to so-called orphan drugs, the law offers firms exclusive marketing rights in the EU for ten years and support to obtain licenses and approvals.[109] A disease is considered rare when there are less than five cases per 10.000 people. This kind of differentiated approach is far more expedient than a general amendment to the patent legislation.

6.5. Recommendations

1) Develop an efficient remuneration-based patent system to supplement the system based on exclusive rights.

2) Determine how to make the compulsory license system more flexible and operational including how to strengthen the use of competition law and compulsory licenses to offset abuse of dominant position and other effects detrimental to the common good.

3) Create incentives to secure free public access to patents of a cross-sectoral importance.

4) Support the development of public databases to facilitate access for new actors, particularly SMEs.

5) Support and develop Open Source strategies in both information technology and biotechnology through public information technology procurement.

6) Facilitate access to defensive publication (publication used to block patenting by others) through public databases and registration options with patent authorities.

7) Clarify and strengthen the experimental use exception so researchers may conduct unhampered research based on existing patents, as long as there is no commercial exploitation.

8) Abolish the exceptions for “ordre public” and morality and instead consider ethical and moral issues in approvals to produce and sell.

9) Support the patent system by providing additional rights and funding in cases where incentives are insufficient to ensure production, such as with orphan drugs.

[109] See Orphan Europe, http://www.orphan-europe.com/

7. The Protection System

Criticism is raised against the administration of the patent system because too many ineligible or poor-quality patents are being issued. It is further argued that the patent authorities' work quality is poor and that the granting process is overly time-consuming. These complaints are particularly valid in new fields such as biotechnology and information technology.[110] They impair legal protection for both patent applicants and third parties. For example, many patents are mistakenly granted. This would not occur if the necessary resources and expertise were available to ensure a thorough evaluation according to patentability standards.[111]

If such assertions are correct, then it is more important to enhance the work quality of patent authorities than to modify patent legislation. More effective administration can be introduced by allocating additional resources, publishing patent applications,[112] establishing standardized evaluation procedures, instituting lateral investigations of patent practice by various case administrators and authorities, and developing international databases and procedures for the mutual recognition of evaluation results.[113] US studies indicate that the cost of improved patent administration is balanced by fewer lawsuits.[114]

There are huge differences between the administration of patents in the US and Europe. US firms like to file patent applications in Europe, perhaps because they hope that patent offices are slightly more lenient and/or faster and more efficient or that they grant more secure patents. The European patent system is also more predictable and – maybe surprisingly – more homogenous because European coordination has forced a number of standardized procedures rather than more subjective case-by-case evaluation. In Europe, the possibility of opposing a patent and the possibility of administrative examination contributes to a more uniform quality and to better legal protection.[115] At the same time, it reduces costs by allowing invalid patents to be cancelled administratively, whereas in the US one must go through the court system.

Box 16: Opposition and Re-examination

Opposition can be raised against European and Danish patents. The time limit for an opposition is nine months from the publication of the patent. Adverse decisions can be appealed within two months. European patents with legal effect in Denmark can also be re-examined administratively. After the time limit for oppositions has expired, any interested party can request an administrative re-examination. The Danish Patent and Trademark Office can either declare the patent invalid or uphold the patent, possibly in a more restricted form. These administrative mechanisms are not yet part of the US patent system.

Denmark has gone so far as to allow anyone to initiate opposition procedures against new patents, irrespective of their third party interests. This broad right of opposition is important to preserve in any future international harmonization.

[110] Merrill *et al* (2004), ibid.
[111] Kellberg, L. (2003): Kommentarer til projectbeskrivelse ang. "Patentsystemets fremtid." Memo. Novo Nordisk.
[112] The Economist (2004): Monopolies of the mind. p. 14.
[113] OECD (2004), ibid; Merrill *et al.* (2004), ibid.
[114] King, J.L. (2003): Patent Examination Procedures and Patent Quality. In: Patents in the Knowledge-based Economy, the National Academies Press, Washington, DC.
[115] Lars Kellberg, Novo Nordisk.

