DRAFT

BACKGROUND PAPER

ISSUES CONCERNING THE PATENT SYSTEM

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DRAFT

SECTION I

ECONOMICS OF THE PATENT SYTEM

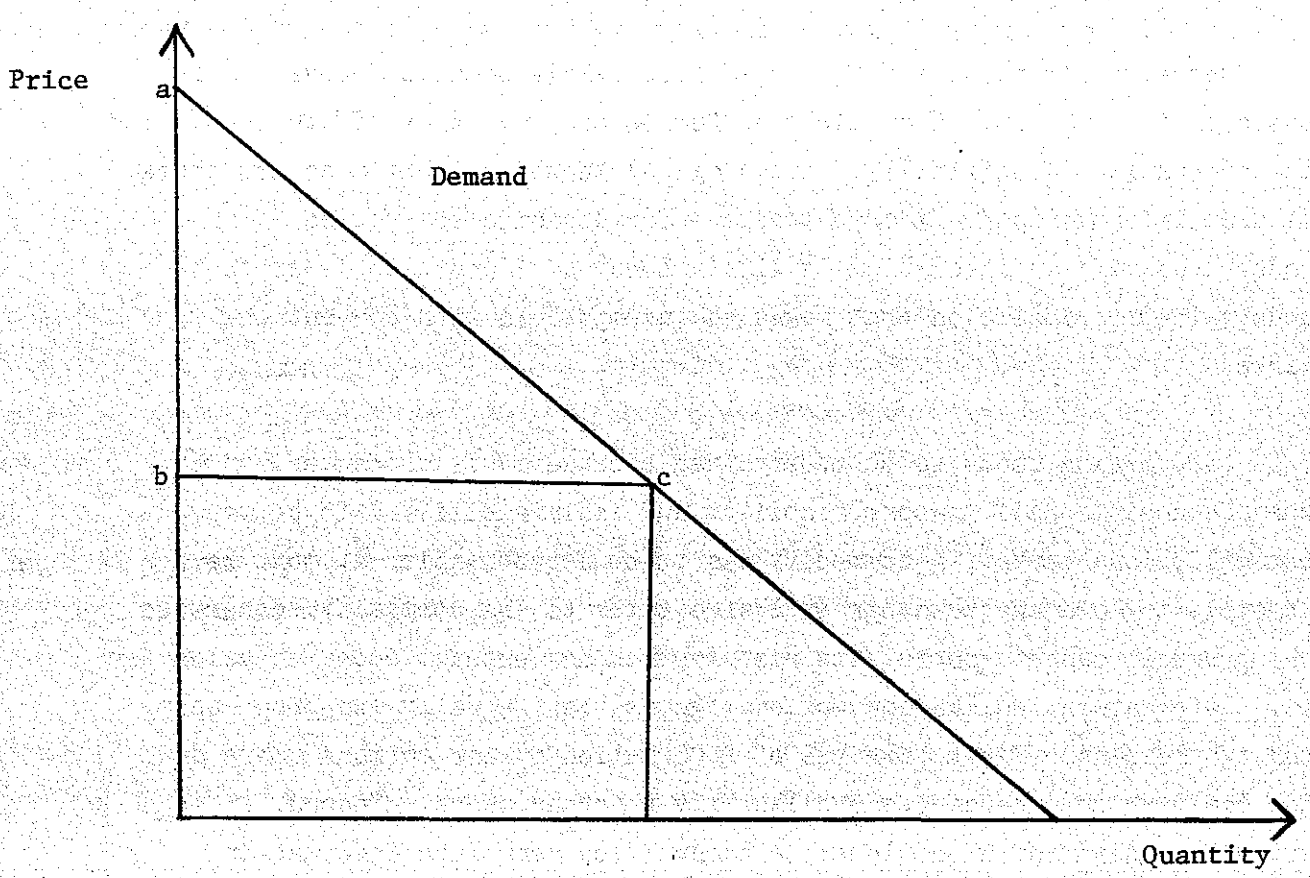
WHY WE CARE ABOUT INNOVATION

Innovation is an activity conducted by individuals and organizations that benefits society at large. Although it may bring such rewards as increased profits or prestige to individual innovators, its ultimate value to the economy is realized through improvements in economic efficiency. Innovation affects efficiency because it leads to changes in the prices and quantities of goods and services produced and consumed in an economy. Efficiency can be gained or lost through changes in prices, which lead to changes in quantities produced and consumed, and through changes in quantities that lead to price adjustments and further changes in quantities. Through improvements in the efficiency of production, innovation makes possible economic growth and increased consumer satisfaction.

Innovation makes economic growth possible by increasing productivity, or the yield in goods and services from given amounts of resources used in production. Productivity improvements typically result from innovations for production processes and for improvements in intermediate or producer goods such as capital equipment and certain chemicals.[1] With increased productivity, existing resources can be used to produce more goods and services throughout the economy, sustaining economic growth.

Innovation increases consumer satisfaction through both economic growth, which provides more goods and services to consumers, and changes in the nature and mix of goods and services available, which enable consumers to make more satisfying choices among available products, given their budgets. Consumer satisfaction depends not only on the monetary value of the types and quantities of products consumed, but also on an intangible quantity economists call consumer surplus. As figure 1 shows, consumers demand most products in amounts that vary inversely with their prices--the lower the price, the more is bought, and vice versa. Since there normally is only one price charged in a given market at any point in time, consumers who value the product at less than its price do not buy it, while consumers

Figure 1



In more concrete terms, the inappropriability of information inhibits innovation largely because it can prevent the recovery of costs incurred in innovative activity, and thereby diminish the profit people can expect to get from procuring new tehnological knowledge. Costs for research and development (R&D) and other innovative activities are one-time costs that are independent of the costs of later use of the information. They are therefore not reflected in the competitive price for transmitting the information, which is its marginal cost--the cost of generating the next increment for use. Anyone who charged more than the marginal cost in a competitive market could be undercut by competitors, who face the same costs for copying and transmitting the information. Therefore, innovators face the risk that competition from imitators will force them to set prices at levels too low to recover their costs in undertaking the innovation.

In addition to being inappropriable, information is also indivisible. This means that it cannot be packaged in varying sizes and sold at corresponding prices to serve users with different levels of interest in it. A party possessing a piece of information pays no more to use it more intensively. However, because the value of a given piece of information may vary among users, charging any one price for it will result in non-optimal purchase and use of the information, largely because potential users with limited interest in it will refrain from buying it. Finally, extracting any price for information may be difficult because potential users can only determine the value to them of a given piece of information--and therefore the price they would be willing to pay--by possessing it. The problem of indivisibility interferes with the efficient dissemination of new technological knowledge.

Uncertainty and the indivisibility and inappropriability of information reduce the perceived benefits and raise the perceived costs of innovation to potential innovators relative to the benefits and costs to society. Without compensating mechanisms, this divergence of private and social costs and benefits results in underinvestment in innovation, from society's perspective, and less efficient producer and consumer behavior

rationale for patents has changed over time with the development of a recognition that the creation of knowledge is not a sufficient motivation for invention.

HOW DO PATENTS WORK

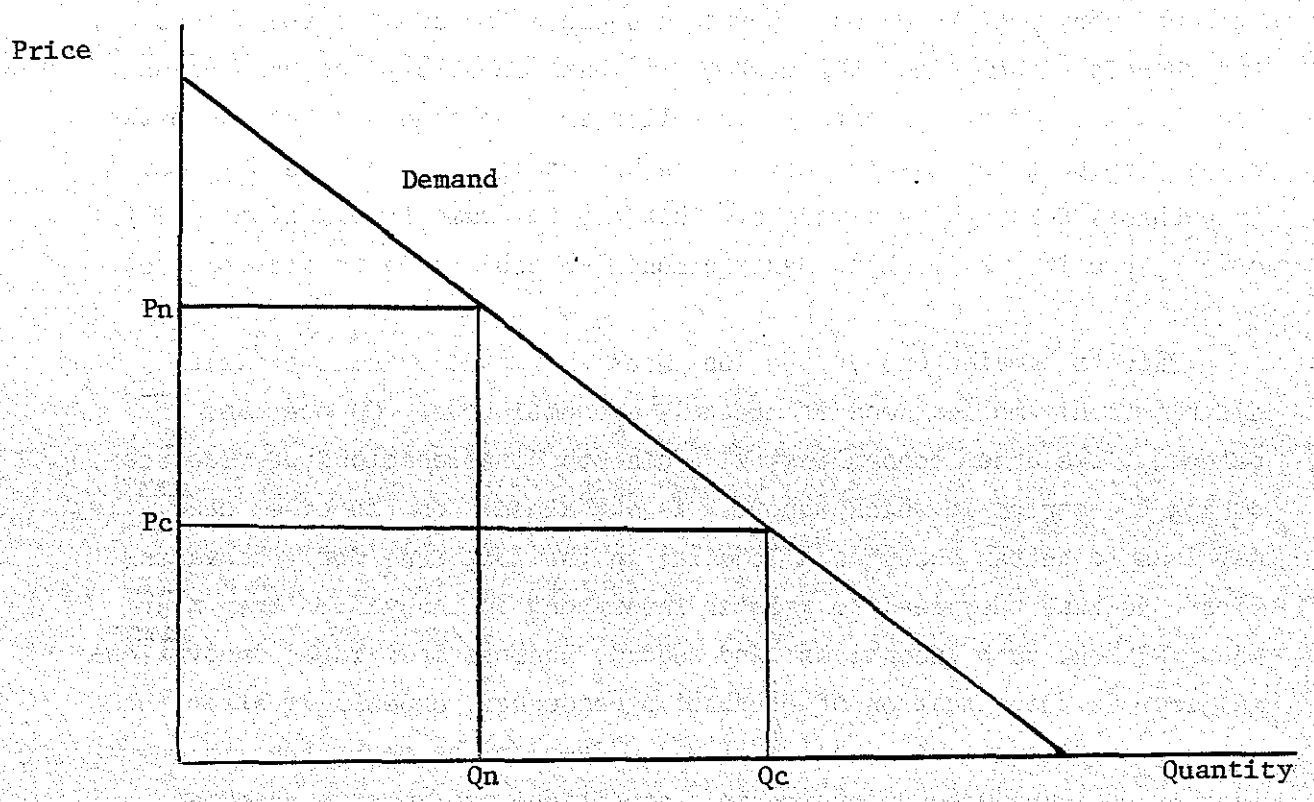
The economic effects of patents and the effectiveness of patents as incentives can be evaluated from two perspectives. The first perspective is a narrow one that focuses on the static theoretical implications of patent-based monopolies. The second perspective is broader and dynamic, taking into consideration differences in industry structure, conduct, and other characteristics that provide the context for the role of patents in different industries. From the narrow perspective, an evaluation of monopoly as the mechanism of a patent establishes the potential incentive power and efficiency consequences of patents. A broader view of industry and firm differences iluminates other forces and incentives that encourage or inhibit innovation, regardless of patents.

THE NARROW VIEW: PATENT MONOPOLIES

Patents create monopolies in innovations for the duration of the patent term, which is seventeen years in the United States. "Monopoly" describes the condition where a market is controlled by a single seller, the patent holder (with or without licensees) in this case. The use of monopolies to promote innovation has implications for economic efficiency and the distribution of wealth in the economy as well as for the conduct of innovative activity.

The impact on a market of a monopoly is customarily measured relative to conditions in a competitive market. A competitive market is shared among many sellers, none of whom sell enough to affect product price. While a competitively produced good is priced at its marginal cost (the cost of producing the next increment of product), a monopolistically produced good is priced above marginal cost. Although a competitive firm

Figure 2



The efficiency effects of patents vary widely among innovations.The levels of price increase, profit, and output restriction achieved for particular patent monopolies depend on the market readiness of a newly patented product or process and on its relationship to other products.

First, market readiness is important because patent terms are fixed at seventeen years beginning with receipt of the patent. If, after receipt of a patent, more time and effort is required before a new product or process can be commercialized, the effective patent term is diminished. This can happen with pharmaceuticals, for example, which must undergo extensive testing before being brought to market. Where the effective patent term is diminished, the opportunity for earning extraordinary profits is also diminished, although the length of effective patent term may be sufficient for the patent holder to recover development costs through extraordinary profits. For process (and some product) innovations, market readiness may be less of a concern in evaluating patent terms than the degree of cost reduction. The larger the cost reduction achieved with a process innovation, the shorter the period necessary for a patent holder to recover development costs. Therefore, for drastic cost reductions, the longer the effective patent monopoly, the greater the inefficiency.[5]

Second, the relationship of a patented product or process to others also affects the impact of a patent monopoly. Because a patent monopoly prevents others from entering only the market narrowly defined by the specific patented product or process, it will be more potent the less other products can be substituted for the patented item. Products are considered substitutable when an increase in the price of one product leads to increased consumption of another or others. Consequently, the availability of substitutes constrains the ability of a producer to profitably raise product prices. Where other products are readily substituted by consumers for a patented item, it can be argued that the patent provides only limited control over the relevant market, defined to include all readily substitutable products. Therefore, patents for rival products or for variants of a patented product are individually, and perhaps even

Figure 3

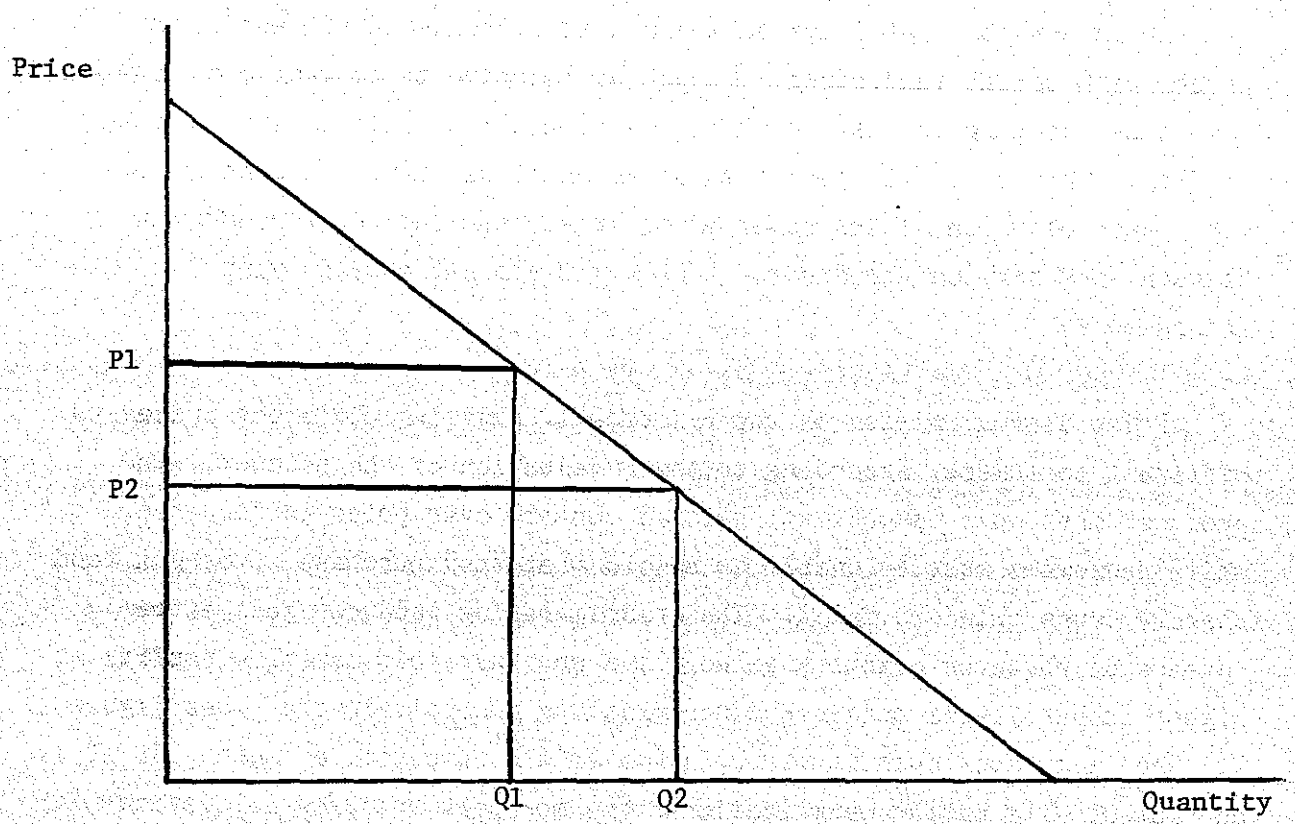
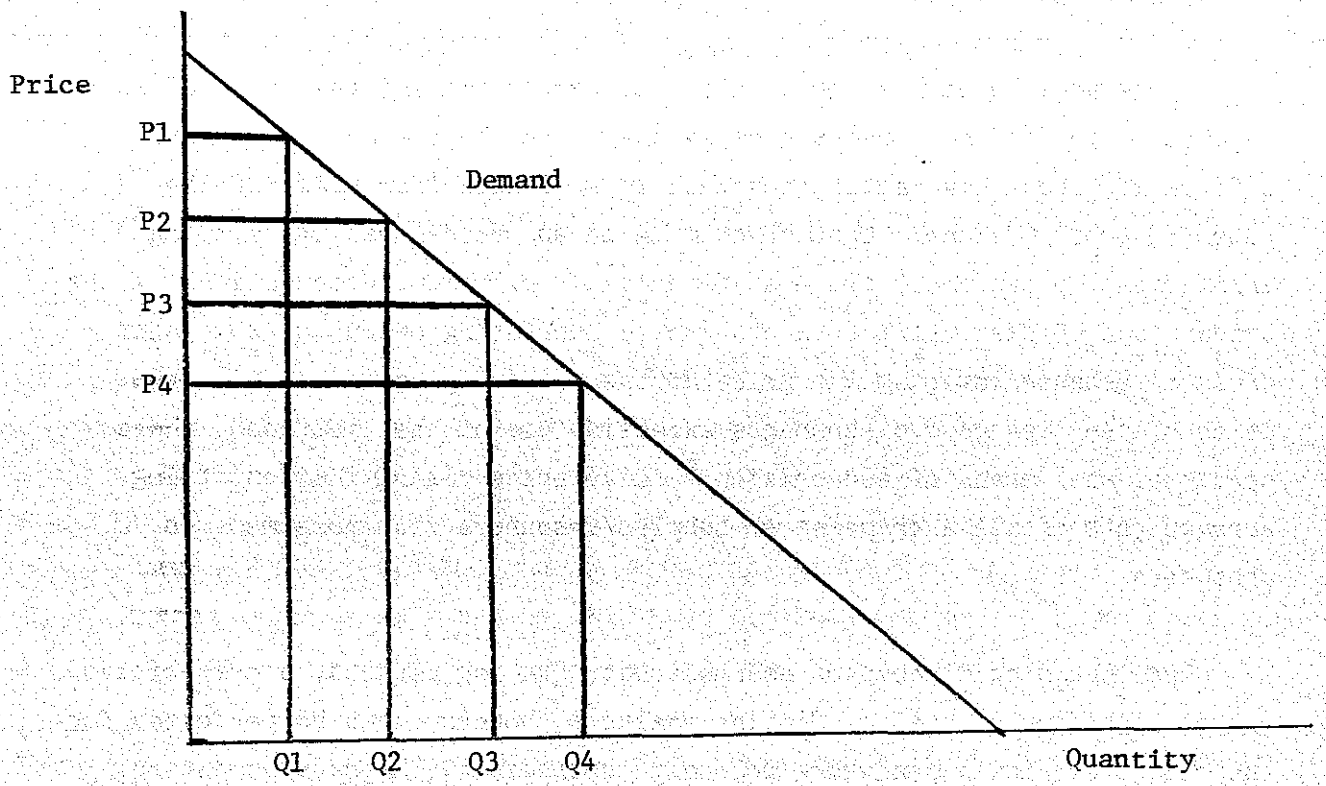


Figure 4



technology product, production of the new product at monopoly price and output levels will lower consumer satisfaction relative to initial levels.[10]

THE BROAD VIEW: INNOVATIVE ACTIVITY AND PATENTS

Both the validity of arguments justifying the patent system and the outcome of economic evaluations of the system depend on perceptions of how invention and innovation proceed. Most economic models of innovation fall into three groups: supply-oriented, demand-oriented, and hybrids.[11] Supply-oriented models, the earliest models, assume that the level of technical knowledge and the tendency of particular individuals to invent are givens which determine the supply of inventions and innovations. From this perspective, patents or other incentives activate inventive individuals. Demand-oriented models tie innovation to the pursuit of profits by business firms, which acquire and use inventive resources to improve productivity and raise profits. Hybrid models relate innovation to the combined stimuli of the state of technology and market characteristics.

