

## The Impacts of Intellectual Property on the Value of the Firm and its Management

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### Abstract

With the increasing importance and use of IP, its management is becoming an integral part of a company's competitive strategies. The present paper examines the impacts of IP on the value of the firm. The study analyzes the relationship between IP and development. The cost of IP, its management and the human resources involved are presented. In order to better derive value from IP, firms use more and more sophisticated methods. The valuation of IP portfolios, its accounting and integration into corporate financial strategies are discussed in the study. In our discussion we try to consider the various aspects about the valuation and management of intellectual property rights. This paper is based on the many specialists' researches of IPRs. Because of the lack of through study about IPRs, this paper is not satisfactory in terms of the originality and creativity. We did not empirical approaches concentrating on the close focus about special topics of IPRs. We only survey the some issues about IPRs. Additional study should be required to furnish this paper with good qualities such as originality and creativity. There are many questions for future researches. For further study we need some databases which are not yet in existence. There should be some useful public investment in the creation of publicly available data sources on innovation and IPRs.

### 국문초록

지적재산의 중요성이 점차 커짐에 따라 지적재산(IP)의 관리는 회사의 경쟁력 제고전략의 중요한 부분이 되어 왔다.

본 논문에서는 우선 지적재산이 기업의 시장가치에 어떤 영향을 주는지에 대하여 관심을 둔다. 이러한 논의에 앞서 지적재산과 경제발전과의 관계를 살펴본다. 그리고 IP의 비용, 관리 그리고 이와 관련한 인적자산에 대하여 논의

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한다. IP로부터 더 나은 가치를 도출하기 위하여 기업들은 점점 더 정교한 방법들을 사용한다. IP 포트폴리오의 가치평가, 회계문제, 기업의 금융전략에 통합하는 문제 등도 논의된다. 우리들의 논의에서 우리들은 지적재산권(IPR)의 가치평가와 관리문제와 관련된 광범위한 관심사를 다룬다.

본 논문은 이 분야의 세계적인 전문가들의 연구결과에 기초하고 있다. 본 연구는 IPR에 대한 철저한 분석이 부족한 관계로 독창성과 참신성면에서 만족스럽지 못하다. 또한 본 논문은 IPR에 대한 특수한 주제에 대하여 초점을 맞추어 실증적인 연구를 하고 있지 못하다. 단지 IPR에 관한 여러 가지 현안들을 조사한 것에 불과하다.

추가적인 연구가 더 필요하다. 미래의 연구에 대한 여러 가지 질문들이 있다. 추가적인 연구가 되기 위해서는 현재에는 존재하지 않은 자료베이스의 구축이 필요하다. 공공투자를 통하여 IPR과 기술혁신에 관한 자료를 확보하는 것이 이 분야의 연구에 매우 중요한 과제이다.

**Keywords** : Intellectual Property Rights(IPRs), IP Protection, Patent, TRIPS, Valuation of IP, IP Management

## 1. Introduction

Until recently, the economic literature dealing with the protection of intellectual property (IP) was limited in scope and quantity. The situation has changed dramatically since the mid-1990s. With the increasing importance of knowledge, private firms and public institutions such as universities, colleges and research institutes have discovered the importance of intellectual property rights (IPR)<sup>1</sup> and their protection.

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1) According to Schaffer, Earle, and Agusti (2005), Intellectual property rights are defined as a grant from a government to an individual or firm of the exclusive legal right to use a copy right, patent, or trademark for a specified time.

IPRs are one category of intangible assets that may be owned by a firm, some others being customer goodwill, human skills embodied in their workers, and good management practice. Firms invest in R&D and new product design in order to gain profitable outcomes by launching new products and using more efficient processes of production. Once the plans of product or process innovations have been made, firms can often use IPRs to protect the returns from their investment from being depleted by imitation.<sup>2)</sup>

The subject of IP protection became a daily preoccupation of CEOs in many industries. This sudden attention followed from the realization that the value of IP of a typical firm rose in many industries substantially higher than the value of its assets. Even though the average difference between the market value and the value of assets declined in the aftermath of the stock market bubble, it remains important.

In the new economy, knowledge is the principal economic asset and its management and protection have become the cornerstones of corporate strategy. This is reflected in the professional literature. For instance, the number of publications dealing with patents indexed in ECONLIT, the leading economic database, rose from 39 publications over the 1981-1984 period to 251 publications from 1999 to 2002. Perhaps even more importantly, there is also a growing body of popular management literature with IP as its focus.<sup>3)</sup>

The present working paper examines the impacts of IP on the value of the firm. The study starts with the relationship between IP and development in section 2. With the increasing importance and use of IP, its management is becoming an integral part of a company's competitive strategies. The cost of IP, its management and the human resources involved are presented in Section 3. In order to better

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2) For this part, refer to Greenhalgh and Rogers (2007).

3) For this explanation, see Petr Hanel(2006).

derive value from IP, firms use more and more sophisticated methods. Finally, the valuation of IP portfolios, its accounting and integration into corporate financial strategies are discussed in the following section.

