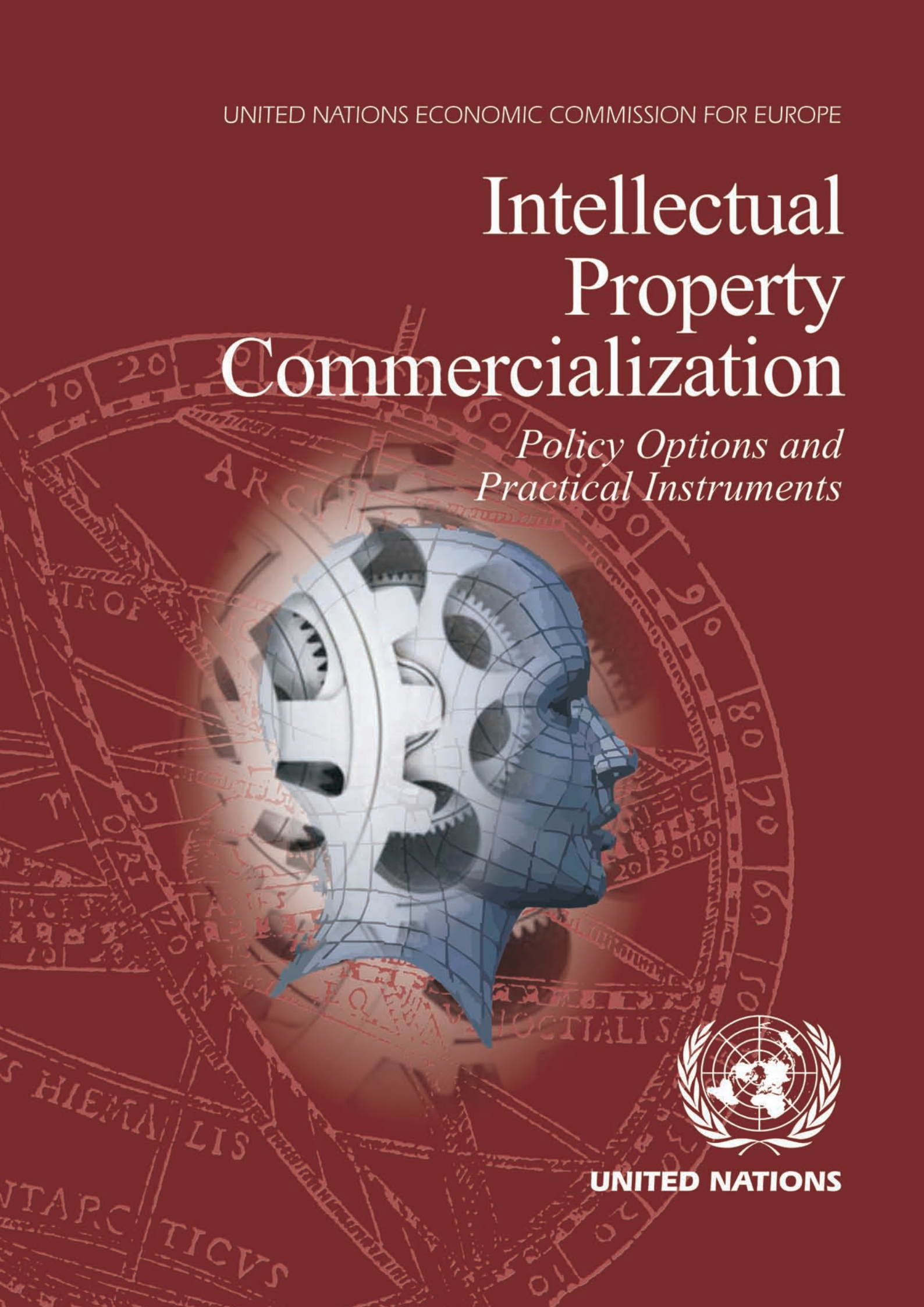
UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

Intellectual Property Commercialization

Policy Options and Practical Instruments



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UNITED NATIONS
New York and Geneva, 2011

NOTE

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ECE/CECI/12

UNITED NATIONS PUBLICATIONS

Sales No. 11.II.E.16

ISBN: 978-92-1-117053-5

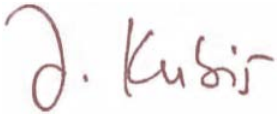
FOREWORD

Innovation is the key driver of economic growth and development in the medium to long term. It can be defined as the process of introducing new products, services and production processes into the market place and to create new profitable enterprises and higher-paying jobs on this basis. A well-balanced, affordable and reliable system of intellectual property rights has an important role to play in this process. Intellectual property rights serve to protect the - often large and highly risky - investments of innovative and creative companies against potential imitators and thereby provide key incentives to undertake such investments in the first place.