Increasing theoretical attention to the relationship between innovation and market characteristics, marked by development and refinement of demand-oriented and hybrid model, signifies growth in the perceived economic significance of patents. Economic models relating invention to market characterstics treat innovation as a behavioral phenomenon, responsive to the presence and form of market-oriented incentives such as patents. A market orientation in models of innovation is also consistent with a historical shift in the locus of innovation from the individual entrepreneur to the business firm. As A.E.Kahn and other economists have observed, the basic question in evaluating the patent system is no longer whether it stimulates inventors to be more active, but whether it stimulates businesses to invest more, and most desirably, in inventors and in innovation. Finally, attention to markets reflects growth in concern with innovation, as opposed to invention, because innovation is inherently concerned with the bringing to market of new technologies.

important technological barrier to entry into an industry appears to be scale economies in R&D, or the need to achieve some minimum scale of operations to successfully conduct R&D. While the existence of scale economies makes major investments in R&D necessary for success in innovation, conducting R&D on a large scale may facilitate diversification in R&D, which can increase the likelihood of success and the level of expected return on investment.[14]

On the other hand, barriers to entry in general slow the rate of adoption of new technology. If entry and competition are limited, prices and quantities may change relatively slowly following introduction of an innovation, putting relatively little pressure on incumbent firms to adopt new technology immediately. The rate of diffusion of process innovations, in particular, depends on entry and competitive conditions. Process innovations directly affect the cost and therefore the price of existing products. Entry conditions affect the rate of change in the price of existing products, which in turn affects the point at which using old technology becomes too costly and unprofitable relative to installing new technology.[15]

Some contemporary analyses suggest that observed associations between R&D and large firm size or concentration may reflect a different order of causation: technological change may lead to concentration by facilitating the development of large firms and the exercise of market power. Almarin Phillips, for example, links industry structure and innovation to defensive conduct. He contends that because rapid technological change creates opportunities that encourage entry into an industry, it motivates incumbent firms to develop technologies that impede entry, until the rate of technological change slows. The pharmaceutical industry is believed to exhibit such behavior.[16] Nordhaus posits a direct structural link between process innovations and industry concentration. Innovations that make conventional production resources more productive may promote industry concentration because they make production at large scales relatively efficient.[17] Although economists have theorized about the effects of

buyers influences innovation is uncertain; the question has received relatively little study.)

Given the size of the market, the relation between market power and the profitability of an innovation appears to depend on the responsiveness of consumer demand to changes in product price (price-elasticity of demand). The more responsive or elastic the demand, the more sales volume will increase for a given percentage reduction in price; the less elastic the demand, the less sales volume will fall with a given percentage increase in price. See figure 5. If a competitive and a monopolistic industry each serve consumers that are comparably responsive to changes in product price, the incentive to innovate to reduce costs may be greatest for the monopolist because he can make more profits than a competitive firm by increasing sales volume and lowering product price. On the other hand, a competitive firm may have the greater incentive--measured in terms of potential profits--to undertake a major process innovation if it sells to consumers who are sufficiently more responsive to price changes than those served by a monopolist. Under these conditions, increases in sales volume following introduction of an innovation would increase profits for the competitive firm more than for the monopolist.[22]

Levels of technological opportunity and product differentiation are other industry attributes that influence differences in innovation and patenting activity between and within industries. For example, Scherer has found that manufacturing firms tend to develop much more of the technology they use than nonmanufacturing firms, which tend to use technologies developed by others. Such differences in the origin and use of new technology by industry reflect broad differences in technological opportunity. Scherer has also found that the propensity to patent is relatively high in chemical and electronic industries, for example, where there are relatively high levels of technological opportunity, and relatively low in general and mechanical industries, which have relatively low levels of technological opportunities.[23] Findings by some economists of greater innovation levels among product oriented industries relative to

process-oriented industries may reflect greater competitive value for differentiation, and hence innovation, for products relative to processes.[24] It may also reflect greater average levels of maturity for process industries relative to product industries.

Levels of technological opportunity and/or product differentiation also affect whether industry structural characteristics such as concentration are associated with industry innovation patterns. Firms with limited opportunities for technological development and/or product differentiation may be more motivated to innovate in concentrated industries than in competitive industries because concentration enables them to capture more profits from an innovation than are possible under competitive conditions.

Aspects of market conduct as well as market structure affect innovative activity. In particular, innovation levels for different industries appear to vary according to the competitive advantages in product markets of being innovative, per se. As Mansfield and others have noted, consumers reward technological change in some industries more than others. Innovation tends to be competitively valuable where products are highly differentiated, a condition which allows innovators to develop new submarkets by creating new products (or processes).The opportunity to obtain patents may reinforce the incentive to innovate for purposes of differentiation because patent restrictions protect new market niches created through innovation.[25] Scherer, for example, found in comparing industries that for a given level of R&D spending, industries producing consumer goods, which are highly differentiated, obtained significantly more patents.[26] However, the obtaining of patents does not assure that innovation--in particular, the use of patented technology--takes place.

Innovative activity may be stimulated directly by competition in R&D, as opposed to competition in a product market. Rivalry in innovation appears to be inherently stronger than other types of rivalry. The fact that each research project and approach is in some way unique, even when

similar to the newest technology is blocked by exisiting patents, rivals can enhance their competitiveness and profitability by developing technologies better than prior art, even if it is inferior to the best available technology that is restricted by patents.

Economists differ as to whether these practices are inefficient and therefore a drawback of the patent system. The argument against inventing around and between is that society benefits most from the introduction of the best available technology, the use of which leads to the most efficient allocation of resources to production. Although these activities are profitable to private parties, the social benefits are negligible compared to the social benefits of activities that yield the best available technology. Intermediate or parallel innovations convey less benefit and exhaust resources that might be more productive in other applications, including other types of innovation. The argument for engaging in inventing around and between is that the efforts might lead to more significant innovations, and the outcomes may improve competition in product markets by narrowing the advantage conveyed by the original patent.

There are two other practices that appear inefficient, although, again, they may be necessary side-effects of a system that yields more innovation compared to conditions without it. First, the prospect of obtaining broad, strong patents may encourage an excessive number of rivals to attempt a particular innovation, because the potential return on investment may be much higher than for other patentable innovations that could more easily be invented around (or between). The converse of this problem is that potential innovators may not invest sufficient resources in other areas because they may not be able to secure broad patents. Second, the inventor may be motivated to introduce new technology too early or too late for society to get the maximum benefits from it. This may happen as an attempt to assure receipt of patent protection and associated private benefits. The privately and socially optimal time to introduce an innovation depend on how the profits and other benefits of an innovation are expected to flow over time and on other factors.[28]

information make innovation relatively unattractive and dissemination of new technological information risky. However, observed levels of investment in innovation may be less than potential levels because of practical problems which limit private gains from innovation, including imperfections in the legal protection of rights in ideas (through patents and other means) and the slowing of technological diffusion due to evaluation and validation activities. The time lag between the introduction of a new technology and the occurrence of significant changes in prices and production activities may be too long to make profit-by-speculation a meaningful incentive. Hirschleifer was unable to conclude, however, that pecuniary gains from speculation would be sufficient to obviate the need for patent monopoly rewards, especially for relatively expensive and fundamental innovations.

The notion that the body of undiscovered technological ideas is a common-property resource is another product of information theory which also supports the conclusion that there may be too much investment in innovation. This notion implies that, without restrictions on the types of research private parties undertake, private parties may "fish" the same "ponds" of new technology and individually catch too many new ideas too soon from society's perspective. With overfishing, each private party catches some new ideas that would have been caught by other parties anyway, so that the total pool of new ideas is really smaller than the sum of ideas caught by each party. From this perspective, note that patents identify (and provide a means for counting) successful new ideas but they do not provide information in time to prevent potentially large numbers of people from exploiting the same ideas. The remedy for "overfishing" would be some form of limiting the "right to fish"or allocating specific "ponds" to specific researchers or inventors. However, because it may be impossible to define the nature of new technologies prior to their development, it may be extremely difficult to allocate specific research rights.[30] Although a common-property resource analysis suggests that there may be too much investment in innovation, there are other forces which restrict actual investment, most notably risk aversion, limitations on the ability of

technologies and such practices as patent proliferation and other activities that may extend effective monopoly control, possible waste of resources in inventing around or between existing technologies, costs incurred by unsuccessful or slower inventors who fail to get patents, and the legal and administrative costs of acquiring and enforcing patent protection. Finally, because the patent system is a legal system, it may put small businesses and individual inventors at a disadvantage because preparing a good patent application and engaging in patent litigation is expensive.

The social costs of the patent system may be moderated by a variety of factors, including cost savings from achievement of scale economies associated with monopolization or possible increases in production efficiency enabled by concentrated control over production processes. Furthermore, the relative social costs of patents vary among innovations according to the benefits they generate. Thus, a seventeen-year monopoly may overreward some innovators and underreward others. The practical effects of the patent monopoly will vary with conditions in individual markets, however, regardless of the patent term.

Many economists point out that patents are relevant to only some types of innovation because only certain types of inventions can be patented and because much innovation doesn't depend on patents. Patents do not seem relevant to major scientific discoveries, which often aren't patentable, and to fundamental or spectacular inventions, which are extremely expensive and time consuming to develop and perfect.[31] However, these activities are often undertaken by universities and/or with government financing, both of which conditions separate them from the free market environment to which patents are oriented. Even where inventions are undertaken by privately-financed entrepreneurs, patents may not be important because of conditions in particular markets. As Scherer and others maintain, patents are important in cases where rapid imitation of new technologies is possible, industry leadership is competitively advantageous, and expected profits from innovating are low. Given the total spectrum of inventive activity,

capitalistic. Therefore, alternative arrangements entail some form of deviation from a pure free-enterprise system.

One alternative to the patent system is a system of subsidies for innovation. Subsidies would be more economically efficient than patents because they don't entail the costs of monopolistic distribution of new technology. However, subsidies do not reduce uncertainty about the appropriability and licensability of new technological information, which may remain of concern to potential innovators. Subsidies may also be less of a standardizing influence across different sets of market conditions than patents.

Another alternative would be for government and/or other non-profit organizations to assume the primary responsibility for invention. This approach would eliminate any possible bias in innovation toward patentable technologies, but it would raise practical problems of how to determine how much to invest in different type of research and how to encourage efficient use of innovative resources.[35]

[8]See footnote 7.

[9]Output expansion & price reduction will be profitable unless the relationship between quantity demanded and price is discontinuous.

[10]See footnote 4.

[11]See footnote 1.

[12]See footnote 4.

[13]Comanor, W.S., "Market Structure, Product Differentiation, and Industrial Research: Quarterly Journal of Economics, Vol. 81, 1967.

[14]Nelson, Richard R. "Research on Productivity Growth and Productivity Differences: Dead Ends and New Departures" Journal of Economic Literature, vol. 19, September 1981.

[15]Fellner, W., "The Influence of Market Structure on Technological Progress" Quarterly Journal of Economics Vol. 64, November 1951.

[16]Phillips, A., "Patents, Potential Competition, and Technical Progress" American Economic Review, Vol. 56, no. 2, May 1966.

[17]See footnote 1.

[18]See footnote 4.

[19]See footnote 3.

[20]Kahn, A.E., "The Role of Patents" in John Perry Miller, ed. Competition, Cartels and Their Regulation Amsterdam: North-Holland Publishing Company, 1962. Also, see footnote 7.

[32]See footnote 20.

[33]Machlup, F., An Economic Review of the Patent System Study (No. 15) of the Subcommittee on Patents, Trademarks, and Copyrights of the Senate Committee on the Judiciary U. S. Congress, 85th Congress, 2d Session, Washington, D.C., 1958.

[34]See, for example, footnotes 1 and 5.

[35]See "Economic Welfare and the Allocation of Resources for Invention" by Kenneth Arrow (footnote 6).

of new manufacture." The grantee did not need to be the first and true inventor; he needed only to bring the working or making of the new product to England. Thus, jobs were created and finished goods were manufactured domestically and exported, rather than imported. Because of the emphasis on innovation, the importation of technology to England from abroad, including by industrial espionage, was strongly encouraged. Patents were more a tool for economic stimulation than a recognition of an inherent property right in an invention.

In the 17th century, the English concept of patents was implanted in the Americas. A number of colonies adopted forms of patents and these colonial patent systems continued after the American Revolution. In the early years of the Republic, the patent system was viewed as a mechanism for improving the tenuous economic condition of the states. Laws differed greatly among the states; some were effective and others relatively ineffective.

National efforts to encourage technology were specifically considered by the Constitutional Convention of 1787. James Madison of Virginia offered a proposal to enable Congress "to encourage by premiums and provisions the advancement of useful knowledge and discoveries." This direct reward proposal was not adopted. Instead, the Convention approved unanimously and without recorded debate the present patent clause which provided exclusive rights to inventors as a means to promote the progress of science and useful arts.

The Supreme Court has frequenly commented on the Constitutional powers provided by Article I, Section 8, Clause 8. In 1966, for example, the Court said:

> ". . . The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose. Nor may it enlarge the patent monopoly without regard to the

From the start, the U.S. patent examination process has been ex parte, that is, the only parties involved are the patent applicant and the patent examiner. Initially by custom, and later by law, examinations were conducted in secrecy. In 1836, communications in the United States were so primitive that effective inter partes participation (by outside parties) was virtually impossible. There was no adequate way to notify all interested parties about the details of patent applications. Further, since the patent system implies a bargain - the disclosure of an invention in return for a grant of a limited monopoly - it was considered unfair to require disclosure without any guarantee that a patent would be granted. Conducting patent examinations in confidence and in an ex parte fashion was also regarded as most expedient from the standpoint of time and expense. However, the secret, ex parte examination of patents has been criticized for denying the public an opportunity to be involved in a process in which there is a broad, public interest. (FN - the information in this section is drawn from extensive studies of the history of patents by P.J. Federico, F. Machlup, and H.I. Forman).

Since ratification of the Constitution and the subsequent adoption of the Patent Acts of 1836 and 1870, many changes have occurred in society and technology, yet the patent system has remained relatively unchanged. The United States has been transformed from an agrarian society to a world leader in technology. Corporate research efforts, rather than individual inventors, account for the preponderance of patent applications. Technologies, such as computers, nuclear energy and genetic engineering, have arisen that were beyond comprehension when the patent laws were first enacted.

Some concern exists as to whether the prevailing patent statutes have become outdated and no longer provide the intended incentives to technological advances and innovation. (See, for instance, S. Melman, The Impact of the Patent System on Research, Senate Subcommittee on Patents, Trademarks and Copyrights, Study 11, 1958, and the Report of the President's Commission on the Patent System, 1966). Fortunately, there is

law of nature, which cannot be patented. The Court, however, has held that the use of an algorithm in connection with a process for producing a physical product is patentable. (Diamond v Diehr, 100 SC, 1981) The policy issue remains unsettled; how to resolve the conflict between the need for incentives for innovation in the field of computer programing and the need to maintain discoveries of pure science and mathematics in the public domain. (FN - For more, in-depth review of computers and patent law see OTAF, Technology Assessment & Forecast, Tenth Report, November, 1981, p. 49-59 and 126-156).

The examples of genetic engineering and computer programing indicate the manner in which the patent system, through statute, and administrative and judicial review, addresses issues presented by radically new technology. The patent system effectively raised the issues and prompted public discussion prior to the issuance of a patent. The Congressional policy-making role was preserved and, in the time required to obtain a final judicial disposition of the issue, each of these new technologies progressed rapidly, providing an opportunity to assess the potential impact of the technology and the effect of patent protection on its development. This process, of course, can entail social costs in that the uncertainty regarding patentability can retard technological development and someone must be willing to undertake the expense of processing the issue through the Patent and Trademark Office and the judicial system.

Utility

In order to accomplish the goal of promoting the progress of useful arts, a patentable invention must be useful. The patent law state: "Whoever invents or discovers any . . . useful process, machine, manufacture, or composition of matter, or any useful improvement thereof, may obtain a patent." (35 USC Sec. 101) Inventions which are immoral, frivolous, or mischievous may be denied a patent based on the lack of utility.

exhibit an activity in treating a disease but also produce an unacceptable risk of death or injury. The judicial standard which has developed with respect to pharmaceuticals is that there must be evidence of situations in which benefits could outweigh the risks for utility to be proved. (In re Anthony, 44 F2d 1385, Court of Customs and Patent Appeals, 1969) The chemical, however, need not meet governmental regulatory requirements for use, nor must there be any reasonable likelihood that the chemical will even be considered for developing the use. (For further discussion, see M. Schiffmiller, Human Pharmaceuticals, Patents and the FDA, Food, Drug and Cosmetic Law Journal, vol. 35, Feb. 1980, p. 83-97, and MPEP, Sect. 608.01(p).)

There are arguments on both sides of the utility standard. On one hand, requiring extensive proofs of utility may result in significant delays in filing patent applications and inhibit the patenting of certain chemical inventions. On the other hand, chemical patents on inventions of impractical utility may discourage research by others to evaluate the claimed chemicals for practical utilities since the patent could prevent them from making, using or selling the chemical.