## 2. Intellectual Property (IP) and Development : Background<sup>4)</sup>

Property rights are rules and regulations regarding the establishment, use, and protection of property. Intellectual property rights (IPRs) are a special subset on account of the distinct characteristics of the property they regulate. Specifically, knowledge is non-rivalrous (i.e. it can be used simultaneously by multiple people) and inexhaustible (i.e. one person's use does not affect the amount left for anyone else to use). These characteristics mean that IPRs perform different economic and social functions than property rights in "normal" goods,<sup>5)</sup> and, moreover, that IPRs are the subject of intense political contestation.

Most analyses of IPRs focus on patents and copyrights, with the basic distinction being that the former protect the ideas underlying inventions while the latter protect forms of expression. To provide an example, one can patent a device for recording love songs and one can copyright the melody and lyrics to a love song, but one cannot patent the idea of a love song.

Patents confer limited monopoly rights over inventions that are new, non-obvious, and have technological application. Thus, patents are not available to knowledge that already exists, or that mark only minor steps of innovation, or that are trivial and cannot be put to use. Of course, these criteria are vague, and national patent offices treat them differently. This provides countries with a

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4) For this section, see Shadlen(2005).

5) In contrast to the normal goods, IPRs have some characteristics of the public goods.

significant amount of policy discretion.

The rights conferred by patents are limited in three significant ways, and the politics of IP can be conceptualised as conflicts over these limitations.

First, patents are not conferred automatically upon possession. Rather, private ownership rights are granted by the state, typically a national patent office, only where applicants demonstrate that their inventions satisfy the criteria of patentability. With application central to the process of establishing ownership, governments can delineate what ideas and innovations can be owned privately within their territory.

A second limitation is that patent rights always include various exceptions to patent-holders' ability to exert control over the use and distribution of their property. Patent regimes include provisions by which third parties retain automatic access and rights to use the idea. The ability to experiment on the basis of disclosed information is an example: patent-holders cannot prevent it, third parties do not have to obtain permission to undertake such activities, and the exception is not time-bounded. Patent regimes also include non-automatic exceptions, where, under certain conditions, third parties can petition the state for access. A compulsory license, for example, allows a domestic manufacturer to produce a patented good without the authorization of the patent-holder. Because non-automatic exceptions dilute patent-holders' exclusive rights more significantly, they are restricted and time-bounded. Nevertheless, all countries condition the rights of ownership and control of knowledge on the prescription and proscription of certain activities and practices, and clauses that stipulate the conditions and grounds for issuing compulsory licenses are standard features of IP regimes.

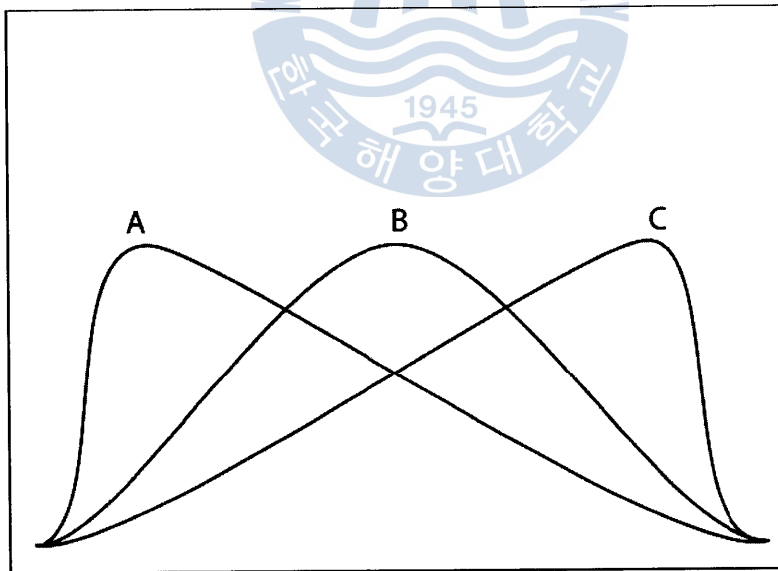
A third limitation is temporal. Patents expire; at some point what is treated as private property enters the public domain, where access to and use of the

knowledge is unrestricted. It is worth emphasizing that patent rights are also limited in a territorial sense, in that they are national and the rights conferred end at the border. This means that potential patentees must apply for patents in each country where they wish to secure protection, and they must defend their patents in each country as well. Even where patents are applied for and granted on a regional basis, e.g. in the European Union, protection and enforcement remains national.

These three limitations constitute axes of variation. When national patent regimes change, the changes can be conceptualised in terms of these dimensions: the processes by which knowledge becomes privately owned, the extent of the rights of patent-holders and third parties, and how long the rights last. Designing IP systems entails difficult and unavoidable trade-offs between providing incentives for the creation of knowledge and facilitating the use of knowledge. IPRs can encourage knowledge creation by providing incentives for innovation: innovators can invest their time and resources in attempting to generate new products with confidence that the protection to be granted will allow them to enjoy the returns. In the absence of IPRs, inventions may take on the character of public goods and, subsequently, be subject to traditional collective action problems resulting in underprovision. But IPRs also restrict knowledge dissemination, since they give owners control over the distribution and marketing of the new knowledge, including the conditions under which the knowledge can be accessed and used by third parties. The trade-off is that without IPRs, some knowledge may not exist; with too much protection, on the other hand, third parties may suffer from reduced access to new knowledge. Limited access, in turn, can rebound negatively on future innovation, to the extent that knowledge creation is an incremental process. A key point of the basic economics of IP is not simply that countries' IP regimes constitute the balance between incentives for the creation of knowledge and incentives for the dissemination and use of new knowledge, but that a single set of laws and institutions cannot maximize both objectives. That is, IP regimes

aim to maximize two desirable –but unavoidably conflicting– social objectives: that knowledge be created, and that knowledge be used. The graphs in Figure 1 present a simple conceptualisation of the trade-offs. Where incentives for either knowledge generation or knowledge use are insufficient, the benefits of the IP regime are minimal.