The present publication is not intended to provide a cross-country analysis of intellectual property laws and their economic impact. Instead it focuses on practical problems of using intellectual property rights in the innovation process, i.e. on the commercialization of intellectual property, and on the question of what economic policy can do to support the various innovation stakeholders in this process. Specifically, it discusses the role of intellectual property in the transfer of technology from public research organizations to the business sector, the management of intellectual property in small and medium-sized enterprises, and the auditing, valuation of and accounting for intellectual property.

The publication has been prepared on the basis of policy documents and other materials submitted to the UNECE by members of its Team of Specialists on Intellectual Property, as well as other publicly available documents and materials. It also draws on the outcomes of international conferences held by the Team in Geneva in 2007, 2008 and 2010.

I hope that this publication will be helpful for practitioners and policymakers, particularly from countries with economies in transition, and that it will contribute to a general process of transnational learning on good practices and policies for promoting the commercialization and protection of intellectual property and the enforcement of intellectual property rights across the UNECE region.



Ján Kubiš
Executive Secretary
United Nations Economic Commission for Europe

ACKNOWLEDGEMENTS

This publication is part of the Programme of Work of the UNECE Subprogramme on Economic Cooperation and Integration in the focus area “Commercialization and Enforcement of Intellectual Property”. It would not have been possible without the guidance, inputs and comments of the bureau and members of the UNECE Team of Specialists on Intellectual Property.

A major substantive contribution to the publication by Gail E. Evans, Reader in International Intellectual Property, Queen Mary Centre for Commercial Law Studies, University of London, is gratefully acknowledged. The Secretariat would also like to thank the United States Patent and Trademark Office and Richard Zheng, University of East London, for their detailed comments on an earlier draft.

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ABBREVIATIONS

ASTP	Association of Science and Technology Transfer Professionals
AURIL	Association of University Research and Industry Links
AUTM	Association of University Technology Managers
CIPO	Canadian Intellectual Property Office
CIS	Commonwealth of Independent States
DCF	Discounted Cash Flow
EARTO	European Association of Research and Technology Organisations
EFP	European Framework Programs
EIRMA	European Industrial Research Management Association
EPO	European Patent Office
ERA	European Research Area
EU	European Union
EUA	European University Association
IAS	International Accounting Standards
IASB	The International Accounting Standards Board
ICT	Information & Communication Technologies
IFPMA	International Federation of Pharmaceutical Manufacturers & Associations
IFRS	International Financial Reporting Standards
INPI	Institut National de la Propriété Industrielle (France)`
IPAS	Intellectual Property Assistance Scheme (Enterprise Ireland)
IP	Intellectual Property
IPC	International Patent Classification
IPR	Intellectual Property Rights
KTO	Knowledge Transfer Office
MTA	Material Transfer Agreement
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PRO	Public Research Organization
R & D	Research and Development
ROI	Release of Information
RTD	Research and Technological Development
SEKIT	Scottish Expertise, Knowledge and Innovation Transfer Programme
SPV	Special Purpose Vehicle
SME	Small and Medium-sized Enterprises
TTO	Technology Transfer Office
UN	United Nations
UNCITRAL	United Nations Commission on International Trade Law
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Office
WITK	What is the Key? (UK Initiative)
WTO	World Trade Organization

I. Introduction

Intellectual property is a key concern in the quest for growth, development and competitiveness. Advancement in knowledge broadly conceived is a key driver of economic prosperity in the twenty-first century. The ongoing revolution in information and communication technologies (ICT) has dramatically reduced the costs of creating, processing and transmitting knowledge, both nationally and across borders. The pace of innovation has accelerated significantly. These twin developments, of closer international economic integration and more rapid innovation, create new challenges for IP regimes and policymaking.

To be competitive in the globalized economy, the UNECE Member States have to maintain, adapt and create institutional and legal frameworks conducive to the creation of knowledge and its commercialization. Intellectual property rights have a key role to play in this regard.

At the same time, both the innovation process itself, and the production activities of firms are globalizing rapidly. This raises challenges in terms of managing, protecting and enforcing intellectual property rights across borders.

Countries with economies in transition face additional challenges to integrate into the increasingly global production networks and to find their own niche in the increasingly global value chains. To be successful, they need to assign high priority to developing their own innovative capacities, as well as their ability to absorb and adapt technological innovations from abroad, and to move up the value chain over time. Again, IP regimes have a key role to play in this regard.