Novelty

An invention must also be novel in order to be patentable. Congress has established a statutory definition for determining novelty and this definition has remained virtually unchanged since the 19th century. There are two basic principals: first, the invention must not be known or used by others prior to the date of the invention; and second, there is a limit to the time that may elapse between the first date that information about the invention becomes available to the public, and the date of filing the patent application. (35 USC Sect. 102(a) and (b).)

This approach toward defining novelty is substantially different than the approach followed in all other major industralized countries with the exception of Canada. These other countries require that the invention must

The U.S. patent statute also differs markedly from the patent laws of most foreign countries with respect to the effect of unpublished knowledge (intangible forms of information) on the patentability of an invention. Since 1870 the U.S. placed a territorial restriction on the intangible form of information which can be used to deny novelty. Knowledge, use or sale of an invention can only defeat a patent if it occurs in the United States, its territories or possessions. (35 USC, Sec. 102(a).) While this restriction was probably justified a century ago because of the difficulties of international travel and communication, these circumstances no longer apply to the same extent. World-wide communication systems provide virtually instantaneous transfer of information.

Domestic U.S. companies now compete in the world market, and foreign-based companies compete in the United States. Furthermore, the United States is now a major producer and buyer of technology. In view of these factors, a statute which may have favored U.S. business in the past may now have the opposite effect. For example, a foreign firm can develop and put to practical application an invention in its home country more than one year before filing a patent application in the United States without such actions being a bar to obtaining a U.S. patent. Such a possibility does not exist for a domestic firm or individual inventor. (See K. Jorda, Those Discriminating Patent Laws)

There have been other changes, even since the recodification of the U.S. patent laws in 1952, which pose new policy issues. The U.S. statute presently requires that in order for a publication to be prior art that can be considered in determing novelty it must be "printed." (35 USC, Sec. 102(a) and (b).) While intended to insure that any publication used to deny patentability would be one that was reasonably accessible to the public, the language may be inadquate in today's world where information is readily available and is transmitted throughout the world in the form of film, magnetic tape and electronic signals.

invention was not created by statute, but rather it was a judicially-established doctrine founded in the Consitution. The judically-established doctrine establishing a standard of invention was exclusive until the Patent Act of 1952 adopted a "non-obviousness" criterion for patentability:

> "A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made." (35 USC Sec. 103)

Why after nearly 160 years of a patent system did Congress adopt a statutory standard of patentability? The "reviser's note" to this section of the U.S. Code states that the secion was added with the view that "an explicit statement in the statute may have some stabilizing effect, and also to serve as a basis for the addition at a later time of some criteria which may be worked out, for refusing patents or holding patents invalid on the ground of lack of invention." The note also states that the second sentence of the section makes it immaterial in determining patentability whether the invention resulted from long toil and experimentation or from a flash of genius.

The reaons for this atttempt to create a standard of patentability appears to reside in the congressional concern that the standard of patentability being applied by the courts was too strict and subject to too much variation. In a dissenting opinion in 1949, Mr. Justice Jackson commented

Justice Douglas then lists a number of patented inventions which he considered to be gadgets on which the Supreme Court ruled and held invalid.

Some had hoped that the 1952 Act would result in the demise of the "flash of genius" and the "synergism" tests for patentablility with a standard of obviousness at the time of the invention being exclusively employed. The transition has not been completed. Pre-1952 Supreme Court cases are still commonly given precedential value in determining patentability. Some commentators argue that the synergism test is still used by many courts and its application is on the rise. (_____)

There are two factors to be considered when looking at the reaction of the courts in implementing the statutory "non-obvious" standard. First, the judically-perceived standard of invention has been merged into the statutory standard. This merger is not unexpected in view of the history of the 1952 Act which was represented at that time to codify the present patent laws and the reviser's note that the secion was "stabilizing". (35 USCA Sec. 103) In fact, many court decisions when the Act first came into effect stated that the Act did not alter the previous law. Thus, the Congressional activity was not viewed as a clear indication of a new policy being established.

The second factor relates to the legal adage that hard cases make bad law. The determination of invention or obviousness is complex. It requires a melding of legal principles and science. An individual making a determination regarding obviousness under the present statute must discern the state-of-the-art at the time of the invention and then must determine what would be obvious to a mythical person of ordinary skill in the art and knowledge of the state-of-the-art. Clearly, such determinations are highly subjective. Moreover, to express the rationale of the decision is even more difficult. The courts, particularly the Surpeme Court, are looked to for general guidance, that is, to provide the <u>stare decisis</u> that enables the common law system to develop. When the court is faced with an

Should Congress, assuming that it is possible, establish policy on implementing the standard of patentability? A more uniformly applied standard could reduce the uncertainty of patent validity and thereby have some enhancing effect on the value of a patent as an incentive for innovation. The practicality of establishing the policy must, however, be considered. Moreover, a judgment needs to be rendered on whether the present standard and lack of uniformity in implementation warrant Congressional consideration from a policy standpoint. With the creation of a Court of Appeals for the Federal Circuit which will have exclusive appellate jurisdiction over patent suits, many observers are predicting an increase in uniformity. (See House Report 97-312)

One of the appproaches available to Congress is to provide more objective bases for the determination of patentability. For example, Congress could specify that an invention should fill a long-felt need, or have some prospect of commercial success. Congress might also narrow the scope of prior art to be considered in evaluating an invention from the standpoint of obviousness. The prior art could be limited by age or by remoteness from the field of technology in which the invention resides. A fundamental concern is whether such objective standards would fall below the Constitutional standard for invention which has developed for nearly two centuries. A second concern is whether the objective standards would be in the public interest. Would the innovation that might be stimulated by the standards off-set the costs to the public? A third concern is whether sufficient flexibility might still exist within the objective standards so that the sought uniformity is not achieved.

Some of these objective standards are now being applied in determining non-obviousness and it has been pointed out that the present statute is unclear as to the weight to be given to these secondary indicators of patentability. Some courts have held that these secondary indicators are to be given weight in all instances where obviousness of an invention is at issue. Other courts have held that if an invention is obvious, the secondary indicators are immaterial, and only when a close question of

The judging of the adequacy involves the use of a reference to "any person skilled in the art". This standard has been interpreted by the courts to be directed to an ordinary person. The fact that the description was adequate for a person to make and use the invention is frequently not persuasive evidence. The test which is often applied is whether undue experimentation is required to make and use the invention. A clear distinction appears to be drawn between the "person having ordinary skill in the art" who sets the standard fo obviousness and the "any person skilled in the art" standard for determining adequacy of disclosure.

The standard for the description of the invention in the U.S. is more rigorous than the standard established in many foreign countries. In countries such as West Germany, the description need only enable one skilled in the art to understand the invention.

The best mode requirement achieved its present form with the 1952 patent act. Prior to that time the statue required that

> "... in the case of a machine, he shall explain the principle thereof, and the best mode in which he has contemplated applying that principle, so as to distinguish it from other inventions"

and that in an infringement action, a defense is that

> "... for the purpose of deceiving the public the description and specification filed by the patentee in the Patent Office was made to contain less than the whole truth relative to his invention or discovery, or more than is necessary to produce the desired effect."

The explicit purpose of the best mode disclosure was thus to aid in an understanding of a mechanical invention, and only if information were purposefully withheld could a patent be found uneforceable. Now, the

the inventor's employer and assignee of the invention cannot be hidden from the public by hiding it from the inventor. While this policy increases the obligations of the inventor in preparing a patent application, it does assure the public of receiving a fair disclosure of the invention and it also prevents a barrier being constructed between the inventor and the development of his invention.

The extent of disclosure of the best mode is subjective and there are no statutory guidelines for determing adequacy. If the invention relates to a process for spray coating an object, do the details of the spray nozzle which appears to provide the best results need to be disclosed. Even if the invention relates to a method for positioning the object to be sprayed? The uncertainites involved and the implication that a failure to disclose is deceitful on the part of the patent applicant make the best mode issue an important issue in the litigation of patents. Although relatively few patents are invalidated for failure to disclose the best mode, the best mode defense opens up avenues for discovery and for equitable considerations in resolving the case.

The Claims

The patent statute states that the specification shall

> "... conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." (35 USC, Sec 112)

From the standpoint of patent reliability, the most important aspect of the patent application is the claims. The claims must cover sufficient subject matter that the essence of the invention cannot be used without the use falling within the language of the claims, but the claims cannot be so broad as to include the prior art or to be obvious in view of the prior art. The manner in which claims are viewed in the U.S. is different than

The analysis of the invention by the inventor and others such as his patent attorney may be a significant factor in obtaining a reilable patent. Knowledge of the prior art can come from several sources such as familiarity with the state-of-the-art by the inventor, his attorney, or other individuals associated with the invention. Prior art searches can also be conducted. The consideration of the prior art should also involve a consideration of the activities of the inventor which could prejudice the right of the inventor to a patent. The primary areas of exploration are whether the inventor disclosed the invention to the public in a printed publication, offered it for sale, or put it in public use more than one year prior to the date of filing the patent application. It is axiomatic that the better understanding of the invention and the prior art, the better the patent which will be obtained.

The True Inventor

Although the claims and description of the invention are viewed as providing the substance to the patent application from the legal and technical standpoints, there are other legal aspects to patent applications which can make the difference between an enforceable patent and an invalid patent. The designation of the inventor in the oath which must accompany the patent application has beeen one of the legal considerations used to invalidate patents.

The Constitution seemingly provides that only inventors can be granted exclusive rights to their inventions. The patent statute provides that the patent application must be filed by the inventor except if the inventor is dead, incapacitated, cannot be located, or refused to execute the patent application. If the designation is incorrect, the patent can be invalidated because the inventor did not himself invent the subject matter sought to be patented. The statute does provide that the designation of inventorship can be corrected if the improper designation of an individual as an inventor was by error and without deceptive intent. The statute provides that such incorrect designation will not be grounds for

separately, perhaps at different times and in different sections of an organization. The availability of patent protection may be denied since there was not a single, joint invention but rather a series of independent inventions. The policy adopted by the courts and by the Patent and Trademark Office is that the prior inventions in the series of inventions is prior art to the later inventions unless the prior inventions were made by the same individual or group of individuals. For example, one inventor makes an improvement in a machine and then, with the input of coworkers, that machine is further improved. The courts have held that the first invention can be prior art under the patent statute which states:

> "... before the applicant's invention thereof the invention was made by another who had not abandoned, suppressed, or concealed it." (35 USC, Sec 102(g)) (In re of Bass, 474 F.2d 12 76 (CCPA), In re Clemens, 672 F2d. 1029 (CCPA-1980)

This policy is discriminatory against U.S. research since the invention by a coworker in a foreign country is statutorily excluded from being prior art.

No longer is the inventor the sole individual who has obligations with respect to the patent application. The courts and the Patent and Trademark Office have established the policy that individuals substantively involved with the invention have a responsibility to disclose information which is material to the examination of the patent application to the Patent and Trademark Office. (37 CFR Sect. 1.56)

With team research, the determination of who is and who is not an inventor is difficult and subjective. A contributor may not be an inventor even though he did all the work. In a research team environment, the decision that certain members of the team are inventors and that other members are not, regardless of efforts expended, can be disruptive to the effectiveness of the team, particularly if rewards exist exclusively for

manufacturing process invention, the applicant must file another patent application. This application is termed a "divisional" application and receives the benefit of the filing date of the initial application. The divisional application is not required by statute to be filed before the initial application is patented or is abandoned, and then the application undergoes the full processing route in the Patent and Trademark Office. The result is that separate patents on related inventions can be granted at different times, each having a 17-year term, and the total period of effective protection can continue until the expiration of the latter patent.

Some have proposed that the term of the divisional patent expire at the expiration date of the first patent. There is a potential here for some inequity to the patent applicant since the divisional patent application must be processed through the Patent and Trademark Office. If the divisional patent is not obtained at the same time as the first patent, the patent owner will not receive a full 17 years of patent protection.

The present policy of the Patent and Trademark Office is to try and examine closely related inventions in the same patent application. However, some limit must be placed on examining more than one invention in a patent application to facilitate the retrieval of information from patents and to avoid an undue burden on the examiner and the Patent and Trademark Office.

In order to expedite the prosecution of the patent application in the event that the examiner believes that more than one invention is claimed the common practice of the Patent and Trademark Office is to request the applicant by telephone to provisionally elect one of the inventions for the purpose of examination. If the applicant complies, the examination of the application can continue without interruption. The efficiency of the examiner is enhanced when the examination can proceed with the first review of the application. If delays ensure, the examiner must spend time to refamiliarize himself with the subject matter of the application.

action against the patent owner to have the patent declared not infringed or invalid. If a wholesaler or retailer receives a threat of infringement, the manufacturer of the allegedly infringing goods can clear the air by seeking a declaratory judgement from the courts. Because the party filing the declaratory judgement action has the choice of jurisdiction, the perception that some courts are less favorable toward patents than others has also discouraged patent owners from threatening suit. The existence of the Declaratory Judgment Act, while muting the problem, has not wholly removed the potential of infringement suit threats against wholesalers and retailers for solely anticompetitive reasons (David L. Ladd, Business Aggressive under the Patent System, University of Chicago Law Review, vol. 26, No. 3 (Spring 1959) p. 353-375, 364 and 365)

Process patents (i.e., a view method for making a product) and method for use patents (i.e., a new use for a product) provide somewhat different considerations than do patents on machines, compositions of matter and manufactured articles. For process and method for use patents, the only direct infringer is the person using the patented invention.

For instance, if the patent claims a method for using aspirin for treating high blood pressure, the only direct infringer is the patent who uses aspirin for that purpose. From a practical standpoint, the patent rights would be unenforceable if the patent owner could only enforce his patent against the direct infringer. The patent statute, however, provides that whoever actively induces infringement of a patent shall be liable as an infringer. (35 USC Sec 271 (b)) Consequently, an aspirin manufacturer who advertised and dispensed its product for treating high blood pressure could be sued by the patent owner for infringement.

Process patents can provide the same type of problem to the patent owner. For example, a patent claims a process for making a chemical with a certain catalyst. A catalyst manufacturer could induce infringement of the patent through the selling of that catalyst.

right of individuals to make, sell and use unpatented items and the enjoyment of patent rights by patent owners. This balance was involved in a recent decision by the Supreme Court in Rohm & Haas case, the patent related to a method for using propanil, a chemical, as a herbicide. Propanil, itself, was unpatented. Dawson Chemical Company manufactured and sold propanil to farmers. Rohm & Haas could not practically enforce its patent rights against the users of propanil and therefore sued Dawson Chemical Company for patent infringement hoping to stop the infringement by stopping the source of the propanil. The Supreme Court found that even though Dawson directly violated no patent rights, propanil had no substantial use other than as an herbicide and its sale by Dawson constituted an infringement of the patent.

Another case exemplifying the balance is Deep South v. Laithram decided by the Supreme Court in 1972. (406 U.S. 518) In Deep South, the various parts of a shrimp deveiner were manufactured in the United States. The parts were then exported where they were assembled. Had the parts been assembled in the United States, Laitram Corporation's patent would have been infringed. The Supreme Court held that despite the clear intent that the parts were to be assembled, there was no contributing infringement since the assembling occurred outside the United States. From the standpoint of the patent owner, a sense of inequity exists, but on the other hand, the balance struck may prove beneficial to the economy since domestic companies are more able to compete in foreign markets where the product enjoys no patent protection.

A balance is also sought in determining whether a repair to a patented apparatus constitutes infringement of the patent. In general, if the repair is to preserve fitness for use affected by wear or breakage, it does not constitute an infringement, but a reconstruction would. Where the line between a permissible repair and a reconstruction is drawn is important. The replacement of the fabric on a patented convertible top, even though the fabric was a key element of the invention, was found to be a permissible repair. (Aro Manufacturing Co. v. Convertible Top Replacement

technology himself has received some criticism. (Floyd L. Vaughan, The United States Patent System, University of Oklahoma Press (Norman, Okla.) 1956, p. 254-6)

Typically the patent laws in foreign countries (including in almost all industrialized countries) require a "working" of the invention by the patent owner. The definition of working differs depending on the country; in some, the working can be nominal such as an offering of a license, and in others, working requires the manufacturing of the invention in the country. The consequences of not working also differs. In a few countries, the patent lapses if the invention is not worked, but for most, an individual wishing to use the patented tehcnology can compel a license to be granted at a reasonable royalty.

There is generally a strong sentiment held by patent attorneys and patent owners against adopting working requirements in the United States on the ground that it unfairly penalizes the patent owner thereby reducing the value of patents. It is also argued that they are unneeded since the Federal government has the right to use or manufacture a patented invention with the patent owner's remedy being "reasonable and entire compensation" for such use and manufacture. (28 USC Sec 1498) Thus, if the non-use of an invention was resulting in harm to national security or public health or welfare, a method already exists to protect the public interest.

The patent owner may also obtain damages to compensate for the infringement. The statute states that the damages are to be no less than a reasonable royalty and can be increased up to three times the amount of damages found. (35 USC Sec 284) The calculation of damages has typically been difficult. Prior to 1946 the patent statute allowed the recovery of both the patent owner's damages and the infringer's profits. In 1946 the statute was amended for the explicit purpose of eliminating profits as a means of recovery because of the complexity and expense involved in determining profits. (Senate Report No. 1503, 79th Cong. 2d Session, p. 2, 1946) As an example of the complexity in determining the infringer's

and may be enforced by lawsuit, if infringed. The legal title to a patent initially vests in the inventor, unless a contractual relationship, such as an employer-employee relationship, expressed or implied, between the inventor and a third party otherwise provides. In such cases equitable (as opposed to legal) title is in the third party until an assignment (transfer of legal title) is made pursuant to the terms of the contractual relationship.

Traditionally, the rights of the employee and employer are governed by the employment contract.[2] In the absence of an employment contract specifically treating the rights to inventions made in the course of the employment, a judically-fashioned policy exists.[3] According to this policy, when an individual is hired by an employer to invent, the invention made by the employee during his employment is equitably owned by his employer. However, if the employment is general and the individual is not specifically hired to invent the legal and equitable title to the invention vest in the inventor. In that case, the employer receives a "shop right" which means that the employer can use the invention without paying a royalty but has no patent rights.

The existing U.S. policy has been questioned with respect to whether the patent system provides sufficient incentives to inventors to invent and to promote their inventions. Concerns existed that inventive individuals were losing the incentive to invent, in part due to a dissatisfaction with the way they had been treated by employers, and that in the race to maintain technological superiority the United States was losing out to foreign countries, most of which provided special legal protection for the rights of inventors in their inventions and compensation to the inventors for their inventions.[4] By providing inventors rights in their inventions, it was thought that incentives to inventors to invent would be increased. However, there is concern over the consequences of government intervention that can affect the bargaining positions of the employer and employee.

return. Another reason is to avoid or settle patent litigation. The primary reasons for the patent owner not licensing or assigning patents are to maximize profits by direct manufacture and to avoid the burden of adopting a licensing program and administering license agreements.

From the standpoint of the patent purchaser or licensee, the primary reasons for buying or licensing a patent are to allow operations which would otherwise be blocked by the patent, to acquire a needed technology and thus supplement or minimize research and development efforts, and to avoid or settle patent disputes.