In this figure, vertical axis is benefit of IP Regime, and horizontal axis is incentive for knowledge creation relative to incentives for knowledge use. At some point, however, the optimal balance yields maximum benefits, indicated by points A, B, and C. The inclusion of three separate curves is to show that the relationship between IP and knowledge use differs in different settings; the optimal balance of incentives for the generation and use of knowledge depends on a variety of national characteristics that affect the degree to which local actors respond to different sorts of incentives.



〈Figure 1〉 Conceptualizing the Trade-offs Generating and Using Knowledge

To gain insights on the national distribution of patenting and innovative capacities, Table One provides data on patents granted by the United States Patent and Trademark Office (USPTO), from 1997-2004. A number of points jump off the page.

First, firms and organizations from the top ten developed countries account for more than ninety percent of all patents granted. Second, the US, Japan, and Germany alone account for nearly eighty percent. Third, the firms and organizations from the top ten developing and transition economies account for less than seven percent, with greater than five percent coming from Taiwan and South Korea. The combined total of the next eight highest ranking countries is a mere 1.36%, slightly more than Italy.

How countries prioritize the quests for creating and using knowledge have traditionally affected where the balance is struck in a given country at a given time. Different countries have their own profiles as “creators” or “users” of patentable knowledge. Whereas Table One demonstrates developed countries’ huge advantages in innovative activities (with the important exceptions of Taiwan and South Korea), Table Two, which examines patent applications according to residency of applicant, suggests that developing countries are generally importers of knowledge. Even in the countries that the World Bank classifies as “high income,” non-resident applications overwhelm resident applications, a reflection of US dominance in this area.

〈Table 1〉 Patents Granted by USPTO (1997–2004)

Top 10 Developed Countries	Percent of Total
1. USA	53.16%
2. Japan	20.64%
3. Germany	6.50%
4. France	2.39%



5. United Kingdom	2.28%
6. Canada	2.09%
7. Italy	1.03%
8. Sweden	0.91%
9. Switzerland	0.84%
10. Netherlands	0.80%
<i>Sub-Total</i>	<i>90.65%</i>

Top Ten Developing and

Transition Countries	Percent of Total
1. Taiwan	2.87%
2. South Korea	2.24%
3. Israel	0.57%
4. Singapore	0.17%
5. Hong Kong	0.13%
6. China	0.12%
7. India	0.12%
8. Russia	0.12%
9. South Africa	0.07%
10. Brazil	0.06%
<i>Sub-Total</i>	<i>6.49%</i>

Source: United States Patent and Trademark Office ([www.uspto.gov](http://www.uspto.gov)).

<Table 2> Patent Applications by Residency(1997–2002)

Income Levels	A. Non-Resident Applications as Share of Total Applications
High income	82.28%
Middle income	97.61%
Low income	99.79%

Source : World Bank, World Development Indicators.

But the asymmetries are even greater in the developing world. Residents account for less than three percent of patent applications in middle-income countries and only one-fifth of one percent in low income countries.

In countries with higher levels of innovation (i.e. where more research and development tends to produce new knowledge), it has made sense for these countries to set incentives to encourage the creation of knowledge. In contrast, in countries with lower levels of innovation, where most new knowledge that is used is imported from abroad, the incentives were typically set to encourage dissemination and use of new knowledge and ideas

To be sure, national IP regimes have not always reflected countries' scientific and innovative profiles. Historically, though, diversity in national patent regimes – both cross-nationally and longitudinally – has corresponded to these basic national characteristics. Wealthier countries, with higher levels of innovation (or, more accurately, higher levels of “patentable” innovation), have typically offered more IP protection than poorer countries. Wealthier countries have made patents available and easier to obtain on a wider range of goods, have placed fewer restrictions on what patent-owners must do to retain exclusive rights, and have offered longer periods of patent protection. The relationship between national income and the relative incentives toward knowledge creation and knowledge-use is best represented by a j-curve.

As countries become more industrialized and thus have greater capacity to use cutting-edge knowledge, their patent regimes tend to facilitate local firms' ability to access such knowledge ; later, as they develop more indigenous innovative capacities, countries' patent regimes tend to emphasize incentives for knowledge-generation.

National variation was facilitated by a permissive international regime. Prior to the Uruguay Round, international governance in the issue-area of IP was weak, both procedurally and substantively. Because IP was not considered “trade-related,” the treatment of IP was not regulated by multilateral trade institutions (e.g., General Agreement on Tariffs and Trade [GATT]). Instead, the principal international covenant for patents was the 1883 Paris Convention for the Protection of Industrial Property, which allowed countries a significant degree of flexibility in designing their patent regimes. Although parties to the Paris Convention pledged to abide by the norms of nondiscrimination and national treatment (i.e., they would not treat patent applications and patents differently depending on the country of origin), they retained virtually complete autonomy in designing national patent legislation.