Well-designed intellectual property rights systems give temporary exclusive rights to inventors and thereby increase their chances to recover the often substantial upfront investments they need to make to generate innovations and to bring them to market. Intellectual property rights systems should also make it possible for innovators to sell, license or give away the rights to their innovations to others, who may be better placed to exploit them. In other words, intellectual property rights are a key prerequisite for intellectual assets to emerge in markets. Well-designed intellectual property rights systems also encourage innovators to disclose their knowledge so that future innovators can build on it, thereby helping to accelerate the rate of innovation.

However, a balance has to be struck between the need to give temporary exclusive rights to innovators so that they can recover their investments, and the need to make new knowledge available for use by future innovators and competitors.

The countries with economies in transition are in the process of developing and adapting their IP regimes with a view to meeting these challenges. They are undertaking commitments in the framework of the treaties administered by the World Intellectual Property Organization (WIPO), accession negotiations to the World Trade Organization (WTO), and/or Partnership Agreements with the European Union. At the same time, these treaties and agreements still leave significant scope for policymaking at the national level.

A well-designed and well-performing intellectual property regime is not an end in itself, but a tool to improve the innovative capacity and competitiveness of the economy. Policymakers should therefore ensure that practices and policies targeting improvements in the intellectual property regime are consistent with and integrated into a larger effort to improve the policy, legal and regulatory framework promoting innovation and competitiveness.[1]

The effectiveness of the intellectual property regime depends in large part on progress made in the design and governance of national innovation systems, the creation of suitable framework conditions for the financing of innovation, and the promotion of innovative entrepreneurs and SMEs. While these issues are beyond the scope of the present document, they are being addressed within the other thematic areas of the CECI Programme of Work.[2]

Given that the effectiveness of IP policies depends on the broader policy, regulatory and legal environment, any policy recommendations regarding the development of IP regimes in countries with economies in transition need to be considered as part of a thorough analysis of the relevant conditions prevailing in the respective national economies.

Beyond the design of the legal framework, intellectual property can contribute effectively to knowledge-based economic development only if the key stakeholders in the innovation process have the capacity to actually make optimal use of the intellectual property system. Even in the leading innovative economies of the UNECE region, research time and again finds that by far not all stakeholders have this capacity. The innovation process, i.e. the process of turning inventions and other forms of new knowledge into production processes, product or services which are commercially successful and generate new jobs and economic growth, is far from automatic. It is fraught with business risks and frequently requires massive capital investments over long periods of time.

Strategic management of intellectual property can be a very important factor in managing the innovation process successfully. However, research organizations and small and medium-sized enterprises frequently lack the skills and sometimes also the incentives to manage intellectual property strategically and to maximize its impact on innovation. The present Review therefore specifically discusses IP management in universities and other public research

[1] The World Intellectual Property Organization has developed a National IP Audit Tool which provides a systematic approach for policymakers to assess the strengths and weaknesses of their IP regimes in the context of the overall innovation policy framework.

[2] See United Nations Economic Commission for Europe, 2007, Financing Innovative Development; United Nations Economic Commission for Europe, 2007, Creating a Conducive Environment for Higher Competitiveness and Effective National Innovation Systems; United Nations Economic Commission for Europe, 2008, Developing Entrepreneurship in the UNECE Region; United Nations Economic Commission for Europe, 2009, Policy Options and Instruments for Financing Innovation; United Nations Economic Commission for Europe, 2009, Enhancing the Innovative Performance of Firms. All publications are available free of charge at: http://live.unece.org/ceci/publications.html.

organizations, and in innovative small and medium-sized enterprises. Rather than providing a detailed analysis of legal frameworks, the Report focuses on the challenges which research organizations and SMEs face in using the IP system, and on the policy options available to support them in this.

Interdependencies exist across various IP policies. For instance, policies aimed at improving IP management capabilities at research organizations or small enterprises are unlikely to have a big impact unless the legal protection of IP is sufficiently strong and enforcement of IPRs is effective. Policies aimed at strengthening legal protection of IP and enforcement of IPRs are unlikely to enhance economy-wide innovative capacity and competitiveness if potential innovators lack the awareness, skills or resources to access the legal IP system or to manage their IP judiciously. Policy should therefore address simultaneously weaknesses in the IP regime along the entire spectrum from the management of IP in research organizations, enterprises and financial firms to the legal and institutional system for IP protection, and to IPR enforcement.

II. Intellectual Property and Economic Performance

"Competition from the new commodity, the new technology, the new source of supply, the new type of organization […] is the powerful lever that in the long run expands output."