The transfer of technology through assigning or licensing a patent evolves from a business relationship. The agreement between the parties must make economic sense to each. In the final analysis, the arrangement is no better than the good faith intentions of the parties, and credibility and equity are essential on both sides to provide a sustaining relationship. Flexibility is also a prerequisite since the conditions surrounding the agreement, such as the state of the technology, competitive pressures, and market demand, are likely to change with time.

Negotiations for the transfer of patent rights usually involves consideration of the degree of exclusivity to be provided, the rights conveyed, which party has the ability to enforce the patent, the remuneration, and the duration of the agreement.

Degree of Exclusivity

The primary types of licenses are an exclusive license, in which the licensee has the exclusive right under the patent for at least a part of the patent term, and a non-exclusive license, which is simply a promise by the licensor that he will not sue the licensee for patent infringement. The non-exclusive licensee does not have the right to sue in his own name for infringement of the patent. This limitation exists primarily because the non-exclusive licensee's interest is likely adverse to the patent owner

The Remuneration

In most licensing agreements, the remuneration is at least in part by royalties, that is, a charge assessed per unit of production. For example, if the subject matter of the license is a method for determining the levels of cholesterol in blood and a kit for performing the method, the base could be the kit and the rate would preferably be a percentage of net sales of the kit. The amount of remuneration is a matter of negotiation with most of the bargaining chips usually residing with the prospective licensee, particularly when the invention is relatively undeveloped. This is not unfair since the fact that the licensee must take all the risks is taken into account. When a patent covers a product that has already been developed, the patent owner is in a better bargaining position.

In the case of the inventor in a university or non-profit institution, the policy of the institutions in virtually all cases provides that the inventor will share in the royalties received by the institution (often about 1/3) as part of the quid pro quo for the assignment of patent rights to the institution. Often the inventions are relatively undeveloped and the inventor's contribution to the technology is relatively significant. The trend has been towards granting the inventor an increased share of royalties which recognizes the importance of the inventor in the licensing process.

The corporate inventor usually does not receive a share of any licensing income. He may be awarded nominal amounts at the time of filing and at patent issuance. Some companies grant special bonuses to reward the inventor if the invention is truly significant. At first glance, it appears that the corporate inventor is being unfairly treated. However, the innovation process within the company requires the services of many other individuals and departments, such as development and marketing, to create a successful product. Hence, the inventor is but one of many key components in the development of a new product and should not be singled out for special financial rewards. Other factors such as stockholder

services. In establishing the balance, the courts have fashioned a policy with respect to certain activities which are deemed to be per se antitrust violations. Regardless of the competitive effect, these violations are illegal. The courts have also established a "rule of reason" with respect to other activities wherein the underlying effect of the activity on competition is evaluated in determining whether an illegal activity has occurred.

The rule of reason includes three important tests. First, the restriction or limitation must be ancillary to the lawful main purpose of a contract, such as a patent or know-how license. Second, the scope of the limitation must not be substantially greater than necessary to achieve the lawful main purpose. Third, the duration of the restraint must be reasonable.[9]

Time Limitations

A limitation in time can serve several purposes and is most meaningful in connection with an exclusive license. For example, the time limitation may be used in a public policy manner so that exclusivity occurs only for the period necessary to provide the incentives for commercialization. At the end of the exclusive period, the license can convert to a non-exclusive license. Also, the patent owner who does not have the capital or the manufacturing or market structure to commercialize an invention may enter into a time limited exclusive license, so that he may enter the market at some future time. During the period of exclusivity, the patent owner obtains royalties, which can be used to develop the necessary resources for commercialization, and then enter the market upon expiration of the period of exclusivity.

Geographic Area Limitations

Geographic area limitations can be particularly beneficial to the patent-owning business which cannot exploit an invention widely. The

sale in the U.S. would be prohibited. These international agreements with territorial restrictions are viewed by the courts under the rule of reason. The factors considered include whether the intent was a bold division of world markets, whether the restriction is appropriate for the technology, and whether the division is for a reasonable length of time.

Making, Using or Selling Limitations

The patent owner may grant a license to make a product in the U.S. under his patent but not to sell the product; the product to be either used by the licensee or exported for sale. An important judicially-created doctrine (the doctrine of exhaustion) is that once the product is sold, the patent owner can no longer control its further use or sale. Thus, the product once sold, can be used or sold without restriction by the patent holder.[10] To place limitations on the purchaser appears to be a per se violation of the antitrust laws. The rationale for such a principle appears to be a balance of the exclusive patent right granted to the inventor as a reward to stimulate innovation and the termination of that right after a first sale of the patented goods which provides to the inventor sufficient financial reward. However, the policy is not clear. The use restriction on a purchaser of goods that had notice of the restriction has been upheld.[11]

Limitations to Particular Uses

The patent owner may license a patent for a particular use. This type of license is referred to as a field of use license. For example, an invention may have several uses: an invented chemical may be an additive for an oral hygiene product and it may be an additive for a breakfast cereal. The patent owner may be a breakfast cereal manufacturer and not intend to develop and market the chemical for the oral hygiene product. By licensing the patent only for oral hygiene products, the public is provided with an innovation, the patent owner receives a royalty, and he has no competition on the product he manufactures.

Sublicensing Limitations

Providing the right to a licensee to sublicense a patent can diminish control of the use of the invention by the patent owner and can increase the administrative burden to the patent owner. The reasons for a licensee wishing the right to sublicense may be similar to those of a patent owner. For example, a sublicense can provide income. The licensee may wish to have the right to sublicense to avoid antitrust problems. The right to sublicense is desirable to avoid or settle patent disputes if the licensee has the right to enforce the patent. An infringer may negotiate a license with the licensee and in return not file or terminate a law suit.

Tying Limitations

There are antitrust limitations on the considerations which can be demanded through a license agreement. A "tie-in" arrangement in which a licensee is required to purchase or lease non-patented goods or services is per se illegal. The rationale is that tie-ins provide a means to leverage a legal patent monopoly into a monopoly of something which is not patented. However, it has been argued that tie-ins can be pro-competitive, particularly for a small business for which assured sales of the non-patented, tied product may assure the viability of production facilities and thus be better for the business's survival than royalty income.[13]

Another type of tie-in can exist. A product may have several uses, one of which is patented. Under the statute[14] the patent owner can refuse to license his patent to purchasers of the product from sources other than the patent owner. Thus, a license to use a chemical for a herbicide can be denied except to purchasers of the patent owner's unpatented chemical.[15] Similarly, a patent owner can prohibit his licensees from marketing the patented chemical in combination with another chemical.[16]

Tie-out restrictions in which the licensee is restricted in dealing with the products of a competitor to the patent owner are similarly per se illegal.

from challenging the validity of the patent. This policy was reconsidered and reversed on the grounds that licensees may often be the only individuals with enough economic incentive to challenge the patentability of an inventor's discovery. If they are muzzled, the public may continually be required to pay tribute to would-be monopolists without need or justification.

Thus, the public policy as determined by the courts is that the interest in ensuring that ideas that should be in the public domain should be freely available pre-empts the enforcement of a contract which is contrary to that interest.[17]

The relationship between the patent owner and the licensee while the validity of the patent is being contested can be important. The judicially evolved policy is that the licensee can challenge the validity of the patent, suspend royalty payments, and continue to operate under the license until validity has been determined. The rationale enunciated for the policy is that if royalty payments were required, it would be in the patent owner's economic interest to delay final adjudication and use the continuing royalties to help defray the cost of litigation. The licensee would have little incentive to challenge the patent if there were a risk of the license being terminated or if royalty payments would still be required. The courts have further indicated that unless the licensee is insolvent, the licensee need not pay royalties into an escrow account during the period that the validity of the patent is challenged.

In establishing this policy, the patent owner often perceives that he is placed in a disadvantageous "no-win" position. If the patent is declared invalid, he has nothing. However, if the patent is declared valid, he recovers nothing but the royalties which he otherwise would have received and he has incurred the expense of litigation. This policy holds the potential for abuse by the licensee, particularly over a patent owner who may not have the resources to fully defend his patent in litigation. The licensee is provided with the economic leverage to use the challenge of patent validity to reopen negotiations for a reduced royalty.

Patent Pooling

Where the combined or pooled patents are competing such that the purpose is to eliminate competition among them, the practice is considered per se illegal. On the other hand, if the pooled patents are such that one is subservient to the other, there is no restraint of trade and no elimination of an alternative use.

Volume Restrictions

Volume and amount restrictions were at one time considered by the Department of Justice to be per se illegal; however, the present view is that such restrictions will be viewed under the rule of reason.

Price Fixing Restrictions

Although it is legal for a licensor to require a single manufacturing licensee to adhere to the licensor's price schedules, any further restriction (two licensees) is considered a per se illegality.

Section III
Patents and Assistance for Innovation

Introduction

The patent system has two broad functions that promote the progress of "science and useful arts." First, the potential profit obtainable through the patent monopoly stimulates innovation. Second, the disclosures of inventions in patents increase the knowledge base, providing information and ideas that can lead to further invention and hasten the development of new technology.

This section explores the assistance for innovation provided by patents from two fronts: first, patents as a technical information resource; and, second, the types of resources that exist to assist the fledgling inventor or small business develop a patented invention into an innovation.

Patents as a Source of Technical Information

Patents are a unique source of scientific and technical information. The Patent and Trademark Office estimates that 80 percent of the technology disclosed in patents is not disclosed anywhere else. (OTAF) For this information to be meaningful, it must get into the hands of those who can use it and the information in the patent must be presented in a manner which is useful.

Patents have typically not been in the mainstream of scientific and technical literature. Public awareness of the value of information contained in patents was lacking and searching patents was time-consuming, inconvenient and expensive. Further, patents have been criticized as obfuscating valuable technical information. (See, for instance, DPR,

Subcommittee on Innovation, p. 125-127, for recommendation to improve the value of patents through accessibility of patents, dissemination of information, and providing relevant information in patent documents.)

Patents, being legal documents, must place priority on assuring that the invention is fully protected. Hence, the type of presentation will be different than that found in technical journals and texts. Moreover, patent applications are generally filed at the early stages of the development of an invention -- often before the most relevant information for innovation is discovered.

Obtaining access to relevant patents is a major hurdle. Access can be through the Patent and Trademark Office, the Patent Depository Libraries or commercial services.

The Patent and Trademark Office:

The primary resource provided by the Patent and Trademark Office is the classified patent search file. This file is arranged by subject matter classes (350) which are further broken down into subclasses (108,000). Two search files exist, both are at the Patent and Trademark Office facilities in Arlington, Virginia. The examiner's search file is spread throughout the facilities such that relevant subclasses are proximate to the patent examiners examining patent applications in that technology. This file contains U. S. and foreign patents and some technical literature (a total of about 25,000,000 documents). The second file is the public search file which is centrally located. The public search file contains only U. S. patents (about 14,000,000 documents). The public, however, is granted access to the examiners' search files.

The searcher must locate the relevant subclasses to search. There are several reference tools available to aid in locating the proper subclass to search. The Index to U.S. Patent Classification is an alphabetical listing of the subject headings, both class and subclass. The Manual of

accessed in geographical areas other than the nations capital, the patent depository libraries have thus far not been able to provide comparable services. First, the completeness of the patent files vary widely among the libraries with some having only the most recent patents. Second, the patents are arranged in numerical order. Thus the collections are only useful for recovering a previously known patent. The exception is Sunnyvale, California, patent depository library which has patents in select technology areas arranged by subject matter classification, but the classification arrangement lacks the breadth and refinement of the Patent and Trademark Office collection.

A problem common to all public depository libraries is the lack of adequate funding on a predictable basis. Maintaining ever these limited patent files is a major expense. By law, the Patent and Trademark Office is to sell a complete set of the patents issued each year for fifty dollars. But the real cost to the libraries of the program has been shelf space, binding, and maintenance which can cost tens of thousands of dollars per year. Accordingly, many of the patent depository libraries have opted to discontinue the program with the Patent and Trademark Office and purchase patents on microfilm.

There are two, one-time only programs to assist the patent depository libraries. The Patent and Trademark Office is making its computer files that are available in the public search room available to the patent depository libraries. These data bases provide information about the classification system. $350,000 has been allocated for this program. (Patent Depository Library/Patent and Trademark Office Conference IV, June 9-11, 1981)

The National Bureau of Standards has initiated another program to upgrade the patent services of three Patent Depository Libraries; Sunnyvale, Boston Public, and Georgia Tech. The purpose of the grant money ($75,000 per year for two years for each library) is to foster technological innovation in the energy field by individuals and small

Sources of Assistance for Technology Commercialization

Background

There was a surge of interest in innovation, technology and the commercialization and utilization of federally-held technology in the early 1970s. This led to a variety of Federal, State and private programs designed to give assistance to individuals (i.e., inventors, innovators, entrepreneurs) and smaller businesses with inventions or technologies they wished to evaluate, develop, sell or license.

Some of the initial impetus was evidenced by President Richard Nixon's message to Congress (March 1972) which established two specific programs intended to stimulate innovation: the National Science Foundation's Experimental Research and Development Incentives Program (RDI) and the Department of Commerce's Experimental Technology Incentives Program (ETIP). Shortly thereafter, the National Bureau of Standards was charged with assisting individual inventors and smaller businesses by evaluating technologies and forwarding those with promise to the Energy Research and Development Administration (ERDA -- now the Department of Energy) for funding support.

As Federal efforts grew and became more visible, some states also became involved in assisting small businesses; in some instances, these state efforts were specifically directed toward smaller, technology-based, growth oriented businesses. Recently, some organizations in the private sector have begun to focus on commercializing technologies and assisting inventors as well as smaller businesses.

Interestingly, just as these efforts were gaining momentum, and the knowledge base was expanding, the Federal government began to cut the budgets of its own programs, many of which are being phased out.

- To encourage research in areas that can lead to improvements in economic growth, energy supply and use, productivity, and environmental quality;

- To promote international cooperation through science;

- To develop and help implement science education programs that can better prepare the nation for meeting the challenges of the decades ahead.

The Small Business Administration (SBA) was created in 1953 to: "aid, counsel, assist and protect the interests of small businesses; insure that small business concerns receive a fair proportion of government purchases, contracts, and subcontracts, as well as of the sales of government property; make loans to small business concerns, state and local development companies, and the victims of floods or other catastrophes, or of certain types of economic injury; license, regulate, and make loans to small business investment companies; improve the management skills of small business owners, potential owners, and managers; conduct studies of the economic environment; and guarantee leases entered into by small business concerns as well as surety bonds issued to them."

The Energy Research and Development Administration (ERDA, now DOE) was established by Executive Order in 1975 in an effort to reorganize and consolidate Federal R&D activities related to energy resources; its purpose is to "develop and increase the efficiency and reliability of use of all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position in regard to international trade, to make the national self-sufficient in energy, to advance the goals of restoring, protecting, and enhancing environmental quality, and to assure public health and safety."

These agencies have been briefly described because they conduct the primary activities involving technology commercialization and inventors and

Product Development Corporation (CPDC) was established by public law in 1972 as a state agency and was capitalized with $10,000,000 in state bonds. This program was designed to provide risk capital to Connecticut firms for product development. No grants are provided for working capital or acquisitions of land, equipment or buildings, but CPDC typically provides grants of up to 60 percent of the development costs of a new technology by an existing firm with the firm providing the remaining capital necessary to bring the technology to market. In return CPDC receives a royalty of 5 percent of sales until the grant has been repaid five times when the royalty is reduced to one-half of one percent.

The Massachusetts Technology Development Corporation (MTDC) was established in July 1978 by public law. It operates as a state agency with the purpose of injecting risk capital into early state ventures unable to obtain capital alone; that is, it provides seed capital for small, technology-based companies in Massachusetts in start-up or expansion stituations. The seed capital is provided as unsubordinated debt in amounts ranging between $100,000 and $250,000 and at rates below prime interest rates. The payback period is five to seven years. The capital provided may be used for development, refinement and commercialization of technology and other working capital needs. The states of Maine and Alaska have instituted similar programs and other states are attempting to initiate programs of this nature.

Other state programs are intended to provide direct services to investors and enterpreneurs. Typical of these is New Jersey's Office for Promoting Technical Innovation (OPTI) in the Department of Commerce and Economic Development. This program was established by public law in 1978 and became operational in 1979. It is specifically designed to aid and assist independent inventors, entrepreneurs and small business involved in technical areas. Services provided included:

- Patent assistance (e.g., recordkeeping instruction, background information, patent search and filing assistance);

evaluation and development services. The type and quality of services as well as their cost varies considerably from one organization to another. Some organizations have preyed upon individual inventors, obtaining fees from inventors, through deceptive practices. (See FTC v. Raymond Lee Organization) Several states have passed legislation prohibiting these practices.

A few universities with schools of engineering will contract to evaluate a technology that falls within their range of expertise and many professors can be hired as consultants. The same is true of research organizations.

Business Planning and Initiation: Services in this area range from marketing to start-up to new project development to management services. Many universities, private consulting firms and seminar groups provide assistance in this area. Also, the large accounting firms have initiated small business units that focus on identifying high growth potential firms with which to work. Few of these focus specifically on the individual or small business with a technology to commercialize -- rather they are directed at the business community in general.

Universities that participated or are participating in federally funded programs or those with curricula in small business and engineering are likely to be resources for individuals and small businessmen with technologies wishing to initiate new ventures. Such corporations as Exxon, Scientific Advances, Inc., and General Electric have new venture groups which provide assistance when they are interested in the business plan.

Licensing: Licensing activities in the private sector consist of a group of companies that provide a listing of technologies available for license; some of these also provide technical services to accomplish technology transfer. For example: Dr. Dvorkovitz and Associates is a firm with a computer data base containing "market-ready inventions and trade secrets"; Control Data Technotec; Worldtech, Inc., a subsidiary of Control

APPENDIX

Brief Overview of Several Federal Programs to Assist Innovation

Technology Commercialization Program
Department of Commerce

Background

The Technology Comercialization Program (TCP) was established in 1976 as a means of mainstreaming minority businessmen into the technology-based, growth business community. Presently there are eight operational Technology Commercialization Centers (TCCs) located throughout the U.S. and a National Office which coordinates TCC activities.

The TCP operates on four basic principles:

1) The process must be profit oriented.

2) It must be set primarily in the private sector with the government role one of continuing coordination and resources development.

3) The system must utilize the normal business process of the participants to the greatest extent possible.

4) The cost to the minority firm in determining product potential must be kept at the absolute minimum.

The TCP had developed a national network of public and private sector resources which are brokers with projects involving technologies with commercial potential. Thus, the private sector works closely with the government in order to commercialize technologies and involve minorities in that process.

Target Audience

The target audience for this program is anyone with a technology that can be commercialized. It is required that a minority inventor, investor, innovator or businessman benefit from the project.

Services

Four services are provided for TCP projects:

- Market/technology evaluation
- Adaptive engineering to meet market needs
- Demonstration of market-ready products
- Assistance in acquiring capital for market-ready products

In addition to these clear cut services, the TCP also provides access to many large corporations and public agencies.