In the US, individual case officers play a larger role in decisions. Analyses demonstrate that this results in differences in the administrative handling of patents.[116] A report by the US Federal Trade Commission from October 2003 proposes a number of recommendations, including the introduction of administrative examination which would bring US practice closer to that in Denmark and the EU.[117]

7.1. Costs

The costs of acquiring and maintaining a patent can be divided into the costs of drafting and filing a patent application, the payment of basic application fees to the patent authorities, the payment of renewal fees and the costs of enforcement.

Commentators assert that the cost of obtaining a patent is too high. The EPO is trying to reduce costs and fees, but the consequences are mixed. In Europe, lower patent costs result primarily in the acquisition of more patents for marginal inventions by large firms, rather than for basic inventions by SMEs. One explanation is that the primary expense rests in the work to be completed by the firms themselves and not in the administrative handling of the application.

Indeed, a study of Danish SMEs demonstrates that patent fees are not the problem. More than half of the enterprises believe that it is reasonable or inexpensive to take out a patent. Eighty percent of the enterprises reject the idea that lower patent fees will lead to more research. The pivotal costs are patent agents, translators and lawyers, not patent fees.[118] Patent fees may be more of an issue for larger firms because they obtain more patents as compared to smaller firms which take out fewer, but more elemental patents.[119]

It should be emphasized, however, that the purpose of fees is to counterbalance excessive patenting and to contribute to a balancing of social interests against the interests of the inventor. It is therefore not clear that it would be good for society to reduce patent fees. However, work should be done to minimize unforeseen costs, such as for translations and for patent agents. In Europe, language problems often make patents unreasonably expensive. Work should be carried out to reduce costs where it is possible, such as, by abolishing translation requirements and/or introducing a Community Patent.

7.2. Enforcement

An even greater problem is high enforcement costs. Many firms lack the capacity to undergo this expensive and time-consuming process. In the US, enforcement may be particularly lengthy and costly. In Denmark, the process is easier due to the injunction system and the utility model system (see Box 17). However, a survey of innovative Danish firms reveals that 37 percent believe enforcement difficulties are a barrier to knowledge protection.[120]

Small enterprises may have a worse time enforcing their patents than larger ones. This underlines the importance of competition law.[121] In a survey of Danish SMEs, many agreed that the introduction of

[116] Cockburn, I.M. and Kortum, S. (2003): Are All Patent Examiners Equal? Examiners, Patent Characteristics and Litigation Outcomes. In: Patents in the Knowledge-based Economy, the National Academies Press, Washington, DC.
[117] Federal Trade Commission (2003), ibid.
[118] Patent- og Varemærkestyrelsen (2000), ibid.
[119] Sideri, S. and Giannotti, P. (2003), Ibid.
[120] Oxford Research (2004), ibid.
[121] Sideri, S. and Giannotti, P. (2003), Ibid.; Merrill *et al.* (2004), ibid.

European legal expenses insurance for patents will provide security and safety, and thus inspire more firms to file a patent application.[122] Instituting such a mandatory scheme for EPO patents would reduce costs to the benefit of small enterprises.

In the US, the formation of the US Court of Appeals for the Federal Circuit in 1982 has led to stronger patent enforcement (see Figure 5) and fewer invalidations by the courts.[123] In Europe, there is a need to improve the court system, preferably through regional or international solutions such as a common European court.

There are plans to set-up a central EC patent court in Luxemburg in tandem with the establishment of an EC patent.[124] Similar proposals are underway in Japan. In Denmark, the formation of a court with special jurisdiction for intellectual property cases has been suggested. This is a step in the right direction.