Joseph A. Schumpeter

A. Introduction

In the medium to long term, innovation is the main driving force of economic growth in leading economies. Other possible sources of economic growth, such as bringing a larger share of the population into employment, installing more machinery and equipment of a given vintage, or using more of the country's land, eventually fizzle out because of the law of diminishing returns: the additional output that can be generated by employing an additional person, or by deploying an additional machine of a given vintage, will grow smaller and smaller, the more people are already employed, or the more machines are already in use, until eventually the costs of using more human resources or more capital exceed the benefits.

Another perspective to arrive at the same conclusion is that economic growth which is not based on innovation, but on producing more and more of the same goods and services using the same old production processes will eventually fizzle out because the contribution which additional production makes to Gross Domestic Product depends on the value which the additional output generates: the more consumers already have of a given good or service, the less they value more of the same.

Innovation is the only way for an economy to get around the law of diminishing returns in the medium to long term and therefore to sustain economic growth. This is because innovation can be thought of as an input in the production process which can be used again and again at no additional cost once it has been generated. Thinking of innovation as the process of bringing new products and services to the market, the reason why innovative economies are not constrained in their growth by diminishing returns is because they grow not by making more of the same, but by making new and better and more varied products and services.

The expansion of the services sector, stronger competition resulting from globalization and the emergence of new information technologies has accelerated the pace of innovation.[3] Knowledge assets of high-tech enterprises often represent over 90 % of their market

[3] OECD, The Knowledge-based Economy, Paris, 1996.

capitalization. Even in the 'brick and mortar' or traditional sectors of industry and business the knowledge content is increasingly providing the competitive edge.

Information and communication technologies (ICT) have facilitated these changes by significantly reducing the costs of outsourcing and cooperation with entities outside the firm. They have fostered greater networking in the economy, speeding the diffusion of knowledge and ideas. This has altered the management of the value creation process, as firms increasingly seek profit not only by selling end products but also by breaking up the value chain and trying to realize profits from individual segments: their R&D, their patent portfolio, software developed in house, their brand name and the distribution chain. Intellectual assets have consequently become strategic factors for value creation by firms.

As spending on intellectual assets increases, so does their economic impact.[4] Recent OECD studies have therefore sought to quantify the role intellectual assets play in economic performance.[5] They show that intellectual assets make a substantial contribution to economic growth.[6] They suggest that R&D spending is associated with an increase in productivity, with estimated gross rates of return (including both net return to capital and depreciation) ranging from 10 to 20%. Social returns, that is, spillovers to firms not involved in the research effort, can be considerably higher.

The emphasis on high value-added activities marks the growing importance of innovation defined as the development and deployment of new products, processes and business models.[7] The shift from mass production to a knowledge-based economy characterized by highly differentiated products with greater knowledge content, and the changing nature of innovation sets the framework for this chapter and the broader report. This changed dynamic of business and intellectual property protection in the information economy calls for a reappraisal of intellectual property protection for each country. Questions as to how knowledge is created, protected, disseminated and used to obtain economic returns have assumed centre stage in the shift to a knowledge-based and innovation-driven economy. This chapter poses two questions: first, what is the role of intellectual assets in sustaining economic growth and secondly, what are the challenges of the growing importance of intellectual assets for government policymaking, particularly in countries with economies in transition. In so doing, the chapter examines the key rationales for patent protection and reviews the evidence from economic studies on the contribution of investments in intellectual assets to productivity and economic growth. The

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4 Expenditure on intellectual assets in the OECD area has grown faster than expenditure on machinery and equipment in recent years. In 2002, total expenditure in R&D, software and higher education was larger than investment in machinery and equipment in the United States and Finland, and grew at a faster rate between 1994 and 2002 in most OECD countries: Organisation for Economic Co-Operation and Development (OECD), Creating Value from Intellectual Assets, 4 July 2007.

5 See Chair's summary of the OECD Council at Ministerial Level, Paris, 23-24 May 2006, Delivering Prosperity at: http://www.oecd.org.

6 When the measure of GDP includes a broadly defined set of expenditures on intangibles as part of business capital spending, investment in intangibles is found to contribute as much to labour productivity growth as investment in tangibles in the United States for the period 1995-2003. Using a variety of official and non-official sources of information, Corrado, Hulten and Sichel have found that, had it been included in the official figures, investment in intellectual assets or intangible capital, would have been about 10% to 11% of GDP by the late 1990s, roughly the same share as tangible investments. See, Intangible Capital and Economic Growth, 2006 available at: http://www.nber.org/papers/w11948.pdf.

7 On Measuring a Knowledge-based Economy see, OECD, 2000a, Is There a New Economy? First Report on the OECD Growth Project, Paris; OECD, 2001a, The New Economy: Beyond the Hype, Final Report on the OECD Growth Project, Executive Summary, Paris.

chapter concludes by identifying a number of challenges policymakers need to address in order to allow intellectual assets to play their proper part in contributing to economic growth.