Innovation Center Program
National Science Foundation

Background

The Innovation Center Experiment was begun in 1974 as part of the Experimental Research and Development Inventives Program.

Innovation Center objectives are:

- To increase the quantity and quality of technological entrepreneurs/inventors from the university environment.
- To establish and increase the perceived value of the Innovation Center to the extent that it can become self-supporting within five years.
- To increase utilization and/or commercialization of university and community held technology.

Target Audience

The target audience of this program are university students interested in technology innovation. The center at the University of Oregon (now closed) focused on inventors and the outreach was nationwide.

Services

The Innovation Centers are required to offer a minimum of one course dealing with technological innovation and to assist, in a laboratory environment, those projects which meet the individual university's selection criteria.

Appropriate Technology Small Grants Program (Discontinued)
U. S. Department of Energy

Background

This program was established in 1979 in response to public concern about U.S. dependence on large-scale, capital and energy-intensive technology. The Department of Energy was authorized to provide grants for the development of energy-related, small-scale technologies appropriate to local needs and skills.

The objectives of the program are:

- To make more energy-related technology options available in the United States.
- To provide access to DOE for individuals and groups who would not otherwise have contact.
- To make available technology not otherwise accessible to DOE.
- To further national efforts in promoting the use of renewable resources and conservation of non-renewable resources.

Target Audience

The target audience for this program includes individuals, local nonprofit organizations and institutions, state and local agencies, Indian tribes, and small businesses. The Department of Energy has simplified the award process to attract this group.

Services

Funding, up to $10,000, is provided for developing new concepts ranging from energy sources to new applications of existing procedures or systems. Awards, up to $50,000, are provided for the systematic and practical development of a concept into a useful technology including design, assembly and laboratory-scale testing. Demonstration projects are funded up to $50,000 to test a technology under operating conditions to show its commercial application is technically, economically and environmentally feasible.

Office of Government Inventions and Patents
National Technical & Information Service (NTIS)
Department of Commerce

Background

In 1973 the National Technical and Information Service was charged with the task of announcing the availability of government patents for license and in 1976 with actively seeking to license such technologies.

Via interagency agreements with most of the Federal agencies engaged in research, program personnel collect, publicize and, in some cases, evaluate and attempt to license inventions of Federal employees which are patented or on which a patent is pending. This program is expected to become self-supporting.

Target Audience

The target audience for licensing and publication activities are smaller, large and medium sized firms which may incorporate the inventions into their product line. The firm must exhibit the ability to commercialize the technology.

Services

Two services are provided. The first is achieved via weekly publications listing and describing the patents reported to the office. The general publication is titled "Government Inventions for Licensing" and there are some 26 others focusing on specific science/technology areas.

The second service involves transfer of the patent from the owning agency to NTIS, development of a plan to promote the invention, evaluation of the technology focusing on market potential and development of a brief description of the technology ("Tech Note") for distribution to the trade press. For the most promising of these, NTIS will contact industry directly in an effort to interest firms in licensing the technology. If this effort yields results, either an exclusive or non-exclusive license may be negotiated. All licenses bear a running royalty and execution fees.

Energy-Related Inventions Program
U.S. Department of Energy and
U.S. Department of Commerce
National Bureau of Standards

Background

The Energy-Related Inventions Program was established in 1974 with the specific purpose of evaluating promising energy-related inventions with particular attention to those inventions submitted by individual inventors and small companies for the purpose of obtaining direct grants from the Department of Energy. It is a cooperative program between the two departments with the National Bureau of Standards (NBS) conducting technology evaluations and the Department of Energy (DOE) staff funding projects to bring them one step closer to commercialization.

Target Audience

The target audience for this program is anyone with an energy-related invention.

Services

Services provided include:

- Evaluation of the technology
- Funding to the holder of the technology in order to move it toward commercialization.

The evaluation conducted by NBS is performed according to a specific procedure which utilizes both in-house evaluators and some 300 outside evaluators. Inventions recommended by NBS are reviewed for funding potential by the DOE staff and a negotiation is conducted with the inventor to determine the nature and extent of funding which will be provided. Hence, the funding could be for market survey, technology development, concept development or product testing, among others. This DOE service is often described as a means of providing inventors with the seed capital necessary to develop the technology to the point where it can be financed through regular channels, licensed or sold.

In addition to the foregoing, the NBS conducts state-of-the-art searches and documentation efforts for those technologies most frequently received for evaluation. The NBS and DOE jointly sponsor a series of inventor conferences where inventors can obtain information regarding how to achieve commercialization for their invention via licensing, sale or new venture initiation.

Small Business Innovation Reserach Program
National Science Foundation

Background

This program was established in 1977 and provides phased grant awards to support advanced research on important science and technology problems with incentives to pursue commercial applications and technological innovation from NSF sponsored research.

The program will support only certain research areas. It will not fund product development, technical assistance, or pilot-plant efforts. It normally will not support clinical research nor does it fund market, classified, or weapons-related research.

Target Audience

This is a highly competitive program for small firms with strong research capabilities in science or engineering; generally speaking this is not a program designed to reach independent inventors without a strong research/scientific capability.

Services

The program will provide up to $30,000 funding to conduct advanced applied research (Phase I) on an innovative idea or approach for a period not exceeding six months. Those successfully completing this first phase, may apply for a Phase II grant to support an intensive research project not to exceed 24 months of support for two or three professional man years (i.e., about $200,000). Phase III, a development phase, is conducted by the small business, is supported by a third party (i.e., larger company or risk capital organization) and focuses entirely on commercialization.

Data Corporation, (domestic and international data bases listing patents available for license); large corporations like General Electric Company and Boeing Corporation have divisions responsible for licensing and technology transfer activities; and University Patents, Inc., (participating universities offer patents for license through this company).

Conclusion

There are a variety of Federal, State and private programs that can offer assistance to individuals and small business wishing to develop new technologies and the foregoing discussion, while not being comprehensive, provides an indication of what has and is being done. But as is apparent, the reach of many of these programs, both in terms of clientele and types of assistance, is limited.

- Technology evaluation conducted in-house and externally;

- Market evaluation to determine if the need for the technology is real;

- Occasionally OPTI will invest in a technology in return for a royalty; such investment may range from $10,000 to $100,000;

- Technology transfer services -- projects with promise are advertised in the media and via direct mail as available for license to New Jersey firms; also, OPTI acts as an agent for foreign technology available for license to firms in the state and attempts to make university-held technology available for license.

Private Sector Activities

There is a broad range of services available from the private sector to assist individuals and smaller businesses, particularly in technology evaluation and development, business planning and initiation, and licensing. It should be noted, however, that while many of these private sector activities center on providing information and assistance to fledgling entrepreneurs in general, there is a dearth of activities focusing on inventors and technological entrepreneurs. Nevertheless, the American Patent Law Association has a listing of more than 500 companies which render development assistance to inventors. (American Patent Law Association Journal, March-April 1982, p. 239-246)

Technology Evaluation and Development: Assistance in this area includes evaluating the invention, developing and testing prototypes and readying the technology for production.

An innovator or small business may take a technology to a broker for evaluation, or to a university or to a research institute to obtain both

smaller businesses. It should be noted that other Federal agencies, such as the Department of Defense, Department of Health and Human Sevices, Department of Interior, and Department of Transportation, conduct programs that may be described as research, technology transfer, technology utilization and technology development; however, as previously mentioned, relatively few programs focus specifically on the combination of technology and inventor or smaller business assistance.

The programs of the lead agencies can be divided into those designed to provide direct assistance from the agency and its regional offices, and those providing funding to a third or intermediary organization in order for that organization to provide services to those with technologies to develop, license or sell. The Small Business Administration and NTIS take the former "direct" approach, while the National Science Foundation and the Department of Commerce take the later "intermediary" approach. One program, the Energy-Related Inventions Program, is a joint program between the Department of Energy and the Department of Commerce, National Bureau of Standards which combines the two approaches.

Examples of the more significant Federal progrms and their approaches are provided in the Appendix. Some of these programs have been discontinued.

State Programs

Like the federal government, a number of states have undertaken to support a variety of programs designed to stimulate small business and economic development. State and local governments that believe there is a causal relationship between technology development and economic prosperity also support special programs designed to stimulate the development of technology-based firms.

Some states have created organizations designed specifically to provide capital for high risk projects. For example, the Connecticut

Federal Programs

For many years, Congress and the executive branch have made it a responsibility of the federal government to assist and/or stimulate small business, and to stimulate innovation, but not necessarily to combine the two functions. There have been only a handful of programs designed specifically to stimulate innovation and the development of technology-based, smaller businesses. Some agencies, such as those described below, have made some efforts in this direction.

The Department of Commerce was created in 1913 with the mission "to foster, serve, and promote the nation's economic development and technological advancement." The following specific agencies have programs concerned with science and technology: Patent and Trademark Office, National Bureau of Standards (NBS), and National Technical and Information Service (NTIS).

The Patent and Trademark Office was established "to administer the laws and regulations governing the issuance of patents and trademarks and to adjudicate resulting questions." The NBS is concerned with strengthening and advancing the nation's science and technology and facilitating their effective application for public benefit. NTIS was established in 1970 to "simplify and improve public access to Department of Commerce publications and to data files and scientific and technical reports produced by Federal agencies and their contractors. The agency is obligated "... to recover its costs from sales to users."

The National Science Foundation, created in 1950, has the following purposes:

- To increase the nation's base of scientific knowledge and strengthen its ability to conduct scientific research;

businesses. Each new "Inventor Information Resource Center" will assist this clientele in several ways: provide state-of-the-art information in science and technology, provide guidance with the inventor disclosure form, provide information on marketing and production, and finally, information on government programs offering assistance to the inventor.

Private Sector Activities:

The private sector has played an important role in enabling the public to retrieve information from patents. One type of private sector activities are abstract services such as Chemical Abstracts Service, Derwent (World Patent Index), IFI/Plenum Data Company and Pergamon that publish abstracts of patents in subject matter arrangements. Many of these services include foreign patents and technical literature in their reports. Also, many of these services can be retrieval by computer. There has been a growth in the number of companies providing these services. While the ease of retrieval of patent information permitted by these services is believed to have led to a more extensive use of information contained in patents, not all the information contained in patents is available through these services.

Another type of private sector activity provides specialized reports on patent information. This includes professional patent searchers located in the vicinity of the Patent and Trademark Office who are contracted, often by patent attorneys, to conduct patent searches. Also, several companies publish collections of patents, or abstracts of patents, in certain technology areas. For example, Omec Publishing Company of Great Falls, Virginia, publishes a biweekly "Biotechnology Patent Digest."

Classification lists the class schedules in detailed outline form. A separate publication, Classification Definitions, provides definitions of class and subclass listings found in the Manual of Classifications.

Another resource provided by the Patent and Trademark Office is the Official Gazette, a weekly publication of the Patent and Trademark Office (through the Government Printing Office) which contains a brief description (abstract) and drawing of each new patent recently issued.

The Scientific Library at the Patent and Trademark Office is another source of technical information. The Library, open to both patent examiners and the public, offers many information resources, including more than 12 million foreign patents from 60 countries arranged in numerical order or by publication date. The library also maintains related technical and scientific literature of use in patent searches.

Reports prepared by the Office of Technology Assessment and Forecast and entitled Patent Profiles presents information about patent activity and trends in various areas of technology, such as synthetic fuels and solar energy. Each issue contains data on patent numbers, titles, active companies, and independent inventors in a particular technology area, as well as levels of patenting by foreigners, and profiles of patenting by U. S. residents by regional breakdowns. The Office of Technology Assessment and Forecast also publishes Technology Assessment and Forecast reports about one a year. The Office prepares special reports, tailored to individual needs, from its computer-based files on a cost reimbursable basis. During fiscal year 1981, the Office prepared 190 specialized reports.

Patent Depository Libraries:

In addition to the patent files housed at the Patent and Trademark Office facilities, there are 37 patent depository libraries located throughout the United States. While a need exists to enable patents to be

13. Bowman, W.S., Patent and Antitrust Law, A Legal and Economic Appraisal, University of Chicago Press (Chicago, 1973)

14. 35 USC Sec 271 (c) and (d)

15. Rohm & Haas v. Dawson Chemical Co.

16. Ciba-Geigy

17. Lear v. Adkins, 395 US 653 (1969)

18. Transparent-Wrap Machine Corp. v. Stokes & Smith Co., 329 US 637 (1947).

Footnotes

1. 35 USC Sec 261

2. U.S. v. Dubilier Condenser Corp., 289 U.S. 178 (1933)

3.

4. Neumeyer, The Law of Employed Inventors in Europe, Study No. 30, Subcommitee on Patents, Trademarks and Copyrights of the Senate Committee on the Judiciary (1963).

5. Gullette, R.L., State Legislation Governing Ownership Rights in Inventions Under Emloyee Invention Agreements, Journal of the Patent Office Society, vol. 69 (December 1980) p. 732-760.

6. Waterman v. McKenzie, et al., 138 US 252 (1891).

7. 26 USC Sec 1235

8. See, for instance, S. 1657 and H.R. 4564, 97th Cong.

9. Finnegan, M.B., "How the Rules of Competition Affect Licensing in the USA", in The Law & Business of Patent and Know-How Licensing, Third Edition, edited by B. Finnegan and B. G. Burnsrold, Licensing Executives Society, Inc. and Patent Resources Group Inc., (Washington, D.C., 1975) p. 14-18.

10. Adams v. Burks, 84 US 453 (1873).

11. General Talking Pictures Corp. v. Western Electric Company, 305 U.S. 124 (1938)

12.

Improvements and Grantbacks

Improvements are the grant of rights by a patent owner to a licensee to additional patents considered to be improvements upon the licensed invention. Thus, the licensee is assured of obtaining the best technology developed by the patent owner. Grantbacks can be considered a form of remuneration to the patentee and provide for the licensee to grant to the patent owner rights under patents obtained by the licensee which are considered to be improvements on the licensed invention. The grantbacks are usually by nonexclusive license. Although no court ruling has occurred, grantbacks by exclusive license, or by assigning the patent have been considered per se illegal on the belief that they tend to perpetuate a monopoly of the licensor and discourage innovation by the licensee.[18]

When the patent owner is licensing a patent in a new area of technology, the issue of improvements and grantbacks becomes important because of the potential for developing patentable improvements. Improvements and grantback requirements can enhance the likelihood that improvement inventions will be brought to practical application; however, they can act as a disincentive for research if the researcher believes that he will lose his patent rights. Also, if the grantbacks and improvements are not provided to licensees, the group having the right to practice the invention of the improvement patents may be able to develop a dominant market position. In essence, the parties negotiating the improvement and grantback aspects of the basic license agreement are establishing policies which can affect innovation and other licenses of the basic patent.

Mandatory Package Licensing

A package license is a license in which the licensee is licensed under more than one patent, under circumstances such that the licensee is coerced by the licensor to accept more patents covered by the package than he wishes. To the extent that a package license is for the convenience of the parties and is not mandatory on the part of the licensor, the license will be lawful.

Other Limitations

Requiring a licensee to pay royalties based on the total sales of a type of product regardless of whether they use the invention is per se illegal.

The collection of royalties based on sales after the expiration of the patent is also per se illegal; however, the collection of royalties, after the expiration of the patent but based on the sale of products prior to the expiration patent is permissible. There is concern that this policy may delay making the invention available to the public. An incentive may be provided to the licensee to hold back production until the expiration of the patent.

Termination

Another important consideration in a licensing agreement is the conditions under which either party may terminate the agreement.

Failure to have the right to terminate in the event that a licensee elects not to pay royalties could put the licensor in the awkward position of allowing a licensee to challenge the validity of the patent while retaining the right to sell the licensed product. Failure to pay royalties has been construed by some courts not to be a material breach or default.

Combined with the question of termination is the issue of the licensee's right to challenge the validity of the patent. Competing policies exist. On the one hand, the law of contracts forbids a purchaser to repudiate his promises simply because he later becomes dissatisfied with the bargain he has made. On the other hand, federal law requires that all ideas in general circulation be dedicated to the common good unless they are protected by a valid patent. The courts have considered these competing policies and first established the doctrine of "licensee estoppel" in which the patent owner could by agreement bind the licensee

Field of use restrictions can result in antitrust concerns. Absent patents, agreements which divide customers or markets are per se illegal. When a patent is involved, a rule of reason standard is adopted since the effect can be to give the public the full use of the invention and provide new products. Particular benefits can occur when the patent owner is a small business and the royalties from the field of use license enhance the patent-owner's competitive position. Situations can exist in which a field of use license may not be in the public interest.

For example, can a licensor who owns a patent for a machine and a method for using that machine to make semiconductor chips license a manufacturing licensee to make the machine and require the licensee to sell the machine to purchasers who take it with notice that to use the machine it is necessary to obtain a license under the method from the patentee? Is the restriction on the purchasing licensee valid?

If the licensor cannot extract a royalty on the production of chips using his method he has no incentive to license the machine for manufacture or to sell the machine to others. That, in turn, would limit its use and its potential benefit to the public assuming that the resultant chip has superior characteristics either with respect to performance or cost. Such an analysis could result in a determination of a pro-competitive effect and hence the restriction would appear to be appropriate and beneficial to the public. Notwithstanding, few patent licensing experts would recommend this type of restriction in view of the exhaustion principle.

Although questions regarding the antitrust implications of field of use licenses exist, the licenses are sought by the government for Federally-owned patents as a mechanism to limit the patent license rights to only those which are reasonable and necessary for the practical application of an invention for the benefit of the public.[12]

business limitation may be due to the lack of a market and service structure throughout the U.S. or due to the costs of transportation. For example, a concrete manufacturer who obtains a patent on an improved process for making concrete may not be able to economically justify making the concrete and shipping it several hundred miles. By a territorially-limited license, others could use the process and not interfere with the patent owner's exploitation in the market area which he could service.

A conflict between the patent and antitrust laws can arise from geographic area limitations. Except for the patent law, horizontal agreements between competitors to divide territories is per se illegal. On the one hand, the policy established by Congress in the patent laws provides for spreading the potential benefit of an invention throughout the United States. The hypothetical cement manufacturer would likely be unwilling to license his patent if the licensee could compete with him. Without licensing, other regions of the country would not benefit from the invention. The problems of transportation were, however, considerably more difficult in the 19th century when this provision was first enacted. Now, fewer companies and products find that their scope is territorially limited.

On the other hand, the application of the per se doctrine through judicial policymaking to the division of territories by competitors arises from the concern that competition is thwarted, resulting in higher costs to consumers.

Commonly, territorial restrictions in licensing are international in nature. That is, the patent owner has obtained patents in more than one country and divides the rights by country. For example, the patent owner can grant world-wide rights to manufacture but retain exclusive rights to sell the licensed goods in the U.S. The patent owner would have no competition in the U.S. and could expect his products to be sold in other countries. This arrangement would benefit the patent owner, who received royalties, and the U.S. balance of trade since imports of the product for

interest, company morale and the fact that the inventor is being paid to develop new products, must also be considered when assessing treatment of the corporate inventor. If the corporate inventor shares in the profits of the company, it most likely will occur through equity participation rather than royalties.