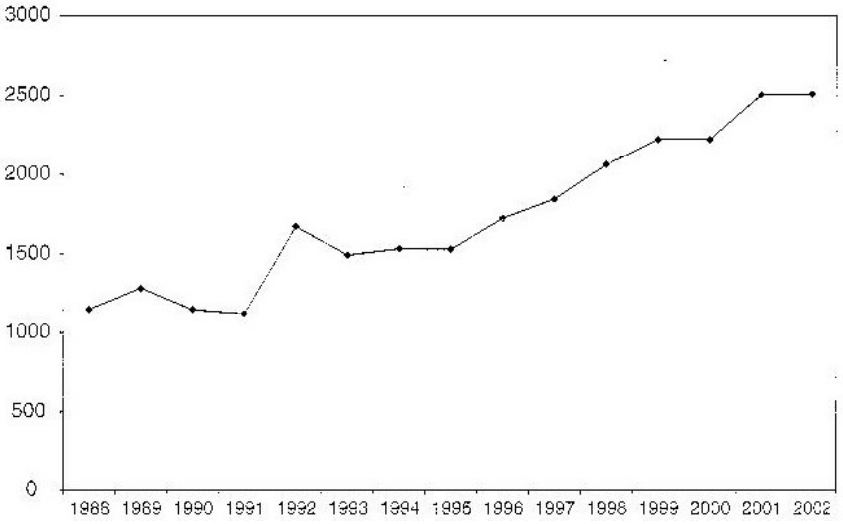

Figure 5: Number of completed patent cases[125].

7.3. More Flexible Methods

New types of patent application procedures could also offset the increased use of strategic patents to block competitors. This could be achieved through a stricter examination process, new fee systems in which fees are reduced if an application actually results in a patent, or weaker types of protection.[126] Another possibility could be improved access through the publication of a patent at a recognized public internet site.[127]

[122] Patent- og Varemærkestyrelsen (2000), ibid.
[123] OECD (2004), ibid.
[124] KOM (2003) 828 endelig. See also Patent- og Varemærkestyrelsen (2003).
[125] Source: Federal Judicial Center Research Division, Integrated Data Base as shown in Merrill et al (2004), ibid.
[126] OECD (2003), ibid.
[127] OECD (2004), ibid.

An excellent alternative is the utility model system particularly in new technological areas (see Box 17). It is more flexible, faster and cheaper, and can supplement the patent system. Firms can either entirely rely on a utility model right or combine an application for a utility model with a patent application. In cases where a rapid and simple establishment of a right is needed but no license will be sold, the utility model right is the answer.

However, the system is not used a great deal and the presence of unproven rights may cause problems of a more fundamental nature. Another shortfall is that the right is valid in only a few countries including Australia, Denmark, Luxemburg, Great Britain and Finland. The utility model scheme is of more general interest because it allows for differentiation in the patent system. It would therefore be useful to harmonize national rules on utility patents and to propagate the idea in Europe and worldwide.

Box 17: Utility Model Rights

The so-called "petty patent" protects inventions which do not meet the requirement of an inventive step. The utility model right is available for the same types of invention which can be patented. However process inventions are not eligible. Registration is required to obtain the right, but the procedures are less rigorous than the ones needed for patenting. This means that the patent authority does not automatically investigate whether the invention meets the requirements of novelty and an inventive step. As a result, the utility model right can be obtained more rapidly and at a lower cost than patent protection. The period of protection is a maximum of ten years. Use of the utility model right is not as widespread as the patent right. For a long time, a proposal has been underway to harmonize the utility model right in the EU, but nothing concrete has occurred in the last few years.

An interim solution could be increased flexibility of examination in the patenting process itself. For example, a deferred examination could be requested to prove the validity of a patent. This may be necessary, for example, in cases in which an examination was not previously conducted and enforcement of the patent is sought.

7.4. International Harmonization

Globalization has increased the need for regional and global harmonization of the patent system. The EU urgently needs to introduce a joint community patent (see Box 18) with access to a joint court system, preferably in one language, such as English, or in two languages to reduce costs. In the long run, the Community patent should lead to the formation of a single European patent system.

Box 18: The Community Patent

The aim of an EC patent is to introduce one document of title valid throughout the European Union. The patent transfers national issuing competence to the Community. This will harmonize the patent granting process since it will no longer be possible to maintain competing (national) issuing competence and the legal effects of an EC patent will no longer be a national affair. In addition to the EC patent, a new judicial system will be introduced – the EC Patent Court – to ensure identical legal effect in the EU. The EPO will be the sole issuing authority. It is unclear when the EC patent will become a reality because negotiations have not yet been completed.

Internationally, there is a need for a global patent system that centralizes both issuance and enforcement, including the administrative cancellation of rights. The creation of the Patent Cooperation Treaty (the PCT system - see Box 19), is already very useful, and it would be inexpensive to establish an international patent right to cover many countries. The Paris Convention and the PCT make the patent system more workable for everyone, including small enterprises, private inventors and researchers.