B. The role of intellectual property in the innovation process

Intellectual property rights (IPRs) can be defined in economic terms as the rights to use and sell (or otherwise dispose of) "creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce".[8] For the firms owning them, they form part of their intangible assets (as opposed to tangible assets such as machinery or buildings), together with customer goodwill, the firm-specific skills of their work forces, knowledge imbedded in the organization, or good management practices. From an economic point of view, IPRs are a policy tool to align the private returns to innovative activity with its social return, i.e. its benefit to society and thus to generate socially optimal incentives for private-sector innovative activity.

In order to generate innovations, in order to bring new or improved products or services to market, or to introduce new or improved production processes, firms need to undertake investments into research and development (R&D) and into their brand name capital. These investments are often highly risky, expensive and take a long time to come to fruition (up to a decade or more in the case of pharmaceuticals). Depending on the industry, firms may have to start dozens or even hundreds of research projects in order to achieve one commercial success. Pharmaceutical companies research hundreds of molecular groups to produce one marketable drug. Similarly, less than 2 % of movies account for 80 % of box office returns. Because of the highly risky nature of the innovation process, venture capitalists earn a positive return on less than 20 % of their investments, and up to 90 % of newly founded firms fail within a short period of time.

Once a new product or service is on the market, though, or in fact, once a truly path-breaking innovative company has created a new market where none existed before, competitors invariably try to muscle in by imitating the successful innovation. While this type of competition benefits consumers by driving down the price of the new product or service, it is potentially harmful in the long run because it may prevent the innovator from earning a profit margin high enough to recover not only the upfront R&D investment into the successful product or service, but also the costs of the many failed R&D projects they also undertook before achieving their break-through innovation.[9] If innovators systematically find that they cannot recover the costs of innovation due to ex-post competition from imitators, this will undermine their incentives to innovate in the future. Would-be innovators who foresee that they will not be able to fully recover their costs will not engage in innovation in the first place.

To protect themselves against imitating competitors, innovators can try to keep the critical elements of their innovations secret, or to stay ahead of the competition by continuously introducing incrementally improved products. And indeed, managers across all industries

[8] In the definition of the World Intellectual Property Organization (http://www.wipo.int/about-ip/en/).

[9] For instance, according to the International Federation of Pharmaceutical Manufacturers and Associations (IFPMA), the average cost of developing a new drug or therapy stands at US$ 800 bln, in large part because out of 8,000 substances studied at the laboratory level, only one reaches the market as a new drug (http://www.ifpma.org/Issues/index.php?id=421), and because of those that do reach the market, not all are commercially successful.

typically rank lead times and confidentiality agreements ahead of formal IPRs as tools to protect their competitive advantages.

However, protecting R&D investments and market positions through secrecy or continuous rapid incremental innovation is not equally feasible for all industries. In industries where the main nature of innovation is not incremental or where its pace is slower, competitors may be able to reverse-engineer new products, and secrecy may entail significant additional costs for the innovator (such as concluding confidentiality agreements with suppliers or putting non-disclosure clauses in employee contracts, and monitoring and enforcing these agreements, as well as implementing measures for physical protection of the information, e.g. restricted access areas, locked storage areas, secure disposal of documents and electronic files, fences, etc.). And indeed, some industries patent much more than others.

More importantly, to the extent that critical innovations are kept secret, their benefits to society remain limited in that other innovators cannot readily build on the insights of those who went before them and may find that they have to "re-invent the wheel" in the process of generating their own innovations.

Formal IPRs are a policy tool intended to protect innovators from imitating competitors long enough so that they can earn sufficient profits to recover the costs of innovating, while encouraging innovators to make their newly gained knowledge available to the public so that other innovators can build on it. Moreover, being intangible assets, IPRs can in principle be bought and sold or licensed out just like other assets. In this way, IPRs underpin a market for innovations, which is significant because brilliant inventors are not always brilliant entrepreneurs and vice versa. Markets for innovations allow inventors and entrepreneurs to match their talents in successfully bringing innovations to market.

One case in point is an emerging "division of labour" in the biotechnology industry, where small firms specialize in more fundamental "early-stage" research and generate many of the radical innovations, while large firms take over from there, by buying or licensing the innovations, and specialize in clinical trials, development and distribution.

It is important to realize that as a general proposition, IPRs are critical for third parties to have access to a given innovation for two reasons. First, they encourage investments in R&D which generate innovations in the first place. Without IPRs, some innovations would not be made at all, and so no third party could ever get access to them. Second, if and when an innovator is able to protect their innovation through IPRs, they no longer need to protect them through secrecy, and can enter into contractual relationships with third parties, giving them access to the innovation on mutually beneficial terms. Without IPRs, many existing innovations would be kept secret, and third parties would have to re-invent (or to steal) them to have access to them.