Minimum payments and advance payments are often required by the patent owner to provide some incentive for the licensee to use the invention. Incentive can also be provided by a contractual provision requiring the licensee to exercise his best efforts to bring the invention to the market place. The care with which the agreement is drawn may be critical in determining the effectiveness of a requirement that the licensee exercise his best efforts, particularly when the invention is in an embryonic stage. The use of milestones in the licensing agreement can be helpful in determining whether best efforts are being exercised. Further, an early determination of whether best efforts are being expended may be essential to accomplish commercial fruition of the invention. Because the patent term continues to run, a late decision to terminate the agreement for failure to exercise best efforts may result in too little of a patent term remaining to provide incentive to another to license the patent. The courts have recognized the licensee's obligation to perfect and market a patented product under licensing agreements and have awarded damages for failure to do so.

The Rights Granted

The patent right is a bundle of divisible rights. The patent owner can select rights from this bundle which are limited by time, geographic area, making or using or selling, and by a particular use. The patent owner can also limit the right to enforce the patent and the right to a licensee to sublicense the patent. There are some limits on the ability of the patent owner to divide rights in a patent. The balance has been established by the interaction between the patent and antitrust laws, both of which seek to stimulate economic growth and the production of goods and

since the only benefit received by the licensee is freedom from being sued for infringement. The exclusive licensee, however, because he enjoys the full exclusivity benefits of the patent, has an interest in upholding the patent and is allowed as a matter of right to enforce the patent.

There are several types of license agreements which fall between an exclusive and non-exclusive right. The licensor may reserve the right to practice the invention, meaning that both licensor and licensee can "make, use and sell" the invention. Although sometimes termed an exclusive license, this usually is known as a "sole" license.

The term "partially exclusive license" has been coined to describe (1) an exclusive license where the exclusive right to less than the entire patent is granted or (2) a license where the number of licenses under the particular invention is limited.

The grant of an exclusive license is desirable for the licensee. Under the present U.S. tax code, an exclusive license to the entire patent for the full life of the patent offers advantages to the licensor because the transfer provides for capital gains treatment.[7] Thus, this Federal policy appears to favor the grant of exclusive licenses to the entire patent for its full life.

However, Federal practices and proposed legislation regarding the licensing of Federally-owned patents appear to favor the grant of more limited licenses.[8] This policy provides that the patents be used in a manner consistent with the public interest and provides only such exclusivity necessary to obtain the practical application for the benefit of the public. Accordingly, the period of exclusivity may be limited to that required for a licensee to develop a commercial product, recover development costs, and establish a lead position in the market.

State and Federal legislation can affect the rights of an employed inventor and the inventor's employer. To date, California, Minnesota, North Carolina, and Washington have enacted legislation which prevents an employer from asserting rights to all inventions made by their employees. In general, these statutes prevent an employer from contractually requiring an employee to assign his rights to an invention when the employer did not contribute resources such as equipment or trade secret information; when the invention was developed by the employee entirely on his or her own time; and when the invention does not pertain to the employer's actual or reasonably anticipated business.[5] Congressional legislative proposals have also been made to restrict the ability of an employer to claim rights to inventions made by employees. (H.R. 4732, 97th Congress)

B. THE ASSIGNMENT AND LICENSING OF PATENTS

The patent law allows the patent owner to assign, to license and to grant territorial rights in the United States. An assignment has been judically defined as the transfer of:

a) the whole patent, comprising the exclusive right to make, use and sell the invention throughout the United States;

b) an undivided part or share of that exclusive right; or

c) the exclusive right under the patent in a part of the United States.

Anything short of an assignment is a license. A licensee has no title in the patent.[6]

There are many reasons why licensing or assigning patents is desirable. The primary incentive for the patent owner to engage in these activities is to bring the invention to market and to secure a financial

profits, if the infringer makes automobiles and uses a brake system which infringes a patent, the court must determine how much of the profit on the automobile was attributed to the infringement. This change, although reducing the complexity of providing damages, according to some commentators has tended to reduce damages to a reasonable royalty. (Committee Report of the American Bar Association, Patent Trademark and Copyright Section, Committee 108, p. __ (1982)) Other commentators disagree noting that there is an increased tendency of the courts to award multiple damages. (Joseph M. Fitzpatrick, Damages in Trademark and Patent Infringement Litigation, APLA Quarterly Journal, vol. 8, No. 1 (1980) p. 29-45, 37 and 38)

The awarding of multiple damages is not required by the statute to be punitive in nature; however, the vast majority of the courts have considered increased damages to be punitive in nature. Generally, a successful defense to a request for increased damages is that the infringer had a good faith and reasonable belief that he was not infringing the patent. (Fitzpatrick, p. 42-43) Most corporations, when faced with a potential infringement problem seek an opinion from a competent attorney that the patent in question was invalid or not infringed, as evidence of good faith.

The patent statute also limits the recovery of damages in that no damages can be collected for an infringement committed more than six years prior to the filing of the infringement suit (35 USC Sec 286) or before the infringer was notified of the infringement (unless the patent owner or his licensee marks the patent products that he makes or sells with a notice that it is patented).

D. THE LICENSING AND SALE OF PATENTS

A. OWNERSHIP OF PATENTS

A patent is personal property,[1] and may be bought, sold, mortgaged,

Co., 365 U.S. 336 (1961)) The reconditioning of corroded, rusted and inoperative canning machines was also found to be a permissible reconditioning. (Wilbur-Ellis Co. v. Kuther, 377 U.S. 422 (1964))

Remedies for Patent Infringement

The right granted by a patent is often characterized as the right to exclude others from making, using or selling the patented invention. The patent statute provides the rights with the power to grant injunctions to prevent the violation of any right secured by a patent. The injunctions are to be granted in accordance with the principles of equity and on such terms as the court deems reasonable. (35 USC Sec 283) Thus, the statute does not mandate the granting of an injunction to the successful patent owner. However, injunctions are generally not denied unless a strongly inequitable result would occur. For instance, injunctions have been denied where the infringer relied on the assertions by the patent owner that he would not sue. (Royal-McBee Corporation v. Smith-Corona Marchant Inc., 295 F2d 1 (CA2, 1961)) Another basis for denying injunctive relief to the patent owner is the legal doctrine of "laches" which, in essence, means that the patent owner has unreasonably delayed in bringing the court action to enforce his patent rights and has therefore given the infringer the basis to assume that his activities were non-infringing or that the patent owner waived his rights, and therefore that the court in a sense or equity will not issue an injunction.

The inequities leading to denials of injunctions to patent owners who have successfully shown infringement usually involve inequities to the infringer. The grounds for denial of an injunction based solely on public interest considerations have not been fully developed by the courts. The Supreme Court, however, has repeatedly indicated that the mere non-use of a patented invention by the patent owner is not a basis by itself for denying an injunction. (Paper Bag Patent Case, 210 U.S. 405, 430 (1908)) and Hartford-Empire Co. v. U.S., 323 U.S. 386, 432 (1945)) The ability of the patent owner to retain the right to exclude while not using the patented

Process patents can also provide a different difficulty. The infringement of a process patent occurs only with the practicing of the patent; the sale or use of an article or a composition made by the infringing process do not constitute an infringement. This is different than the laws in most major industrialized countries in which the sale or use of an article or a composition is an infringement of a process patent. However, it should be recognized that until recently in many of these countries, process patents were the only type of patent protection available for certain classes of inventions such as new chemicals. In the United States, patents can be obtained on new chemicals. Since the infringement of a process patent only occurs when the process is practiced in the United States, a product made by an infringing process can be imported into the United States without recourse by the patent owner under the patent laws. However, the patent owner can seek to bar importation of the product as an unfair trade practice in an action before the International Trade Commission. (19 USC Sec 1337) The patent owner must not only prove that the product was made by an infringing process but also that the importation is inflicting substantial injury to an efficiently and economically operated domestic industry in order for the International Trade Commission to issue an order preventing importation. An International Trade Commission action is therefore more difficult for a patent owner to pursue than an infringement action in the courts. Proposals have been made to amend the patent statute by making the importation of a product made by a process patented in the United States an act of infringement. (see, for instance, The Report of the President's Commission on the Patent System, 1966, p. 35-36)

The patent statute also provides that selling a component of a patented product or a material or apparatus for practicing a patented process for the purpose of enabling the purchaser to infringe the patent is contributing infringement. However, the component, material or apparatus must not be a "stable article or commodity" (that is, an item in common use) of commerce suitable for substantial non-infringing use. (35 USC Sec 271(c)) In essence, the statute attempts to strike a balance between the

C. Patent Infringement

What Constitutes an Infringement

The patent statute broadly defines an infringer as

> "...whoever without authority makes, uses or sells any patented invention, within the United States during the terms of the patent therefore..." (35 USC Sec 271(a))

A person making, using or selling a potential invention is termed a "direct infringer." Thus, for example, if the patented invention was a new wrench, direct infringers would include the manufacturer who made the wrench without the permission of the patent owner, the wholesaler who obtained the wrench from the manufacturer and sold it to a retailer, the retailer who sells it to a consumer, and the consumer who uses the wrench. The patent owner, at his descretion, may elect to pursue his patent rights against any, or all, of these infringers. Practicalities usually dictate that, because of the expense of patent litigation, only a party with substantial infringing activities (e.g., the manufacturer) will be pursued. However, the possibility of an infringement suit can dissuade wholesalers and retailers from handling goods that might infringe another's patent.

In 1941, the Congressional Temporary National Economic Committee specifically found that some patent owners were using threats of bringing infringement suits against retailers as an anticompetitive tool and recommended that the law be revised to prohibit infringement action against any purchaser. (TNEC Final Report, p. 10, 1941) The recommendation was not adopted by Congress and strong recommendations to limit infringement actions to manufacturers and importers have not been forthcoming. In part, the decreased emphasis on abuse of infringement suits has been brought about by the passage of the Declaratory Judgement Act of 1934 (28 USC Sec 2201-1) which permits a party receiving a threat of suit to bring a court

the inventors. Patent laws, such as those in West Germany, permit no penalities if all contributors are designated on a patent application.

Restriction to single inventon

The patent statute provides that a patent application can only be directed to one invention; however, the Commissioner of Patents and Trademarks is given the discretion to waive that requirement in appropriate circumstances. (35 USC, Sec 121) The requirement that a patent application be directed to one invention enables the Patent and Trademark Office to examine patent applications more effectively since the subject matter is restricted. Also the requirement facilities public access to the information in the patent since the patent is directed to one subject and not to a group of unrelated or marginally related inventons.

The criteria used by the patent examiner for determing whether he will require the applicant to restrict the application to one invention include the burden that would otherwise be placed on the Patent and Trademark Office. For example, if a diverse field of search would be required, then the applicant would be required to restrict the patent application. The policy adopted resides with the Commissioner and is subject to change. The present policy is more liberal toward allowing the patent applicant to claim more than one invention in a single patent than was so in the past. The degree of discretion allowed to the Commissioner has been subject to judicial determination. The standard of review that has been applied in reviewing an examiner's decision to require restriction has been more rigorous than that normally provided for discretionary acts by an agency.

There are policy concerns with restricting patent applications to one invention. For instance, the patent applicant may be required to bear the costs of filing more than on patent application. A more subtle effect amy also occur. For example, if a patent application claims a new chemical compound and a process for making the compound, the Patent and Trademark Office could require restriction. If the applicant wished to pursue the

invalidating the patent if the error can be corrected. While the statute appears to be limited to stituations in which individuals other than the inventor were orginally designated as inventors or not all inventors were designated, recently the policy has been extended by the courts to enable a complete change in the designation of inventors. The Patent and Trademark Office has requested that this policy be secured by legislation (H.R. 6260, and S.2211 and 2326, 97th Congress).

The requirement that the true inventor, and only the true inventor, be designated in a patent application serves several useful purposes. First, the ownership of the property right is with the inventor. If the inventor is not designated or if more individuals than the inventor are designated, then the inventor's property rights are affected. Second, by requiring the inventor to be designated, he is responsible for the application. His input into the description of the invention and the best mode is thought to ensure a meaningful disclosure of the invention to the public since the inventor is generally the most knowledgeable person about he invention. Third, the inventor is likely to be knowledgeable about the prior art to the invention and any disclosure, public use or sale of the invention.

An issue exists as to whether the designation of inventorship should continue to be critical to the validity of a patent. The U.S. is one of the few countries which requires that the patent application be filed by the inventor. The practice in other industrialized countries of the world is that the owner of the invention (such as a company to which the rights to an invention have been asssigned) can file the patent application. Further, in these countries a misdesignation of the inventor will not lead to an invalidation of the patent.

It is argued that the reasons for requiring the inventor to be designated correctly in a patent application are not as valid today as they were two hundred years ago. Then, research was usually conducted by individuals. Now research is most often conducted by teams. Many inventions are the result of the combined efforts of individuals working

the manner in which claims are viewed in many foreign countries. In the U.S. claims are seen as being analogous to a deed to a piece of property. Thus, the claim defines the perimeter of the subject matter covered. The typical foreign practitioner looks to the claim to define the essence of the invention, and the boundaries of the invention are established in an infringement action. The foreign claim system does not provide a clear notice to the public where the limits of patent exclusivity are; but the patent owner is not penalized if he does not know the limits of the invention when the claims are written.

A judically developed doctrine provides some equity to the U.S. patent owner who incorrectly frames his claims more narrowly than the full scope of the invention. This doctrine is known as the "doctrine of equivalents". There is a countervailing doctrine which limits the application of the doctrine of equivalents. This doctrine is known as the doctrine of file wrapper estoppel. In essence, the doctrine provides that if the patent applicant was refused a broader claim by the Patent and Trademark Office because of prior art, he cannot later extend the scope of a granted, but narrower, claim by the doctrine of equivalents. While this is a description of traditional file wrapper estoppel, the applicant can also prejudice the interpretation of the claims by other actions such as making admissions against interest during the prosecution of the patent application. The rationale for the estoppel is that the applicant should not be permitted to take one position in order to obtain a patent and the opposite position when the patent is being enforced.

In view of the interpretation of claims in U.S. patent practice and the potential prejudicial effect of having to narrow claims during the prosecution of the patent application, an understanding of the prior art and the scope of the invention is essential to the preparation of a good patent application. While the inventor may know that an invention has been made, it is often the case that the full scope of the invention is not appreciated. For example, an inventor may think that the chemical he has invented is a solvent. It may turn out tha the chemical is also a pain killer.

disclosure of the best mode is an affirmative duty placed on the patent applicant.

The effect of the best mode requirement will depend on the date that the best mode is disclosed, on whose knowledge the best mode disclosure is based, and the detail required in the best mode disclosure. Since the Patent and Trademark Office has no basis on which to effectively investigate whether the best mode requirement has been satisfied, the policy has been established by the courts. Although the statute does not explicitly state, the best mode which is required to be disclosed is that existing on the date of filing of the patent application.

Some have expressed concern that the disclosure of the best mode may prompt an early filing of the patent application to avoid the necessity to disclose information which would be expected to result from the development of the invention. Legislative proposals have been made to require that an applicant update the best mode description after the application is filed. Several countries such as Mexico have patent laws which permit the government to obtain an up-dating of the best mode from the applicant. (____) There is opposition to such up-dating because of concens that it would result in the loss of trade secret information developed by the patent applicant for which no patent protection is or can be obtained. The patent applicant has to evaluate the loss of proprietary information through disclosure against the benefit that patent rights will provide. Requiring an up-dating on best mode information may discourage filing patent applications and thereby close off an avenue for the public disclosure of technical information. Also, such a requirement could discourage the development of the technology during the patent application pendency to avoid the need to disclose improved technology.

Although the statute states that the best mode contemplated by the inventor is to be disclosed, the policy which has developed includes the knowledge of the best mode of others in a relationship with the inventor. In other words, the best mode of practicing the invention known to, say,

patentability exists are the secondary indicators relevant to a determination of patentability.

The Disclosure of the Invention

The patent statute requires the patent appliction to

> "... contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention." (35 USC Sec. 112, 1st paragraph)

The intent behind the statute is to ensure that the public receives a fair disclosure of the invention in return for the grant of a patent and that the inventor cannot hide a material piece of information needed to effectively practice the invention.

A problem faced in drafting the patent application is ascertaining where to draw the line on describing the invention. The determination of what information needs to be disclosed is subjective. If an invention relates to a procedure for seismic exploration, does the description need to disclose how to program a computer to analyse the seismic signals? In order to use the invention a computer is required and the hypothetical person skilled in the seismic art would not be expected to know how to program a computer. The courts have generally taken the position that when the practice of an invention requires more than one art, the description must be judged on its adequancy to the artisan in the art to which the description pertains.

invention which it does not believe to be patentable, the words employed to express in educational generalities the rationale for the decision can be misleading when applied to another situation.

Recognizing the subjective nature of decisions regarding patentability, is it possible to obtain a more consistent determination of what is a patentable invention? One attempt to establish a uniform standard is being developed in conjunction with the European Patent Office. The European Patent Office is a single patent office that issues patents which can be enforced in any of a number of countries subscribing to the Munich Patent Convention. Although the patents are granted by the European Patent Office, the patents must be enforced in the national courts. Concern existed because various member countries appeared to adopt different standards for patentable inventions prior to the embodiment of the European Patent Office.

The legal definition of the standard of patentability adopted in establishing the European patent system is similar to that in the U.S. in that a patentable invention will exist if the invention is not obvious to a person skilled in the art. (Munich Patent Convention, Article 36) In implementing the standard, the European Patent Office referenced the standard to existing practice in the member countries. In particular, the standard is that used by the West German patent office rather than the strict Dutch standard or the more liberal British standard. The description of the standard was not in terms which would describe how to evaluate in invention, but rather it referenced an experience factor. The experience factor is, however, understandable only to those who are familiar with the decisions made in each of the referenced countries.

The approach taken by the European Patent Office is indicative that within the non-obviousness standard for patentability there is a broad gradient of potential standards and that a definition of where in that gradient the line is to be drawn is virtually impossible except through experience.

"... the only patent that is valid is one which this Court has not been able to get its hands on." (Jungersen v. Ostby and Baston, 355 U.S. 560, __ (1949)

At that time there were two particularly troublesome tests for patentability that had been established by the Supreme Court. One test is referred to as the "flash of genius" test. Simply stated, this test required that an invention represent more than mechanical skill, the improvement must display the flash of creative genius in order to be patentable. Under this test, the methodical approach to science such as that used by Edison would theoretically not result in patentable inventions. The other test, the "synergism" test required that an invention composed of known elements is patentable only when the whole exceeds the sum of the parts. Allied to this is the test that an invention is not patentable when it produces an expected result. The synergism test has prompted comments that there is no such thing as a mechanical invention which is patentable since each component of the invention operates in an expected fashion to produce an expected result.