Attempts to create a global patent are ongoing. The US refuses to budge and so do several developing countries. Denmark takes a middle position in the global negotiations which are entering a new and critical era. Talks resumed in February in Washington and in Munich in April 2005. The results of these negotiations are positive.[128]

The main problem is the substantial variation in patent systems internationally. In Europe, for example, the person who applies first gets the patent. In the US, the person who is the first to invent gets the patent. The latter is more fair and predictable, but is difficult to administer and leads to numerous court cases. These varying approaches are difficult to align. However, there will be huge efficiency gains if harmonization of patent systems and procedures is successful, particularly for Japan, the US, the EU and China. The TRIPS Agreement is a step in the right direction. A further important step is the ratification and implementation of the Patent Law Treaty at the World Intellectual property Organization (WIPO).[129] In addition, new databases could be developed in new technologies, and agreements could be concluded on the mutual recognition of search and examination results. This would help to avoid duplication of work.[130]

Box 19: PCT – The Patent Cooperation Treaty

The treaty was concluded in Washington in 1970 and later modified in 1979 and 1984. Its objective is to facilitate the granting of patents that are applied for in several countries. The treaty's main principle is that the national patent authority must agree to consider an application on its merits if it meets the requirements of the treaty as to form and content. On the basis of the PCT, Denmark can be named in international patent applications filed by applicants from the 100 PCT member countries, and those applications may later become patents in Denmark.

The development of a European or global patent system may cause problems for local capacity and management. For example, practically no one would choose Denmark as their first country of application. Fewer applications can lead to a lowering of the quality of patents in Denmark. Today's competitive environment probably means that in 10-20 years there will be only three to five internationally-recognized IPR competent centers left in Europe.

Box 20: PLT – The Patent Law Treaty

Completed in 2000, the treaty concerns procedural questions relating to patent applications and other issues. The treaty is not yet in effect, but Danish patent law fully satisfies treaty requirements. There are ongoing, intense negotiations under the auspices of WIPO to devise a Substantive Patent Law Treaty (SPLT), within the Paris Convention framework. The aim is to expand the PLT and possibly at a later date lay the foundation for a more comprehensive, global harmonization of patent law.

On the other hand, some firms need a local connection.[131] Research shows that half of Danish firms believe that it is of great or some importance that national authorities offer IPR services. They also state that a broader range of services is desirable rather than the traditional focus on managing and issuing rights.[132] Another study indicates a connection between national patent authorities that are professional and the number of patents.[133] This indicates a need for local or regional authorities with advisory capacity. Such authorities are particularly important for small enterprises.

[128] http://www.european-patent-office.org/news/info/2005_04_20_e.htm
[129] Sideri, S. and Giannotti, P. (2003), ibid.
[130] OECD (2003), ibid.
[131] Patent- og Varemærkestyrelsen (2005), ibid.
[132] Christensen and Rasmussen (2001) as quoted in Patent- og Varemærkestyrelsen (2005), ibid.
[133] Inside Consulting (2003) as quoted in Patent- og Varemærkestyrelsen (2005), ibid.

One possibility could be to decentralize the EPO by placing regional centers in The Hague, Vienna, Berlin and the Nordic countries. The Nordic Council of Ministers has initiated efforts to create joint Nordic PCT authority (see Box 19).[134] But it may be unwise to have several levels in the patent system. It could lead to differences in the administration of individual cases and other unintended effects. Denmark, for example, rarely opposes patent applications at the EPO because opposition prevents it from participating in any later administrative hearings to re-examine the patent. When an EC patent is introduced, national offices could still provide information and advice as well as forward applications to the EPO which can then consider the application on behalf of the Community.[135]

7.5. Recommendations

1) Improve the quality of patent administration by increasing resources, establishing standardized guidelines for examination, conducting cross-sectoral investigations of patenting guidelines at various administrative offices and authorities, and developing international databases and/or procedures for the mutual recognition of examination results.

2) Ensure that future harmonization preserves the broad right of opposition currently practiced in Denmark so that everybody can oppose new patents.

3) Facilitate opposition procedures and demands for administrative re-examination.