In the 1980s and 1990s, however, global governance in IP underwent a sea change, as developed countries, led by the U.S., pushed for stronger enforcement of a less flexible set of regulations regarding the treatment of IP. The goal, in essence, was to universalise OECD-style IP protection.

The increased prominence of IP in U.S. foreign policy is a story of sectoral politics, in which well-organized industry groups representing the biotech, chemical, pharmaceutical, entertainment, and software industries pushed the U.S. government to use trade sanctions against countries that were argued to be lax in protecting their copyrights, patents, and trademarks. In 1984, Congress amended Section 301 of Trade Act of 1974 to make violation of intellectual property rights “actionable.” As the business constituency for stronger IP protection grew, the same coalition succeeded in obtaining another amendment to Section 301 in 1988—“Special 301,” which heightened the United States Trade Representative’s (USTR) authority to act against countries that provided insufficient protection of intellectual property.

In addition to unilateral strategies of IPR enforcement, the U.S. also insisted on

integrating the theme of IP into the Uruguay Round negotiations in order to establish a new set of global standards to guide countries' IP regimes. Integrating IP into the multilateral trade regime would accomplish two goals simultaneously: it would take a giant step toward harmonization of IP, and it would convert the new standards into enforceable international law, where violators could be punished with retaliatory trade sanctions. The product of this campaign is the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which creates new global standards regarding virtually all aspects of how countries treat IP. TRIPS places significantly greater limitations on how countries configure their patent regimes. The reduction of policy space under TRIPS is best illustrated with reference to the three axes of variation noted above: establishing private rights over knowledge becomes more automatic, the rights are more absolute, and they last longer.<sup>6)</sup>

Whereas countries could previously deny patents to certain types of inventions so as to encourage reverse-engineering and lower the barriers to entry in technologically-intensive sectors, now countries must offer patents in virtually all fields. Whereas countries could include extensive exceptions to patent-holders' monopoly rights in order to facilitate broad access to patented knowledge, TRIPS strengthens the rights of patentees to control access and use of patented information. Whereas countries could make enjoyment of the monopoly rights conferred by patents conditional upon local production or licensing and transferring technology to local users, TRIPS limits how governments regulate patent-holders. And whereas countries could offer patents of short duration to increase the entry of knowledge into the public domain, TRIPS requires that the strengthened rights of patent holders extend for twenty-year patent terms.

Thus, TRIPS makes it more difficult for developing countries to gear the management of IPRs toward speeding the pace of local technological diffusion and

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6) For the comprehensive explanation about TRIPS, see Greenhalgh and Dixon(2002).

spurring indigenous technological development.<sup>8</sup> Because TRIPS focuses primarily on establishing incentives for innovation and knowledge-generation, activities which occur disproportionately in developed countries, it limits developing countries' rights to design patent regimes to encourage imitation and technological learning. In sum, TRIPS ushers in a new relationship between patent regimes and level of development.

One concession granted to the developing countries regarded transition periods for implementation: while all countries were required to introduce national treatment and non-discrimination immediately into their existing IPR laws, developing countries had until January 2000 to bring their IPR regimes into full conformity with the WTO, and the least-developed countries were given until 2006. Special transition periods were included for pharmaceuticals and chemicals, and here, too, the least-developed countries are granted additional time. Eventually, when most transition periods are over, developed and developing countries will be subject to the same standards for IP management, with the poorest countries still remaining exempt from many obligations.

Notwithstanding the very real constraints set by TRIPS, the agreement still leaves room for national variation in how countries treat intellectual property. The borders of the upper bar in Figure Three, particularly the bottom border of the upper-right bar, should be viewed as imprecise. Countries may exhibit substantial variation in their patent regimes, all while being compliant with TRIPS; and there is room within TRIPS for countries to develop dynamic patent regimes. To quote a prominent IPR scholar who has also been a strong critic of TRIPS, "Developing countries were able in the pre-TRIPS era to define patent policies with a great degree of freedom. This has changed dramatically, but it is still possible to design patent laws taking into account broader developmental objectives and, particularly, the creation of a legal environment to promote innovation and technology transfer".

### 3. The impact of IP on the value of the firm<sup>7)</sup>

Economists and business analysts working with stock market data endeavor to determine the effect of IP instruments on the value of a firm. There is a growing body of literature covering various methodologies for assessing the economic value of IP rights and their impact on the value of the firm. These are mostly retrospective studies and are reviewed in this section. Methods used to evaluate new technologies available for sale, licensing or other means of extracting value from IP are presented in the next section, devoted to the management of IP.<sup>8)</sup>

There is a long tradition of using patent statistics as economic indicators. Economists and students of technological change have used patent statistics and patent information for various purposes. The advantages and shortcomings of patent-based measures used as economic indicators have been frequently discussed in economic and business literature; the most authoritative survey of this literature well worth reading but too comprehensive to review here is by Griliches (1990). See also a series of empirical studies in Griliches (1984).

#### 1) Economic value of patents

Only a subset of this literature is concerned with the economic value of patents. According to Jaffe (2000), studies that estimated the value of the patent right show that it ranges from 5% to 10% of research spending in some industries to a high of up to 35% in other ones. According to Gallini (2002), the value of patent protection, estimated from European patent renewal data and averaged over technological fields, has been found to be 15-5% of related R&D expenditures. These modest estimates are consistent with findings from surveys of innovating

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7) For this section, see Petr Hanel(2006).