In this regard, effective IPR protection and enforcement can be seen as a quid pro quo between innovators and society: an innovator who, in the process of obtaining IPR protection, discloses to society at large the critical elements of their innovation needs to be confident that their exclusive rights can be enforced. Otherwise, the innovator would be disclosing critical information to potential imitators and other third parties, but these third parties could use this information without permission and without compensating the innovator.

The various IPRs, such as patent, trademarks, copyrights and related rights, and industrial designs, protect different aspects of the business of an innovative firm, and typically a given product will be protected by more than one IPR. The underlying technology may be protected by one or several patents, the product as a whole by one or more trademarks, and its outer appearance by a design mark or, e.g. in the United States, a design patent.

Given that IPRs are essentially national in scope, innovative firms operating in more than one national market will need to protect their IPRs in all jurisdictions where they are conducting business.

Box 1. Relationship between IPRs and other tools to promote innovation

IPRs are but one policy tool to promote innovation. There are two others, namely the public research system and public funding of private R&D (through procurement, grants, subsidies & preferential loans, prizes, tax breaks).[10] These tools differ along several dimensions. IPRs are financed by the customers who pay mark-ups over competitive prices, whereas public research and public funding are financed out of general taxation. In most forms of public research and funding, inventors have their costs covered or reimbursed irrespective of the market value of the invention (if any). IPRs allow the inventor to capture (most of) the market value. Hence, public research and funding are actually best thought of as tools to stimulate research, and are hence particularly well-suited to generate basic or generic (i.e. broadly applicable) research. IPRs by contrast are best thought of as tools to stimulate the commercial application of inventions (since (i) patents are granted only for inventions with industrial applicability; and (ii) the patent owner will not benefit from the patent unless he successfully commercializes a resulting product himself or makes it available to others for commercialization through a sale or licensing agreement). From the point of view of economic efficiency, a drawback of patents relative to other instruments is that the former temporarily exclude (some of the) competition, whereas the latter do not. In the case of public research and public funding, it is typically the government that selects the projects or areas of research, whereas IPRs can be obtained for any invention in any field (in the case of tax credits and some subsidies/grants/soft loans it can also be the recipient company that chooses the research field). Finally, in the case of public procurement and prizes, the government (sector) obtains control of the results, whereas in the case of subsidies and IPRs the private sector usually does.

C. Evidence on the role of intellectual property rights in economic performance

In principle, the case for intellectual property rights as a key tool in the innovation process, and by extension an important factor in generating economic growth is solid on *a priori* grounds. However, as intellectual assets contribute a larger share of economic value, the policy question of how exactly the IP regime should balance the benefits of control against the benefits of access becomes increasingly salient.

Apart from the IPR regime itself, the other key factor that will determine the impact of IPRs on economic performance is competition policy. The trade-off between encouraging innovation and constraining competition is governed not only by the laws on patents, trademarks, copyright etc. It is also governed by the general framework regulating market competition. A well-designed competition policy will go a long way towards ensuring that companies can use

[10] Guellec, Dominique and Bruno van Pottelsberghe de la Potterie, 2007, The Economics of the European Patent System, Oxford University Press.

intellectual property rights for their intended purpose, which is to build innovative businesses, without abuses that could stifle beneficial competition.

Where the above balance should be struck is an empirical question, the answer to which will depend among other things on the level of development and the structure of the economy in question. Unfortunately, the only systematic evidence that exists is on patents. This is unsatisfactory because trademarks in particular are likely to also play a very significant role in economic performance for two reasons. First, trademarks are the intellectual property rights by which companies protect their brand name capital, i.e. their investments in the quality of their products and the reputation of their brands. Brand name capital is a major component of the intangible assets of leading innovative companies and accounts for a major part of their stock market valuations. Second, trademarks are one of the main intellectual property rights by which companies differentiate their products from those of competitors. This product differentiation creates variety of choice for consumers. Increased product variety in turn is considered a major source of gains from international trade and of value-added and therefore economic growth. Studies suggest that trademarks are associated with higher productivity levels and productivity growth, particularly in the services sector. But it would be desirable to produce more internationally comparable economy-wide empirical evidence on the nexus between the trademark regime and economic performance.