The rather strict tests adopted by the Supreme Court (at least when the tests are judged literally) perhaps can be explained by the policy approach taken toward patentability by the Court. This approach is expressed by Justice William O. Douglas in a 1950 opinon:

"Every patent is the grant of a privilege of exacting tolls from the public. The Framers of the Constitution plainly did not want thos emonoplies freely granted. The invention, to justify a patent, had to serve the ends of science--to push back the frontiers of chemistry, physics, and the like; to make a distinctive contribution to scientific knowledge." (Great A. & P. Tea Co. v. Supermarket Equipment Corp., 340 US147, __ (1950))

Furthermore, the "printed publication" requirement has raised other controversies which the statute fails to address. For example, a single typed copy of a college thesis catalogued in the library of a university has been held to be a "printed publication." (Potter Instrument Co., Inc. v. ODEC Computer Systems, Inc., 370 F Supp. 198 (D.C., R.I., 1974).) On the other hand, a microfilm of a German patent application, available to the Library of Congress, has been deemed not to qualify as prior art. (In re Tenney, 254 F2d 619, CCPA, 1958) Recently, this anomaly has seemingly been stricken; "printing" no longer is interpreted as a technical requirement, only dissemination or accessibility are required for a document to constitute prior art. (In re Wyer, ___ CCPA, 1981) Once again, the role of the judiciary in shaping policy can be seen.

It has been argued that the sheer volume of technical literature, which has been increasing exponentially, prohibits an authoritative review of the prior art. Proposals have been made to limit the prior art which may be considered in determining patentable novelty. One proposal provides that only information which is reasonably available should be considered. Hence, an obscure periodical with limited distribution in the USSR would not defeat patentability, and the patent reward is provided for the public disclosure of the technology. Several factors must be considered in devising a statutory provision which differentiates certain types of publications from others for purposes of determining novelty. Are there Constitutional limitations which prescribe providing patents to inventions which are not novel in an absolute sense? How is the line to be drawn between publications which can defeat novelty and those which can not? What is the relative effect of such a distinction with respect to U.S.-based as opposed to foreign-based entities and with respect to large and small corporations or independent inventors?

Non-obvious subject matter

Since the beginning of the U.S. patent system there has been a standard of invention required for patentability. The standard of

not be known or available to the public at the time the patent application is filed. The President's Commission on the Patent System recommended that the United States adopt the approach taken by other industrialized nations to encourage prompt action in filing a patent application and making the invention available to the public, to provide greater uniformity with foreign patent systems, to simplify the examination proceedings (since the filing date and not the date of invention determines novelty), and to avoid forfeiture of foreign patent rights by inventors who relied on the U.S. one-year grace period. (President's Commission, p. 13-19)

There are advantages to international uniformity in determining novelty. Simplicity is an obvious advantage. A further factor to be considered is the future likelihood of patent systems evolving on a regional or world-wide basis that could issue patents valid in more than one country.

A trend in this direction has already begun. A single patent application to the European Patent Office can provide secure patent protection in one or more countries. The Patent Cooperation Treaty, which was ratified by the U.S. in 1970 and came into force in 1978, provides for cooperation among patent offices for searching prior art with respect to a patent application upon which patents have been requested in several countries. Uniformity of patent systems would be advantageous if the eventual unification of national patent systems is the desired policy goal.

There are advantages to the present U.S. approach. The grace period for filing patent applications permits a more extensive evaluation of an invention prior to undertaking the expense of filing. The one-year grace period also serves the interests of some researchers, particularly in the academic community, who wish to see their work published promptly. The grace period provides some protection against foreclosure of patent rights and can result in the disclosure of information which might otherwise remain hidden as a trade secret. Consequently, there was strong opposition to the recommendations of the President's Commission (See IDEA, cites Green)

In practice, a presumption appears to exist that an invented process or product is useful. The standard applied by the Patent and Trademark Office is that only in instances when the proclaimed activity is unbelievable on its face (e.g., perpetual motion machines) does a utility need to be proven to procure a patent. (Manual of Patent Examining Procedure, Sec. 608.01(p), Jan. 1981, revision at page 102)

Because of the standards applied by the Patent and Trademark Office, the utility requirement for patentability can easily be satisfied. For example, most chemical compounds, when administered in sufficient dosage levels, have insecticidal or herbicidal properties. If patent rights are obtained for a chemical on the basis of its utility as an insecticide (even though it is impractical to use the chemical for that purpose since it is not as effective as existing insecticides) the patent may bar another person, who discovers that the chemical is useful as an antibiotic, from making, using or selling the chemical.

Two of the more prominent issues relating to utility involve whether a chemical which has as its sole utility its being a precursor to another chemical which has a significant utility is patentable, and whether an activity exhibited by a chemical is a satisfactory utility for patentability even though the chemical is impractical for that application.

By judicial interpretation, a chemical, or a process for making a chemical, whose sole utility is that of an intermediate to making an ultimate chemical of significant utility is patentable. (Brenner v. Manson, 86 S. Ct. 1033 (1966). But no utility was found since the final product had no significant utility. (See, for instance, in re Magerlein, _____) (For further discussion see W.D. Woessner, Recent Decisions Affecting the Patentability of Chemical Intermediates, Journal of the Patent Office Society, v. 63, May 1981; p. 258-275.)

The latter issue of impracticality arises particularly in connection with chemicals asserted to have bioactivity. For example, a chemical may

a degree of flexibility in the existing patent system and Congress has the authority to intercede legislatively should further changes be required.

B. The Statutory Requirements for Patentability

Statutory Classes of Patentable Inventions

One area of the law which has undergone revision in the past pertains to the subject matter of patentable inventions. Since 1870 Congress has limited the classes of subject matter of inventions which can be patented to a ". . . process, machine, manufacture,. or composition of matter, or any . . . improvement thereof . . ." (35 USC, Sec. 101) A clear intent at the time of passage of the statute was that discoveries relating to the laws of nature, physical phenomenon, and abstract ideas could not be patented. While the century-old statutory language has managed to accommodate thousands of inventions, there have been some technological advances that do not fall readily into the subject categories identified by statute in 1870.

The field of genetic engineering, for example, has raised serious problems. The Patent and Trademark Office initially took the position that a microorganism which was genetically engineered by man was unpatentable because the statute does not explicitly state that living organisms can be patented. After eight years of Patent and Trademark Office and court appeals, the Supreme Court ruled that living organisms are patentable. (Diamond v. Chakrabarty, 100 SC 3304, 1980) (FN - For a further discussion, see OTA Report on Impacts of Applied Genetics, Microorganisms, Patents and Animals, Chapter 12, 1981)

In the area of computer programing, the Supreme Court upheld a Patent Office determination that an algorithm (a procedure for solving a mathematical problem) used to convert binary code decimal numbers to equivalent pure binary numbers is unpatentable. (Gottschalk v. Benson, 409 US 63, 1967) The basis for the finding was that an algorithim is like a

innovation, advancement or social benefit gained thereby. Moverover, Congress may not authorize the issuance of patents whose effects are to remove existent knowledge from the public domain, or to restrict free access to materials already available. Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must promote the progress of . . . useful Arts.' This is the standard expressed in the Constitution and it may not be ignored. And it is in this light that patent validily requires reference to a standard written into the Constitution . . . "(Graham v. John Deere Co. of Kansas City, 383 US 1, - (1966))

The standard for patentability has been considered to be a Constitutional standard. The patent system operated until 1953 without any statutory language attempting to define an invention.

In its early years, the patent system created by Congress underwent several changes. Under the law of 1790, the responsibility for granting patents to novel and useful inventions resided in a board composed of the Secretary of State, the Secretary of War and the Attorney General. The board existed for only three years, granting fifty-seven patents, before the law was changed to establish a registration system under which patents were granted without an examination as to the novelty or usefulness of the invention. High fees were assessed and foreign patent applicants were assessed premium fees. This enabled the patent system to serve as a source of needed income for the fledgling government.

Complaints about the granting of invalid patents and the necessity and expense of challenging such patents in court resulted in demands for reform. In 1836 the patent laws were changed to reinstate the examination of patent applications.

Section II

Selected Issues in Patent Law

A. The Foundation of the Present Patent System

The United States Constitution, Article I, Section 8, Clause 8, provides that:

> "The Congress shall have the Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to . . . Inventors, the exclusive Right to their . . . Discoveries."

This Constitutional provision is the basis for our federal patent system. An understanding of the factors which influenced the drafting of this provision is helpful in assessing the role of the patent system intended by the founding fathers.

The practice of granting exclusive rights (patents) to inventors has existed more than five centuries. By the 16th century, patents were widely used by German princes to encourage commerce within their principalities by providing incentives for the introduction of new technology into their territories.

The English Crown adopted patents of monopoly to reward court favorites with exclusive rights to sell certain basic commodities, such as salt, in specified geographic areas. Thus the emphasis shifted from encouraging innovation to granting economic advantage to a privileged few.

Because of the abuses, the Parliment in 1624 adopted the Statute of Monopolies which banned the granting of patent monopolies except to a "first and true inventor" or for "the sole working or making of any manner

[21]See, for example, discussion in "R&D, Knowledge, and Externalities..." by Richard R. Nelson (footnote 2).

[22]Kamien, M.I., and Schwartz, N.L., "Market Structure, Elasticity of Demand, and Incentive to Invent" The Journal of Law and Encomics, vol. 13, no. 1, April 1970.

[23]Scherer, F.M., "Research and Development, Patenting, and the Micro-Structure of Productivity Growth" Final report to the National Science Foundation (Grant no. PRA-7826526) Mimeographed, June 1981.

[24]See footnote 13. Note that empirical studies often measure innovation by counting patents, journal articles, or other concrete ouputs which may or may not be reliable measures of innovation.

[25]See footnote 13.

[26]See footnote 23.

[27]Nelson, R.R., "Research on Productivity Growth and Productivity Differences: Dead Ends and New Departures" Journal of Economic Literature, vol. 19, September 1981.

[28]See footnote 4.

[29]Hirschleifer, J. and Riley, J.G., "The Analytics of Uncertainty and Information -- An Expository Survey" Journal of Economic Literature, vol. 17, December 1979.

[30]See "The Role of Patents" by A.E. Kahn (footnote 20).

[31]Gilfillan, S.C., Invention and the Patent System, prepared for the U.S. Congress Joint Economic Committee, Washington, D.C., December 1964. See footnotes 16 and 23.

Footnotes

[1]Nordaus, W.D., Invention, Growth, and Welfare, Cambridge, MA: M.I.T. Press, 1969.

[2]Nelson, R.R., "R&D, Knowledge, and Externalities: An Approach to the Puzzle of Disparate Productivity Growth Rates Among Manufacturing Industries" in C. Bliss and M. Boseup, eds. Economic Growth and Resources, Volume 3: Natural Resources New York: St. Martin's Press, 1980.

To some economists, invention leads only to the development of templates; to others, invention yields knowledge that serves as more than a template.

[3]Markham, J.W. "The Joint Effects of Antitrust and Patent Law Upon Innovation" The American Economic Review, vol. 56, no. 2, May 1966.

[4]Kitti, C. and Trozzo, C.L. The Effects of Patent and Antitrust Laws, Regulations, and Practices on Innovation. Prepared by the Institute for Defense Analysis for the National Science Foundation, Washington, D.C., February 1976.

[5]See footnote 1.

[6]Arrow, K.J. "Economic Welfare and the Allocation of Resources for Invention" in National Bureau of Economic Research The Rate and Direction of Inventive Activity: Economic and Social Factors (conference report). Princeton: Princeton University Press, 1962.

Scherer, F.M. Industrial Market Structure and Economic Performance, Second Edition. Chicago: Rand McNally College Publishing Company, 1980.

[7]Bowman, W.S., Jr. Patent and Antitrust Law, Chicago: The University of CHicago Press, 1973.

it appears that patents may be what Scherer calls an "incremental stimulus", an important factor in some but not all innovation.

To the extent that patents do affect potential innovators, many economists argue that the benefits of patents should be measured from a dynamic perspective. Kahn, for example, argues that a continuous flow of innovation is desirable and a proper goal for mechanisms such as patents.[32] With a continuous flow of innovation, resulting benefits such as economic growth can outweigh the costs of temporary inefficiencies associated with the patenting of individual innovations. Similarly, the public interest in innovation for areas such as medicine, food, and chemicals may be so great that monopoly is intolerable but technological progress is so important that the incentive value of patents outweighs transient costs of monopoly. From the perspective of the system it can even be argued that temporarily inefficient use of individual innovations may not be bad where there are many innovations, because individual inefficiencies may be offsetting.[33]

Economists have focused on the patent term in analyzing ways to perfect the patent system. Various economic models indicate how patent terms may be adjusted to balance the costs and benefits and minimize inefficiency. Models take into account such factors as the degree of cost reduction in process innovations, discount rates used in evaluating innovation costs and benefits, elasticities of demand for different products, and growth in population and income levels.[34] Given a practical need for administrative simplicity, such models may be of little practical use because they indicate that optimal patent terms must be calculated for each invention.

Economists have also discussed alternatives to the patent system. Most alternatives discussed in the literature involve separating the reward--and therefore the incentive--for invention and innovation from charges to users of new technological knowledge. As Arrow notes, however, the link between the reward and the user charge made by patents (or other mechanisms that create a property right in an invention) is inherently

inventors to appropriate their ideas, and uncertainty about new technological frontiers.

Finally, improvements in analysis of the behavior of firms may also affect evaluations of the patent system. Conventional analyses of innovation tend to regard technological knowledge as the main determinant of production decisions and to assume that production decisions are made by a single-minded entity called management, which bases production decisions primarily on technological knowledge and the goal of profit maximization. Recent developments in organization theory and industrial organization theory have called that assumption into question. Theoretical and empirical work suggest that technological knowledge defines only a rather broad realm within which managerial decisions are made. Actual managerial decisions reflect such factors as different personal motives of firm members, different organizational goals (alternative to profit maximization), and different attitudes toward risk. The confluence of all of these factors serves to dull the effects of any one incentive, such as patent monopoly, to complicate prediction of firm and industry behavior, and possibly to slow the rate of technological diffusion.

IN SUM...

An overall evaluation of the costs and benefits of the patent system is difficult to make because the magnitudes of costs and benefits are difficult to measure. In general, economists today appear to accept that patents are valuable because they stimulate invention that would otherwise not be forthcoming, although the costs, benefits, and overall effectiveness of patents seem to vary among classes of innovations as well as among industries.

The social costs of the patent system reflect both the nature of patents and the conduct of inventors, businesses or individuals, in exploiting them. Costs include losses in efficiency and consumer satisfaction associated with monopoly restrictions on access to new

ON THE OTHER HAND...

Three relatively new theoretical developments expand and perhaps alter the analysis of patent economics beyond more conventional evaluations of how patents influence producers. One development focuses on the pecuniary effects of innovation, one on the common-property nature of undiscovered ideas, and one on the behavior of firms.

Attention to the pecuniary effects of innovation has come from development of the economics of information. Most economic analyses of innovation focus on the technical effects of changes in technological knowledge--the changes in production processes and product mix. Hirschleifer points out that the generation of new technological information provides opportunities for monetary gain that are separate from, but dependent on, the technical effects of innovation. Because the essential product of invention is information, an inventor can not only change his own production activity or sell the information so that others can change their production activities, he can also use the information to speculate and invest optimally. An inventor can obtain financial gain by investing in productive activities (without necessarily engaging in them) before publishing his new technological knowledge, while prices and profits in the economy at levels that do not account for his invention. After publishing the new technological knowledge and/or marketing his invention, the speculating inventor benefits from changes in prices and profits consistent with adoption of his innovation. Society gains from the publishing of the new information and the resulting reallocation of resources.[29]

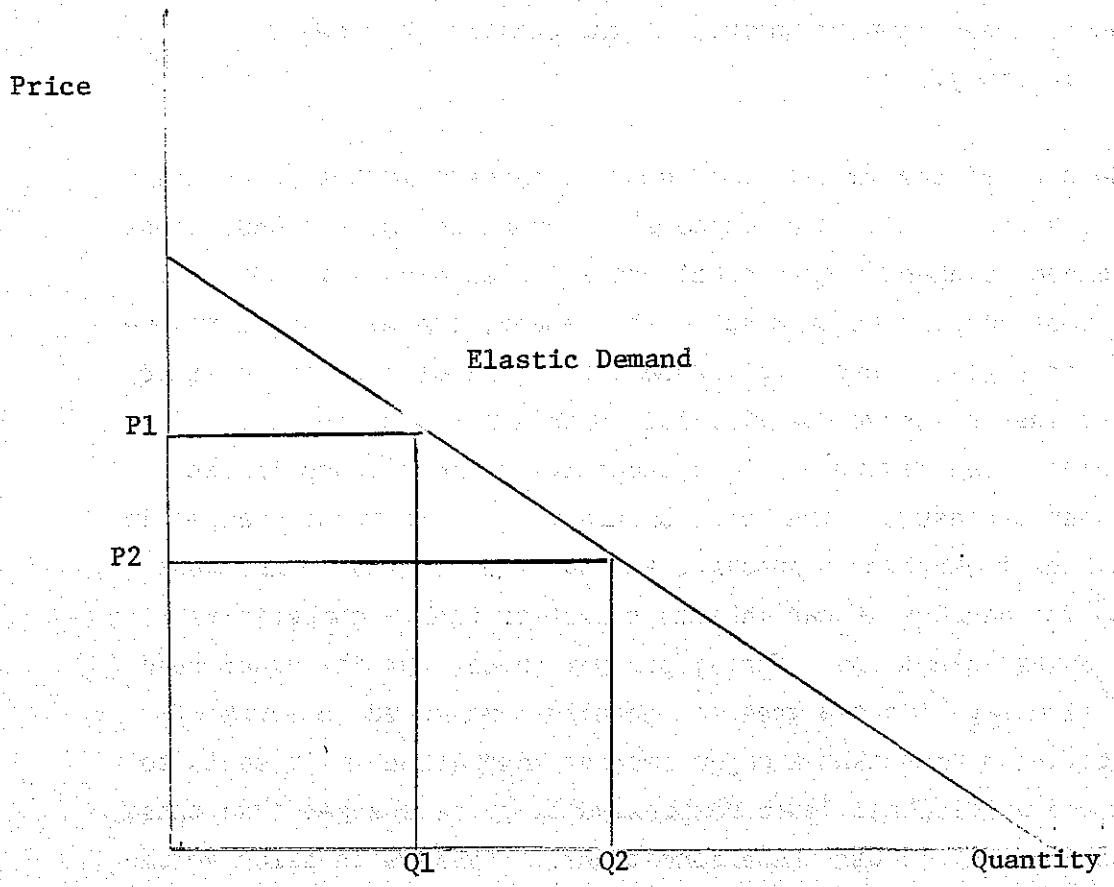
From this perspective, dissemination of new technological information is both privately and socially beneficial. Furthermore, the prospect of private gain from speculative as well as productive activities may motivate overinvestment in innovation. This conclusion is substantially different from conventional analyses, where the exclusive focus on the technical effects of innovation and the problems associated with the marketing of