8) According to Webster(2002), compared with the tangible economy, knowledge and intellectual capital is dominated by the three classic forms of market failure: uncertainty, inappropriability and invisibility.

firms suggesting that innovators do not consider patent protection very effective in protecting the returns from innovations.

When research is sequential and builds upon previous discoveries, stronger protection may discourage subsequent research on valuable but potentially infringing, follow-up inventions.

Lerner (1994) examined the impact of patent scope on firm value. Using a sample of privately held venture capital-backed biotechnology firms, he shows that the breadth of patent protection significantly affects valuations.

A one standard deviation increase in average patent scope is associated with a 21% increase in the firm's value. Broad patents are more valuable when substitutes in the same product class are plentiful, a finding consistent with theoretical suggestions. The scientific merit of patents along with their number and R&D expenditures appear to be patent characteristics that drive up the stock market value of small and large firms.

The use of patents in economic research has been seriously hindered by the fact that patents vary enormously in their importance or value and, hence, simple patent counts may be misleading indicators of innovative output.

As shown by Trajtenberg (1990), patent counts weighed by citations as indicators of the value of innovations overcome the limitations of simple counts. The market value of firms is closely related to its knowledge assets and, according to Hall (1998a, b), patent-based measures contain information about this value above and beyond that given by the R&D expenditures. In the conclusion of her survey of recent findings in this field, Hall indicates that patent counts-weighted citations are overcoming the limitations of simple counts by improving the precision of the estimated relationship. See also a recent study of the relationship

between backward citations of US patents and stock returns by Fung (2003).

## 2) Accounting rules and value of IP

According to existing accounting rules, the book value of a firm does not include intangibles such as the value of IP. The value of the intangible assets of firms included in the Dow Jones Industrial accounted for 43% versus 24% for the fixed assets in 1997, according to Bratic et al. (2002).

The phenomena of the rising value of intangibles and the role of IP in the the role of IP in the “New” economy was the subject of the Brookings Institution Study (2001). The growing gap between the value of a firm and the value of its fixed assets led Razgaitis (2002) to define the Old Economy as a system where there is a direct measurable connection between the assets and income. The connection (correlation) between assets and value has changed radically in the last 20 years. In the New Economy, the price-to-book ratio increased notably, suggesting that the conventionally accounted assets no longer represented the market value of a company. The case study shows that Microsoft’s market value follows much closer the number of US patents issued to Microsoft than the book value of its assets. Thus the value of technology seems to be the missing component in the value equation.

Even though the stock market value of most knowledge intensive firms has declined significantly since the 2000 peak, there still remains a significant gap between the market value of most firms and the value of their tangible assets. For example, the stock market value of Microsoft in Spring 2003 is far below its peak but still well above the book value of its tangible assets. However, the measure of the intangible capital of semiconductor firms based on citation-weighted patents provides, according to Shane and Klock (1997), a better measure than simple patent counts. The study by Blundell et al. (1999) examines the empirical relationship between technological innovations, market share and stock market



value. The study finds a robust and positive effect of market share on the observable headcount of innovations and patents. Another method for deriving the value of patents is based on patent renewal information (Lanjouw et al., 1998).

A significant proportion of patented inventions is likely to be used in industries other than the one to which the original inventor and/or owner of the patent belongs. For example, inventions patented by a chemical firm may be used in the pharmaceutical, plastics or rubber industries. A study of a large sample of major manufacturing firms operating in the US has shown that the patent-weighted R&D of upstream firms shows up in the increased profitability of downstream (user) firms (Hanel and St-Pierre, 2002). The evidence on the growing gap between the value of a firm and its book value is not limited to the US. Bosworth and Rogers (2001) investigate how R&D and IP activity influences the market value of Australian firms, using Tobin' q approach. R&D data are available for the period 1994-6 and data on patent, trademark and design applications for 1996. The findings suggest that R&D and patent activity are positively and significantly associated with market value. The results also suggest that private returns to R&D in Australia are low by international standards. Hoshi and Kashyap (1990) examined the effect of patenting on Tobin q in Japan. Two recent studies explored the IP-economic performance nexus with German data. The empirical analysis of a sample of 49 manufacturers of machine tools shows a strong positive relationship between the market value of the firm and its patenting activities (Fleischer, 1999).

Holger (2001) analyzed a panel of 50 German machine tool manufacturers and found that national patent applications lead to sales increases with a time lag of 2 years after the priority year.

The mean value of patents may not, however, represent very informative statistics since the distribution of returns from patents is very skewed. According to Scherer and Harhoff (2000), the top 10% of their sample captured from 48 to 93% of the total sample returns. Patenting is a distinctive feature of the patterns

of technological entry and exit across sectors and over time. Malerba and Orsenigo (1999) found that most of the entrants are occasional innovators, while persistent innovators are few in number but large in terms of patents. Patents confer temporary monopoly power, which may be translated into higher prices. Jones et al. (2001) examine the impact of the 1987 changes in the Canadian Patent Act on the pricing of ethical drugs. From 1969 to 1987, Canada opted to control pharmaceutical prices by using the compulsory licensing provisions of the Act to promote competition between branded drugs and their generic equivalents. In 1987, however, the Act was amended to guarantee patent holders an extended period (7-10 years) of protection. The major conclusions are: despite evidence of significant first-mover advantages which resulted in higher brand prices, competition from generics succeeded in reducing overall market prices prior to 1987; but, after 1987, the efficacy of generic competition was reduced and both brand and market prices increased. This conclusion is, however, contradicted by earlier empirical studies reviewed by Frank and Salkever (1992). Their article suggests that the entry of generic competitors results in minimal decreases or even increases in brand-name drug prices as well as sharp declines in brand-name advertising.