Similarly to the case of trademarks, solid empirical evidence on the value of copyright to society and the impact of the copyright regime on economic performance is scarce because copyright protection is granted automatically to all creative works without a need to file or register. However, “creative” copyright-based industries contribute a rising share of GDP in advanced economies.[11]

Patents

On the one hand, patent law has been strengthened worldwide over the past two decades.[12] This has helped to increase substantially the value of patents and has in turn led companies to file for more patents. It has also boosted their licensing activity with positive effects on the diffusion of technology.[13] On the other hand, increased patenting has also restricted the freedom to operate of other companies. The balance between the two effects has not yet been well investigated.

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[11] See for instance the World Intellectual Property Organization's project on the economic contribution of copyright (http://www.wipo.int/ip-development/en/creative_industry/economic_contribution.html).

[12] Martinez, C. and D. Guellec, 2004, "Overview of Recent Trends in Patent Regimes in the United States, Japan and Europe", in Patents, Innovation and Economic Performance, proceedings of the OECD conference on IPR, Innovation and Economic Performance, 28-29 August 2003, OECD, Paris. See, A. Gowers, Gowers Review of Intellectual Property, HMSO, December 2006. Danish Board of Technology, “Recommendations for a Patent System of the Future”, 2005; Commission on Intellectual Property Rights, “Integrating Intellectual Property Rights and Development Policy”, London, September 2002; With respect to the US, see Federal Trade Commission, “To Promote Innovation: The Proper Balance of Patent and Competition Law Policy”, October 2003; National Academies’ Board on Science, Technology, and Economic Policy, “A Patent System for the 21st Century”, 2004; K. Maskus, “Reforming U.S. Patent Policy, Council on Foreign Relations, November 2006 and; IBM, “Building a New IP Marketplace, A Global Innovation Outlook Report”, 2006.

[13] J. Sheehan and C. Martinez and D. Guellec, “Understanding Business Patenting and Licensing: Results of a Survey”, Chapter 4, in Patents, Innovation and Economic Performance - Proceedings of an OECD Conference, OECD, Paris, 2004.

Recent studies have shown that the trade off between a "temporary exclusive right" and "innovation incentive" is much more complex than the typical textbook description, making the optimal design problem very difficult.[14] The trade-offs between open and controlled access to intellectual assets and their effects on business innovation and economic performance need to be further explored, especially in an environment that is changing rapidly as a result of technical developments, such as the internet. A related issue is the development of markets for technology, since they increase the value of technological assets for both IP holder and society. In so doing it is necessary to review potential obstacles to the creation of technology markets - whether regulatory, fiscal or informational - with a view to identifying policy options for overcoming such obstacles.[15]

How valuable are patents?

The true value of an invention, to a firm and to society at large, is only revealed over time as new processes, products or services based on it are subjected to the test of the market. In the case of patents, all available studies confirm that the value distribution is highly skewed, i.e. that there is a small number of very valuable patents, while the vast majority of patents turn out to have little or no value. As a result, most patents are allowed to expire long before their statutory maximum life time, simply because their holders consider the renewal fees too high compared to the value of the patent. The underlying technologies then enter the public domain. On average, and taking account of inherent differences in the innovation characteristics of different industries, patents and trademarks have been found to raise the productivity and stock market valuation of innovative firms in the long run, both of those filing the IPRs and of others via positive spillovers.[16]

The impact of patent strength on economic performance

The strength of a patent regime, and hence the balance it strikes between stimulating innovation and constraining competition can be assessed along three dimensions (Box 2). The following paragraphs summarize empirical work on how changes in patent regimes along any or all of these dimensions affect innovation and economic performance. The trade-off between the costs of market power granted by intellectual property rights and the benefit of the innovation incentive is not likely to be uniform across different economic development levels so that a "one-size-fits-all" rule is far from optimal. It stands to reason that the impact of further "strengthening IPRs" depends heavily on the starting point, i.e. on which countries one is talking about and what degree of IPR protection they currently have in place.

Relatedly, industries differ in the nature of their innovative process and therefore in their needs for IPR protection.

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[14] Bronwyn H. Hall, "Patents and Patent Policy", 2007, available at: www.elsa.berkeley.edu/~bhhall/papers/BHH07_OxREP_patents.pdf.

[15] Kamiyama, S., Sheehan, J., and C. Martinez "Valuation and Exploitation of Intellectual Property", STI Working Paper, OECD, 2006.

[16] Greenhalgh, C. and M. Rogers, 2007, The Value of Intellectual Property Rights to Firms and Society, Oxford Review of Economic Policy 23(4): 541-567.