4) Reduce unintended costs for patent applicants where possible such as by abolishing the need for translations and/or by introducing a common patent in the EU.

5) Consider various options to strengthen patent enforcement by improving the court system, establishing a common European court and/or introducing compulsory European legal expenses insurance.

6) Harmonize and replicate the utility model system in all of Europe to provide more flexible access and/or introduce deferred examination.

7) Introduce an EC patent in only one language (English) or in two languages in order to reduce costs.

8) Develop international databases in new technology and create standardized international guidelines for examination, including the mutual recognition of application and examination findings.

9) Work towards a global patent system that centralizes both the issuing and enforcement of patents.

[134] Patent- og Varemærkestyrelsen (2005), ibid.
[135] Patent- og Varemærkestyrelsen (2003): Annual Report.

8. Conclusion: Challenges of a Patent System for the Future

The effects of the patent system are unclear. In the last two decades, most reforms were implemented without any profound knowledge or thorough analyses of the societal and/or economic impact.[136] The working group believes that it is no longer tenable to keep shoring up the old system without producing solid evidence of the need for doing so. In particular, advancements in biotechnology and information technology place the system under pressure. On the other hand, the impact of these advancements has resulted in positive discussions about the patent system's fundamental nature.

It is difficult to judge whether the patent system benefits society. Existing analyses point in several directions. Arguably, in 1958 Machlup best expressed the conclusion to be drawn in one of the earliest economic analyses of the patent system:

> *If one does not know whether a system 'as a whole' (in contrast to certain features of it) is good or bad, the safest 'policy conclusion' is to 'muddle through' – either with it, if one has long lived with it, or without it, if one has lived without. If we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it.* [137]

It should be recognized that there is a striking correlation between wealth, economic performance and the scope of the patent system in all affluent countries. This correlation invites respect.

Therefore, it is not our intention to propose fundamental changes. But, we believe that reforms must be discussed. As Machlup says, we should possess or acquire sufficient knowledge before deciding upon any alterations. "*A little more or a little less*."[138]

Clearly, additional information and studies of the implications of the patent system are greatly needed, as are more critical "reviews." Based on what is already known, our conclusion is that a number of changes should be introduced not only to the patent system itself but also to the rules and regulatory frameworks that supplement and balance it. Our general belief is that a more differentiated and flexible patent system is necessary with different terms and scopes of protection depending on development time, costs, market conditions and product life. At the same time, we believe that the system should be viewed and designed as a remuneration-based right rather than an exclusive property-based right in order to avoid any detrimental effects on competition and on access to new knowledge and technology.

In recent years, the patent system has been both strengthened and expanded without any evidence of the benefits to society. We recommend slowing down and attempting to control this evolution in order to secure the development and exchange of knowledge needed to support future growth and welfare.

[136] OECD (2003), ibid.
[137] Machlup, F. (1958): An Economic Review of the Patent System. Study no. 15. Committee on the Judiciary. United States Senate. Washington, D.C.
[138] Machlup, F. (1958), ibid.

Based on these general conclusions, we recommend the following:

8.1. Recommendations

Interaction with other types of legislation

- Make a targeted effort to balance the patent system by using other measures such as competition policies, price controls, information technology and funding for research.
- Support the patent system by providing additional rights and funding in cases where incentives are insufficient to ensure production, such as with orphan drugs.

Amendments to the protection system

- Develop an efficient remuneration-based patent system to supplement the system based on exclusive rights.
- Develop new strategies for the use of patent fees so that they depend not only on the term of the patent, but also on its scope.
- Harmonize and replicate the utility model system in all of Europe to provide more flexible access and/or introduce deferred examination.
- Replace overly broad product patents for gene sequences by use and/or process patents or by product patents in which the scope is narrowed to only the core function of an invention.
- Institute clearer criteria to evaluate whether the inventive step has been met – particularly for software patents.
- Enact a requirement that software patents cannot block efforts to ensure interoperability with other software.
- Analyze the costs and benefits of a patent system that features a more differentiated approach to protection terms.
- Abolish the exceptions for "ordre public" and morality and instead consider ethical and moral issues in approvals to produce and sell.