#### 4. The Management of intellectual property<sup>9)</sup>

With the understanding that in the New Economy the knowledge capital and not bricks or heavy machinery is the principal source of value, the protection of IP acquired a new importance (see Granstrand (1999a, b) for intellectual capitalism, Nonaka et al. (2000) for firm as knowledge creating entity and Prahalad and Hansel (1990) for the core competence of a corporation). Possessing promising technology well-protected by appropriate IP instruments has become a necessary condition for attracting venture capital, accomplishing a successful initial public offering (IPO) and increasing the value and profits of established firms.

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9) For this section, see Petr Hanel(2006). This section is based on Hanel's survey article about IPRs.

The management literature has added the management of knowledge and intellectual capital to its popular subjects. There is an increasing number of reference materials providing guidance to practitioners of IP and technology transfer. They typically cover the whole domain of IP management, including the financial aspects.

In this section, I review the most important recent contributions to this fast-growing literature that deals with the management of and strategies for IP protection. I overview those that take a broader view and leave aside those that deal only with legal issues.

### 1) Assessing, measuring and auditing IP portfolios

The growing interest in the management of IP has resulted in efforts to improve its measurement. IP performance is now measured in ways other than simple patent counts. The emerging measures combine quantitative and qualitative aspects and enable organizations to better evaluate and manage their patent portfolios Bratic et al. (2002).

Firms are performing IP “business” audits of their IP in order to assess the commercial value and competitive use of IP for their business. The audit classifies IP into several groups. It is the first step to creating an IP portfolio for strategic purposes. For example, Dow Chemical, which has 29,000 patents, required each business unit to classify its patents under three groups:

- (1) most valuable patents related to high growth business,
- (2) patents that had no present or planned use but are still of value to others and
- (3) patents unlikely to be used.

The first group was left for business unit competitive purposes, the second offered for licensing and the third donated or abandoned. Identifying IP portfolio and mapping IP are of crucial importance for licensing. Fox and Kelley in Berman (2001, Chapter 9) present Hewlet-Packard’s approach on how to turn intellectual

assets into business assets and how to manage innovation and IP based on a marketing-centric strategy.

## 2) Valuation of IP<sup>10)</sup>

One of the most important steps in managing IP is to establish its value. Valuation is the process of ascribing value to technology. Valuation is particularly crucial for the commercialization of early technologies, for licensing and for mergers and acquisitions (M&A).

Probably the best sources on the valuation of IP in general are Razgaitis (2002), Smith and Parr (1998) and Lamb in Simensky et al. (1999, Chapter 5) and Damodoran (1994). According to Razgaitis, the basis of valuation is recognition that there are two concepts involved: Technology and Right. When these change, the value changes as well. The principle valuation methods are:

1. Industry standards (key is finding an appropriate benchmark).
2. Rules of thumb (25% rule and many variants thereof).
3. Rating-Ranking.
4. Discounted cash flow.
5. Advanced methods(Monte Carlo, Real options pricing (for details see author's book Early Stage Technologies: Valuation and Pricing).
6. Auctions.

Razgaitis recommends using multiple methods of valuation. Multiple methods produce value or a coherent range of values that make sense from those multiple perspectives. The valuation of early technologies presents specific challenges as evidenced by the dot.com and telecom bubble of the late 1990s. This lends a special interest to the book on valuation of early technologies published at the peak of the stock market frenzy (Razgaitis, 1999; Smith and Parr, 1998, Chapter 10). The study of a sample of 127 semiconductor patents suggests that, for patents

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10) Park and Park(2004) presented a new method for technology valuation in monetary value. This method is based on the structural relationship between technology factors and market factors.

used as “bargaining chips,” novelty and inventive activity are the most important determinants of the value of patent rights. In a series of related papers, Reitzig (2003, 2004a, b) estimated the value of patent ‘pools’, patent ‘fences’ and patent ‘thickets’ of a sample of 612 European patents and found that the value depends on the type of patented technology (discrete or complex). The valuation of IP is also particularly important in M&A. On the valuation of brands in M&A, see Forbes(2000). The role of IP in M&A is especially important in information technologies (Rivette and Klein, 2000). A comprehensive treatment of IP in M&A is presented by Bryer and Lebson on the WIPO(2003) Internet site. The valuation of patents, when included in an industry standard, should take into account the value conferred by the patented invention and the value attributable to the standard (Patterson, 2002). Smith (1997) treats valuation of trademarks. Intellectual property protection is also a significant factor in strategic alliances. Firms adopt more hierarchical governance modes when protection is weak (Oxley, 1999).

Patent citation data are used to measure ‘technological overlap’ between firms before and after alliance formation. Partner selection can be predicted by measures of technological overlap and, once formed, alliances appear to affect the technological portfolios of firms in ways predicted by the resource-based view (Mowery et al., 1998).