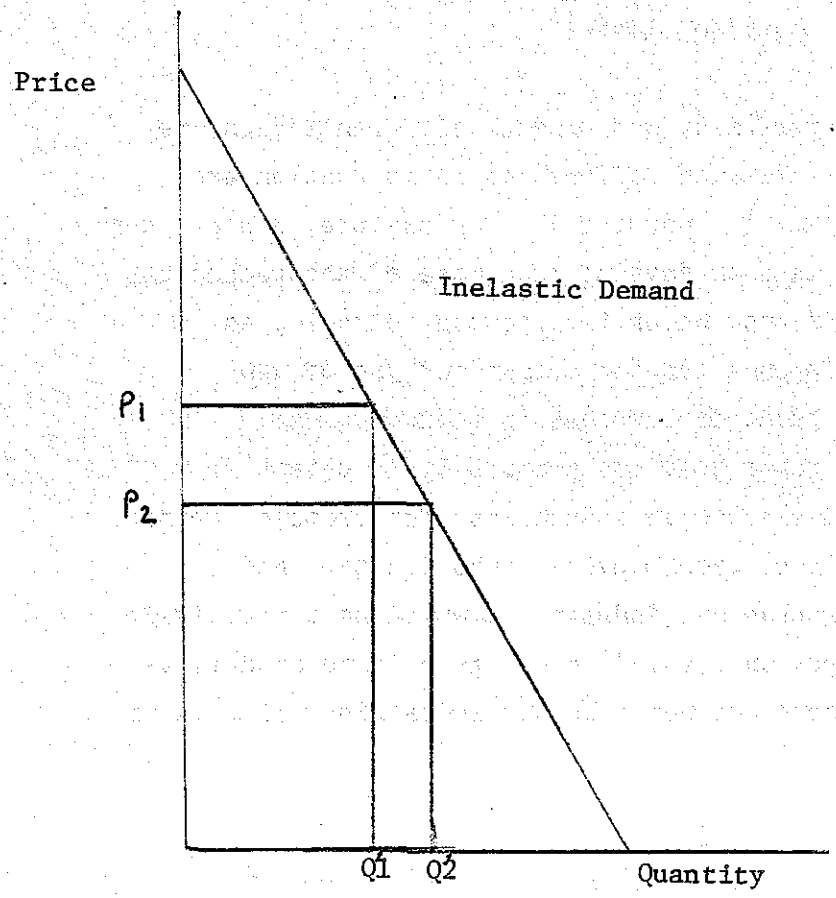
aimed at a common innovation goal; the likelihood that only one approach will succeed; and the tendency for individual firms to assess their own innovative or technological prowess overoptimistically compared to that of other firms make cooperation less likely for innovation than for other aspects of industry conduct, in particular pricing. For either innovation or pricing, however, profits for each firm and for the group or industry would probably be higher with cooperation.[27]

Although technological opportunity, potential for product differentiation, and other market characteristics affect the level of competition in R&D among industries, the patent system seems to promote competition in R&D. This is so because, although it is expected in general that some firms competing to innovate will succeed while others fail, a patent system makes financial reward for a particular innovation contingent on being the first to succeed (and apply for a patent). However, while the value of being first stimulates inventive behavior, it does not necessarily stimulate innovation or the use of new technologies. Because receipt of a patent restricts use of new technologies by parties other than the patent holder, it may lessen the incentive to a patent holder for using patented technology to compete in product markets.

The patent system may affect competition in R&D and the allocation of resources to R&D in several ways. First, there may be an incentive to rivals to develop innovations that are similar to a patented development, a practice referred to as "inventing around". Success in a particular innovation for one rival encourages imitation by other rivals because it illuminates an area where innovation can be successful; developing technology may be less risky in that area than in untried areas. Inventing around is also encouraged by the patent system because the introduction of new technology, the use of which is restricted by a patent, can pose a direct competitive threat to the innovator's rivals in product markets. Second, there may be an incentive to rivals to develop innovations that are intermediate between prior art and newly patented technology ("inventing between"). If using or patenting technology that is

Figure 5


Price
Elastic Demand
P1
P2
Q1
Q2
Quantity


Price
Inelastic Demand
P1
P2
Q1
Q2
Quantity

innovation in industry structure, there is relatively little empirical evidence of such effects to date.[18]

The presence of antitrust law, which limits industry concentration and monopolization, complicates study of the "natural" influence of concentration on innovative behavior. The preponderance of opinion among contemporary economists is that patent law, which creates monopolies, and antitrust laws, which dismantle or inhibit development of most monopolies, are in fact fundamentally consistent. Patent and antitrust law may (separately and together) affect different industries differently, however, because industries differ in their propensities to patent and to inhibit competition.

Economists disagree as to how patent and antitrust influences interact. Markham argues that the joint existence of patent and antitrust law encourages innovation and patenting as means for gaining market power because patenting is legally rewarded, while other means are legally circumscribed.[19] Kahn and Bowman, on the other hands, assert that the existence of antitrust laws reduces the incentives offered by patent laws.[20] Bowman is at odds with Kahn and most other economists, however, in arguing for more lenient antitrust treatment of restrictive arrangements that may be made in selling or licensing patented items. Bowman argues that such provisions are more efficient as well as more profitable to the patent holder, while Kahn and others contend that they are inefficient because they restrict competition and discourage innovation by restricting application of new technological knowledge.

Innovation varies among industries, depending on other industry attributes as well as concentration. For example, the size of the market--the number of potential buyers and the level of potential demand--is an important industry attribute affecting innovative behavior. The larger the market, the greater the expected profit from introducing a new product or process, because sales volume is larger, making scale economies and minimum unit production costs easer to achieve.[21] (Whether concentration among

A large body of theoretical and empirical analyses of invention and innovation suggests that the value of patents depends largely on the setting for R&D, which varies by industry with characteristics of industry structure and firm conduct.

Market structure and conduct affect innovation with or without patents. Early analyses by J. Schumpeter and other proponents of supply-oriented models of innovation focused on large firm size and market power (control over price)--ingredients of industry concentration in general and monopoly in particular--as requirements for innovation. Such analysis supported the use of patents because patents act to promote innovation by enhancing market power. However, empirical studies have shown little or no consistent association between spending on R&D or other inputs to innovation and attributes of large firms and concentrated industries that economists have hypothesized might be important for innovations. Such attributes include liquidity, large capital requirements, product diversification, scale economies in production (the association of large production volumes with low unit costs), and even scale economies in research. There appears to be greater doubt about the importance of large (absolute) firm size for innovation, as opposed to invention. Although, in general, the larger the firm, the more is spent on R&D, and the more spent on R&D, the more patents are obtained, large firms do not seem disproportionately innovative.[12]

One factor associated with relatively large firm size and concentration that does appear important for innovation is the need to possess some technological expertise and specific types of research facilities in order to compete, which economists refer to as the presence of technological barriers to entry into an industry. Moderate-level, rather than low- or high-level, technological barriers to entry may stimulate innovation. The possibility of some entry provides an incentive to innovate to protect or enhance firm market position, while some restriction of entry makes rapid imitation of technological developments by competitors, which would discourage innovation, less likely.[13] An

sell at least as much of the patented product as under conventional monopoly conditions by setting the price of a patented, primary product lower than its potential monopoly price and setting the price of the (unpatented) complementary good higher than its competitive price. If more of the patented product is sold through tying arrangements than under conventional monopoly conditions, the outcome is more efficient as long as the complementary good is (otherwise) competitively supplied and the patent holder gains more profit.

Tying arrangements allow a patent holder to "meter" the value of an innovation to different users because they give the patent holder more information about user activities than is available from sales of the patented product alone. Consequently, a patent holder can use a tying arrangement to "enforce" the most technically efficient combinations of the primary and complementary products (while increasing output of the joint product) because lowering the price of the primary good and raising the price of the tied good discourages excessive use of the tied good, where possible, as a means of economizing.[8] Like price-discrimination, tying arrangements entail a transfer of surplus/resources from consumers to producers.

The foregoing discussion assumed that, but for patents, a competitive market might/would obtain. Similar analyses, however, can be performed for the relatively few cases where monopoly is the initial market condition. Innovations applicable to initially monopolistic markets are more commonly for new processes rather than for new products because monopoly is sustainable for very few products. The introduction of new processes into a monopolistic market will generally raise benefits to consumers, because cost reductions almost always make output expansion and price reduction profitable[9] Introduction of a new product will almost always increase consumer benefits by creating new consumer surplus (unless the monopolist perfectly price-discriminates). However, if a product innovation allows a market to be monopolized and the monopolist can prevent consumers from buying--and gaining original levels of satisfaction from--the old-

dependent monopolist. Innovations that produce less drastic cost reductions, however, may not make significant output expansion profitable and without significant output expansion there would be little consumer benefit during the patent term. In all of the above cases, a transition to competitive prices and output levels following termination of the patent term would substantially increase consumer surplus.[6]

It is possible, at least in theory, to increase output and lower prices with patent (and other) monopolies relative to conventional monopoly levels by changing the way in which the monopolist collects extraordinary profits. This could (if permitted under antitrust laws) be done in two ways, each of which alters/compromises the distribution of resources between consumers and producers: price discrimination and tying arrangements.

Price discrimination is the practice of charging different prices to different consumers, according to their valuation of the product. The producer must be a monopolist, because control over price is required, while consumers must be unable to resell what they purchase to others (and thereby cause price to fall). The discriminating producer gets extra revenue on whatever quantity is sold and may therefore maximize profits at higher output levels than non-discriminating monopoly levels. See figure 4. When a greater quantity is sold (up to the competitive amount, if it is consistent with profit maximization), the monopoly resource allocation with discrimination is more efficient than without. However, consumers transfer much or all of their surplus valuation to the producer. There is also a loss in "social efficiency" because purchasers paying different prices cannot increase their satisfaction by trading with others).[7]

Tying arrangements make sale of a primary good contingent on purchase of a complementary good (for example, a photocopying machine and paper used with it). They take advantage of the fact that consumers may value the primary and complementary products jointly, for example where both are inputs to a final product. With a tying arrangement, a patent holder could

collectively, likely to create relatively little inefficiency through inflated prices and restricted outputs. The practice of developing product or process variants, referred to as inventing around, may nevertheless be inefficient in other ways, as discussed later.

Monopoly raises distribution as well as efficiency questions. Because less product is sold under monopoly than under competition, fewer consumers--only those who value the product most--may be served. Because prices are higher under monopoly, consumers transfer in prices paid to producers what would have been surplus valuation under competitive conditions. For a given quantity of product sold, consumer surplus is lower and producer surplus (the surplus in revenue over the cost of real resources used in production) is higher with monopoly. Because producers gain greater control over resources relative to consumers, they may effect a different mix of consumption and production activities across the economy than might obtain if consumers controlled more resources, although either allocation may be efficient.

Patent monopolies may also yield increases in consumer satisfaction that offset the erosion of consumer surplus implied by monopoly price and output levels. The introduction of a new product, at any volume, provides a new source of consumer surplus. Consumer satisfaction will always increase with the introduction of a new product unless the patent holder excercises perfect price discrimination, a practice (discussed below), which transfers all consumer surplus to producers through prices paid.

A process innovation may or may not raise consumer surplus during the patent term; the effects of process innovations on consumer surplus depend on whether and how much output is expanded. Growth in output raises consumer surplus. See figure 3. Growth in output depends on the degree of cost reduction achieved. The introduction into a competitive market of a process innovation that lowers marginal production costs below the initial competitive price level (a "drastic" reduction, according to K. Arrow and others) will make growth in output level more profitable for the patent-

patents) an innovative competitive firm can earn extraordinary profits long enough to at least recover development costs depends on the nature of the innovation and the ease with which it can be imitated, which determines the ease with which new firms can enter the market for the innovation.

By creating limited monopolies, patents enable any firm, whether originally in a competitive, oligopolistic, or monopolistic market, to earn extraordinary profits on an innovation because use of patented technology and therefore entry into the market for that technology are restricted. The economic effects of patent-monopolies are the same whether the patent holder produces the new product or whether he licenses others to produce it in exchange for royalty payments. That is, the same levels of monopoly prices, profits, and output restrictions are achievable in either case.

Patents provide one of the instances where the overall efficiency (and distribution) implications of monopoly are ambiguous. On one hand, patents, like other monopolies, give rise to misallocations of resources during the period in which monopoly is sustained. On the other hand, they may lead to better resource allocation in the long run, for two reasons: First, because they lead to greater investment in innovation than might occur without such incentives; and second, because individual innovations may improve the alocation of productive resources, especially after the patent monopoly ceases to be in effect. Even in the short run, an innovation introduced under monopoly conditions may improve resource allocation relative to preinnovation conditions. For example, productivity improvements from process innovations may at least offset the misallocation effects of non-competitive prices and production levels unless the monopoly price (and production restriction) is so great as to overpower the productivity effects.[3] The likelihood that patents promote efficiency overall is greatest where patent-derived profits are just sufficient to recover research costs; the likelihood of reduced efficiency overall is greatest where patent-derived profits are disproportionately larger or smaller than research costs.[4]

would lose business by pricing at levels exceeding marginal cost, a monopolist controls both production output and price levels; he can take advantage of the responsiveness of sales volume to price level to maximize profits. The higher relative price of a monopolistically-produced item leads consumers to buy less of it and more of other goods and services. See figure 2. Consequently, the allocation of goods and services in the economy is inefficient relative to a situation where all goods are produced competitively.

While both competitive and monopolistic firms seek to maximize profits, competitive profits (the excess of revenues over costs, where costs include a competitive level of return on investment) are said to be maximized at a level of zero and monopolistic profits are greater than zero. That monopoly profits are higher than competitive profits is what makes monopoly attractive to entrepreneurs in general. This differential can be sustained because monopolistic markets are fundamentally different from competitive ones. The critical difference is one of opportunity to enter into production in the market. In a competitive market, "normal" profit levels do not attract new firms. New producers enter when profits exceed normal levels, increasing the total quantity of product sold and causing the price to fall until profits return to normal levels. In a monopolistic market entry by any other firm or firms is barred by one or more factors (for example, cost conditions that allow the market to be served efficiently by only one producer), allowing the monopolist to reap extraordinary profits continuously. Extraordinary profits and output restrictions may be observed in a variety of intermediate market structures, including oligopoly (control by a few sellers), but generally at lower levels than in pure monopoly.

Competitive markets are relatively unsupportive of innovative activity because free entry prevents competitive firms from earning extraordinary profits for long. Without extraordinary profits, firms cannot recover the costs of innovative activity, which are independent of the costs of producing a new product or developing a new process. Whether (without

than if there were more development, publication, and use of new technological knowledge. Patents can help to correct the problem of underinvestment in innovation by helping inventors to appropriate the technological information they create and recover their costs for creating it. Patents do not, however, necessarily motivate the use of new technological information. Whether and how new technological information is used, with and without patent protection, depends on a multiplicity of factors, most notably the attributes of the markets for specific innovations.

The ideas that innovation is desirable and that creation, dissemination, and use of new technological knowledge do not ordinarily proceed at socially desirable levels have been accepted for years, although the rationales for patents and the evaluations of patents have varied. Economists and others have advanced a variety of justifications for patents over the past two to three centuries. Four common justifications are identified by F. Machlup in his comprehensive review of the economics of the patent system: natural law, reward by monopoly, exchange for secrets, and monopoly profit incentive.

The natural law argument, claiming that inventors have a natural property right in their original ideas, and the reward by monopoly argument, claiming that justice requires a reward for the public service of innovation, were popular in the eighteenth and nineteenth centuries. These arguments were abandoned in twentieth century economic debates, in part because they are not economic arguments; property rights and just rewards are legal and social constructs without intrinsic economic meaning. The exchange for secrets argument focuses on the economic value of disseminating new technological knowledge, for which society compensates its creators with patents in exchange for its dissemination. Finally, the monopoly profit incentive argument focuses on the relationship between market structure and firm profits. It claims that patents are the easiest way to motivate innovation, because monopolies promise extraordinary profits and profits are the central concern of innovators. The prevalent

spreading the risks of innovation lead inventors, businesses, and investors to underinvest in innovative activity. However, they would underinvest in innovative activity even if optimal mechanisms for spreading risk were available. This is so because, given the relatively high risk levels associated with innovation, the cost of adequate risk spreading (such as insurance premiums) would greatly reduce or even eliminate the net profit from innovation and greatly reduce or even eliminate the incentive to invest in innovation.

Underinvestment in innovation is also likely because innovation is based on information. Economists differ in the ways they relate innovation to information (specifically, technological knowledge) but a common theme is that information provides a template for economic activities.[2] Underinvestment in innovation is likely because information tends to be undervalued, a condition that makes it incompatible with conventional markets.

Information tends to be undervalued because it is characterized by what economists call inappropriability and indivisibility. To be traded optimally in a market, a commodity has to be appropriable--it must be possible to hold and transfer exclusive title to the commodity, otherwise the producer cannot control its distribution and extract economic value for it. Information, unlike conventional goods, is virtually inappropriable for two reasons. First, the use of information by one or more users does not diminish or exhaust its availability to other users. Second, it is extremely cheap--even costless--to transmit or reproduce information. Because of imperfect appropriability, producers (and users) of technological information lose some control over it in commercial applications. Information is shared with customers and/or competitors through embodiment in products or production processes and because it is assimilated into the skills and thinking of employees. Potential developers and buyers of new technological information undervalue it because of these losses of control, and consequently engage in too little invention and innovation.

who value the product at levels at least as high as the price do buy it. The triangle a-b-c in figure 1 represents consumer surplus, the additional value consumers may attach to products above the price they pay. The creation of new products through innovation almost automatically raises consumer satisfaction because it increases the number of products consumed (more "triangles"). Cost-reducing process innovations increase consumer satisfaction when prices fall and quantities produced rise, raising consumer surplus (bigger "triangles").

WHY WE DON'T GET ENOUGH INNOVATION

Although innovation can have a profound impact on different markets, most economists feel that it is not an activity that normal, competitive market behavior will support at levels commensurate with its economic value to society and even to private parties. Markets fail to support innovation adequately primarily for two reasons: because of uncertainty and because the essence of innovation is information, which is peculiarly incompatible with normal market behavior.

Innovative activity is characterized by relatively high levels of uncertainty. No one knows with certainty whether innovative activity will yield desired technological changes and/or whether new technologies will prove commercially successful. The probabilities that innovative efforts may be partial or complete failures, and the loss of time, money, and other resources that occurs with failure, make investment in innovation risky.

From society's perspective, any new activity, including innovation, should be undertaken if, on average, it is expected to yield at least the level of return on investment available in normal, competitive market activities. However, individuals and businesses thinking about investing in innovation tend to base their decisions on the relative variability of possible returns and the relative likelihood of loss, rather than on the average or expected level of return on investment. Reluctance to risk losses and the absence of adequate mechanisms (such as insurance) for