License conditions and access

- Create incentives to secure free public access to patents of a cross-sectoral importance.
- Support the development of public databases to facilitate access for new actors, particularly SMEs.
- Support and develop Open Source strategies in both information technology and biotechnology through public information technology procurement.
- Facilitate access to defensive publication (publication used to block patenting by others) through public databases and registration options with patent authorities.

- Determine how to make the compulsory license system more flexible and operational including how to strengthen the use of competition law and compulsory licenses to offset abuse of dominant position and other effects detrimental to the common good.

Public research

- Clarify and strengthen the experimental use exception so researchers may conduct unhampered research based on existing patents, as long as there is no commercial exploitation.

- Establish licensing guidelines for patents developed by public research institutions so that they protect the public interest and guarantee access by public researchers.

- Facilitate strong public research efforts to strengthen technological advancement in areas where the incentive for privately-financed research and development is missing even with the prospect of patenting.

- Work towards a more effective dissemination of publicly-financed technology and knowledge by only acquiring a patent when the largest possible diffusion will be ensured, but refraining from acquiring a patent when widespread diffusion will not be achieved.

The patenting process

- Improve the quality of patent administration by increasing resources, establishing standardized guidelines for examination, conducting cross-sectoral investigations of patenting guidelines at various administrative offices and authorities, and developing international databases and/or procedures for the mutual recognition of examination results.

- Ensure that future harmonization preserves the broad right of opposition currently practiced in Denmark so that everybody can oppose new patents.

- Facilitate opposition procedures and demands for administrative re-examination.

- Reduce unintended costs for patent applicants where possible such as by abolishing the need for translations and/or by introducing a common patent in the EU.

- Consider various options to strengthen patent enforcement by improving the court system, establishing a common European court and/or introducing compulsory European legal expenses insurance.

International harmonization

- Introduce an EC patent in only one language (English) or in two languages in order to reduce costs.

- Develop international databases in new technology and create standardized international guidelines for examination, including the mutual recognition of application and examination findings.

- Work towards a global patent system that centralizes both the issuing and enforcement of patents.

Enhanced knowledge

- Establish a "precautionary principle," to ensure that future reforms and expansions of the patent system will be implemented only if they can be shown to benefit technological development.

- Ensure more comprehensive and exhaustive analyses of the possible national and international effects of future reforms and expansions of the patent system.

- Conduct a rigorous analysis of the problems and options that the patent system presents to SMEs.

- Ensure that these analyses are included in the political decision-making process by increasing contact and improving communication between analysts and politicians.

- Promote greater transparency in the administration of the patent system and more representative hearing processes by involving other actors, including consumer groups, trade unions, environmental groups and development organizations.

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Appendices

List of speakers at working group meetings:

- Anne Rejnhold Jørgensen, The Danish Patent and Trademark Office.
- Knud Erik Vingtoft, Association of Danish Patent Agents
- Kim Østrup, IBM.
- Martin von Haller Grønbæk, BvHD, Law firm
- Lars Kellberg, Novo Nordisk

List of participants in workshop on 16 March 2005:

BvHD, Law Firm	Martin von Haller Grønbæk
The Danish Institute of Agricultural Sciences	Preben Bach Holm
Confederation of Danish Industries	Catharina Dreyer
Ferrosan A/S	Trine Wulff
The Danish Consumer Council	Grit Munk
Gastrotech Pharma	Lise Ryberg
Copenhagen Business School	Mogens Kühn Pedersen
Hexal A/S	Jørgen Juhl-Christensen
IBM Danmark A/S	Kim Østrup
IT-politisk Forening	Anne Østergaard
The Competition Authority	Anders Ring
Ministry of Science, Technology and Development	Kåre Jarl
Novo Nordisk	Lars Kellberg
NovoZymes A/S	Bo Hammer Jensen
The Danish Patent and Trademark Office	Anne Rejnhold Jørgensen
The Danish Patent and Trademark Office	Peter Langkjær
Association of Danish Patent Agents	Knud Erik Vingtoft
Patientforeningen Danmark	Karsten Skawbo-Jensen
Plougmann & Vingtoft	Knud Erik Vingtoft
PremiTech	Jan Ishøj Nielsen
Simcorp	Peter Theill
Skejby Sygehus, Aarhus University Hospital	Jens Chr. Djurhuus