Under some circumstances, the value of corporations’ intellectual capital (protected or not) is maximized by the strategy of corporate “carve-outs.” A corporate carve-out occurs when a company itself desires to hold the intellectual assets of its business in two or more sister companies. In contrast to a corporate spin-out (or spin-off) whose shares are distributed to existing shareholders, a carve-out establishes a new set of shareholders. The chapter by Malackowski and Harrison in Goldscheider (2002, Chapter 13), describes in detail the reasons for carve-outs, the criteria to be used in evaluating the intellectual capital for carve-outs, the selection of potential partners and how the carve-out should be structured. See also Zack (2001) on how to restructure technology rich companies. The joint venture IP strategies and special problems with Strategic Alliances are described by Smith and Parr (1998, Chapters 13 and 14).

### 3) Managing of IP assets

The evidence of corporations being increasingly capable of extracting value from intellectual assets is provided by the growing importance of licensing. This increase in importance had, according to Manfroy (2002), the following consequences:

- (1) Corporate vision changed and many corporations created the position of Chief Technology Officer.
- (2) Emergence of the Intellectual Capital Model. A model of a company from the intellectual assets perspective that explains how the different pieces of a corporation fall together, how they interrelate and their impact on a corporation's intellectual assets and profitability.
- (3) Attention is given to intellectual assets management.
- (4) With the increasing importance of intellectual assets licensing professionals are demanding increased remuneration.

The various aspects of best licensing practices are presented in a collective volume edited by Goldscheider (2002), in Goldscheider (1998) and UNIDO (1996). Although the present survey does not provide an over view of the legal aspects of IP management, I wish to draw attention to the chapter on the 'Dos and Don'ts of licensing agreements. It is a very useful guide that should help managers and legal councils interact better in their endeavors to write precise but comprehensive legal agreements (Ramsay, 2002). Licensing increasingly involves a combination of patents, trade secrets and copyrights in the realm of software and the Internet (see, respectively, Jager's Chapter 6 and Lechter's Chapter 7 in Goldscheider, 2002). Trademark protection and licensing from the US and Canadian perspectives are treated in Small and McKay's Chapter 8. Positioning IP for share holder's value through "Patent Brands" is discussed by Berman and Woods in Berman (2001, Chapter 10). One of the companies whose value is based on several world's most valuable brands is Proctor & Gamble. Weedman in Berman (2001, Chapter 11) describes how the IP portfolio is managed and exploited by Proctor & Gamble. Smith and Parr (1998) present a Strategic IP plan and Gap analysis, illustrated by case studies

of Merck and Dupont. The best intellectual capital management practices of a group of about 30 leading companies are the raw material from which Davis and Harrison (2001) distilled the patterns that characterize some of the activities leadingedge companies use to realize value from their intellectual capital and property. Rivette and Klein's (2000) book is full of examples of how the high tech firms in information technology industries extract value from their knowledge assets. They propose a three-pronged patent strategy for large R&D projects (Knight, 2001).

#### 4) Accounting and IP

The American Institute of Certified Public Accountants (AICPA) has been requiring all companies—private and public—to disclose certain risks and uncertainties that could affect their financial performance, effective for fiscal years ending after December 15, 1995. The new requirement, known as Statement of Position (SOP) 94-6, "Disclosure of Certain Significant Risks and Uncertainties," challenges senior managers of businesses to find an appropriate balance between complying with new disclosure guidelines and guarding their own competitive positions and trade secrets (Kwestel and Nusbaum, 1996). However, this measure did not prevent the financial scandals that marked the end of the 1990s. In June 2001, the Financial Accounting Standards Board of the US introduced new Financial Accounting Standards (FAS #142) Goodwill and Other IA that required significant changes in how companies record the value of their IP. As stated by Baruch (2001) who was on the committee, "For the most successful companies patents, copyrights, brands and other IA trump physical assets, such as factories, offices and even product inventory, hands down" In May 2001, the Securities and Exchange Commission Chairman recommended that the SEC encourage supplemental reporting by corporations on such assets. Kossovsky and Brandege (Goldscheider, 2002, Chapter 12) show how firms respond to these new rules by integrating IP management strategies into corporate financial strategy. The framework for auditing intellectual capital (see also the section on IP portfolios above) uses different methods. The comparison of their effectiveness is found in Abeysekera (2001). Many larger IP agent and attorney firms propose one model of IP audit or

another, e.g. see the website of Bereskin & Parr, Toronto, Ont. [www.bereskinparr.com](http://www.bereskinparr.com) which offers a series of IP management related texts, articles and guides written by the firm's IP professionals (Rudolph; see also Aylen, 2001).

Financial accounting and reporting considerations are also covered by Carter and Lasinski in Simensky et al.(1999, Chapter 8). One particularly sensitive issue in the era of precipitating technological change is the obsolescence of new technologies and their fiscal treatment. Amortization of IP for US Federal income taxes is the subject of Gehan's chapter in Simensky et al. (1999, Chapter 9). Patent renewal data were used by Bosworth and Jobome (2003) to estimate the rate of depreciation of technological knowledge. Global exploitation of IP creates special accounting and fiscal issues, especially for joint ventures. The rules, constraints and methods of dealing with them are presented in Smith and Parr (1998, Chapter 14). Baumgarten et al. (1995) look at fiscal aspects of software transactions.

##### 5) IP as financial asset

IP assets are increasingly integrated into a corporation's financial strategy. IP is leveraged in investment banking transactions. As IP assets are used increasingly by corporations as financial assets, their value is also assessed by rating agencies

IP management as a financial asset draws its approaches from financial management. One of the more sophisticated approaches is the application of the options pricing theory to IP, presented in Berman's (2001, Chapter 5) by Arrow. He presents the pros and cons of the options approach. Schwartz (2004) develops and implements a simulation approach to value pharmaceutical patents and patent protected R&D projects based on the real options approach. The options approach is also exposed in Razgaitis (2002). The interplay of risk and reward involved in inventing is closely related to a similar interplay in investing. Jorasch (in Berman's (2001, Chapter 6) develops the concept of business-driven inventing: a process which starts by identifying what the market wants and then finds a unique (perhaps patentable) solution to fill the need. The chapter is illustrated with



examples from several industries (a pharmaceutical company, a firm developing business solutions, a casino slot machine company). The relationship between IP and venture capital financing is the topic of Malackowski and Wakefield's chapter "Venture Investment Grounded in Intellectual Capital" in Berman (2001). Securitization of IP, i.e. using IP instruments to secure financing, is one of the latest manifestations of "intellectual capitalism". Several subjects: Financing IP royalties, Credit analysis of Intellectual Property Securitization, Asset-based IP financing, Relevance of IP in M&A and Patents on Wall Street, are described in the last section of Berman (2001). The taking of security interests in IA must conform to international laws and comply with national statutes. Simensky et al. (1999) present the situation in 33 countries, including Canada.

## 5. Concluding Remarks

Briefly we summarize our previous discussion as follows.

In this paper we examined the relationship between IP and economic developments. With the increasing economic importance of knowledge, it is not surprising that IP in general and patents in particular are an increasingly valued business asset. The fast rise of the value of high-tech firms in the run-up to the late 1990s stock market bubble attracted attention to the economic value of IPRs in general and of patents in particular. As in the effectiveness and use of IPRs, there are important inter-industry differences in the estimates of the economic value of patents. According to several studies, they range from 5% to 10% of research spending in some industries to 35% in others. The market value of firms is closely related to its knowledge assets. The patent-based measures of a firm's knowledge assets contain information about the firm value above and beyond that given by R&D expenditures. The wider the breadth of patent scope, the stronger the impact of patents on the value of the firm.

One of the defining characteristics of the New or Knowledge-based Economy is the close correlation of the market value of a firm and the value of its IP.

Increasingly, the market value of a firm, especially in the knowledge intensive industries, is associated more closely with the number of patents it owns than with the value of its physical assets. Even though the market value of most knowledge intensive firms has sharply decreased from the 2000 peak, that market value is still well above the book value of their assets. The evidence of the gap between the value of the firm and the book value of its assets is not limited to the US.

The realization of the increased importance of IP rights as a co-determinant of the market value of a firm has led to an increased interest in the management of IP. Management literature has added the management of knowledge and IP capital to its popular subjects. To properly manage IP, firms have to be able to measure and assess the value of their IP portfolios. Several recently published management books specialized in this subject show the practices of the most notorious large patenting firms. The valuation of IP is particularly important for IPOs, for M&A of knowledge intensive firms and for strategic alliances. Auditing their IP in order to determine its contribution to a firm's value added, and licensing patents, know-how and brands not crucial for the firm's core business, enable the extraction of more value from IP assets. The case studies and anecdotic evidence point to the increasing importance of licensing. There are a growing number of management texts instructing managers and legal council how to better interact with the management of IP and its licensing.

The increasingly important role of intellectual assets poses a challenge to accounting. In 2001, the Financial Accounting Standards Board of the United States introduced new Financial Accounting Standards that brought about significant changes in how companies record the value of IP. A particularly difficult issue in a period of rapid technological change is the rate of obsolescence of new technologies and their fiscal treatment. The present survey lists several useful sources where these subjects are treated.

One particularly interesting aspect of IP management is drawn from an analogy of risk and rewards characterizing both inventing and investing. This led to the application and adaptation to IP of the financial theory of option pricing. Another spill-over from financial theory and practice is the securitization of IP, i.e. using IP instruments to secure financing. This section of the survey is completed by a thorough overview of national regulations and international standards relative to the securitization of IP in 33 countries.

In our discussion we try to consider the various aspects about intellectual property rights. This paper is based on the many specialists' researches of IPRs. Because of the absence of through study about IPRs, this paper lacks the originality and creativity. In this paper, also we did not empirical approaches concentrating on the close focus about special topics of IPRs.<sup>11)</sup> We only survey the some issues about IPRs. Additional study should be required to furnish this paper with originality and creativity. There are many questions for future researches.<sup>12)</sup> For further study we need some databases which are not yet in existence. There should be some useful public investment in the creation of publicly available data sources on innovation and IPRs.

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11) For example, Greenhalgh and Rogers(2006) analyse market valuation of UK companies and consider the interaction of competition, R&D and IP.

12) Greenhalgh and Dixin(2002) presents a list of questions for future researches, which include 1)Incentives offered by IP system, 2)efficiency of markets, 3)rates of return to IPR, 4)science and industry, 5)domestic policy issues, and 6)international aspects of IP systems.

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