Box 2. Dimensions of patent regimes

Patent regimes can be characterized along three dimensions: the length of the patent term, the breadth of the patent, that is, the range or scope of the inventions covered,[17] and the "height" of the inventive step required for an invention to be patentable. These three dimensions have an impact on the effects of the patent regime on the incentives to innovate, the pace of knowledge diffusion and the intensity of competition in markets for innovative products and services. As to the length of the patent term, the TRIPS Agreement mandates a 20-year patent term. In addition, a number of countries, including the United States, the member States of the European Union, Japan, Australia and Israel now provide for extended patent terms for pharmaceuticals and certain other products to a maximum extension of five years, in order to compensate for the time lost waiting for regulatory approval.[18] The greater the length of a patent, the longer the period over which the firm can earn premium profits. Longer patent terms give a greater incentive to prospective inventors but slow diffusion of an innovation in the economy.

As to patent breadth, Greenhalgh and Rogers (2007)[19] argue that one US patent typically is equivalent to three Japanese patents because American patents are broader. The broader the scope of a patent, the larger is the number of competing products and processes that will infringe the patent, and the larger the market power of the patent owner.

Theoretical models suggest that broad but finite patents improve diffusion, but that long-lasting and narrow patents (which are easily displaced) can lower R&D costs by encouraging effort toward larger innovative steps. There is no universally valid answer to the question of where to strike the balance between these two objectives. In part this is because the optimal balance may be different for different industries, depending on the nature of the product market and the nature of the technology in question. Real-world patent systems generally do not provide for differences in the above three dimensions for different industries or technologies. Currently, the only exceptions to the uniform treatment of technologies are those permitted by the TRIPS Agreement in Article 27.3 for "diagnostic, therapeutic and surgical methods for the treatment of humans or animals" and "plants and animals and essentially biological processes for the production of plants or animals".

There has been a trend to expand patenting activity in three dimensions: subject matter (software, business methods), patenting entities (universities and other PROs), and geographically (through expansion in WTO membership). Empirical work looking at variations in the strength of patent protection in one country over time finds that stronger protection leads to more patenting, but not necessarily to more innovation, as measured for instance by R&D spending. Branstetter[20] for instance studied the effects of expanding patent scope by allowing multiple claims in Japan in 1988 and found that this change to the patent system had a very small effect on R&D activity in Japanese firms.

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17 Gilbert, R. J. and Shapiro, C. "Optimal patent length and breadth". RAND Journal of Economics 21, 1990, 106–12; Klemperer, P. "How broad should the scope of patent protection be?", RAND Journal of Economics, 1990, 21, 113–30.

18 Although there are no internationally agreed standards for patent term extension, the provisions for patent term extension in those countries that provide for it contain some common features: extension is not automatic; the patent owner must make a specific application; the length of the extension granted depends on the length of time between the date of filing of the patent application and the date of marketing approval; a maximum extension of 5 years is provided for.

19 Greenhalgh, C. and M. Rogers, 2007, The Value of Intellectual Property Rights to Firms and Society, Oxford Review of Economic Policy 23(4): 541-567.

20 Branstetter, L. G., 2004. "Do Stronger Patents Induce More Local Innovation?", Journal of International Law 7, 2, 359-370.

Analyses of surveys of firm managers, asking about their patent use and the use of patents in their industry[21] and matching the responses to R&D spending and innovation outcomes,[22] have concluded that introducing or strengthening a patent system by increasing the scope of rights or improving enforcement results in an increase in patenting and also in the use of patents as a tool of firm strategy.[23] Patent filing statistics bear this out,[24] but it is conceivable that this reflects redirecting such activity toward things that are patentable and away from those than can be kept secret within the firm.[25]

Available survey evidence from a number of countries shows that the importance of patents for innovation differs greatly across industries and possibly between mature and newly founded innovative firms. For mature firms, the evidence, albeit somewhat dated, suggests that patents are not among the most important means to appropriate returns to innovation, except to varying degrees in pharmaceuticals, medical devices, specialty chemicals, special-purpose machinery, computers and auto parts.[26] More recent evidence from start-up companies confirmed an important role of patents in biotechnology and medical devices, but found that they were relatively unimportant for software and internet-based industries.[27] However, most survey respondents agreed that patents were important to block competitors and to promote the transmission of knowledge. Also, early-stage investors evaluate the strength of patent portfolios when selecting start-up companies to invest in.

Empirical work looking at variations in the strength of patent protection over time in a cross-section of countries confirms that the impact of changes in the patent regime depends inter alia on the level of economic development. It typically finds a positive relationship between patent strength and R&D in countries above a certain threshold of economic development. For instance, a study of shifts in the strength of patent protection across 60 countries in a 150-year period finds that the impact of patent protection-enhancing shifts were greater in nations with weaker initial protection and greater economic development.[28]

Similarly, Park and Ginarte[29] found that the strength of IP rights was positively associated with investment and R&D in countries with above median income but not for the less-developed

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21 See E. Mansfield, Patents and Innovation: An Empirical Study. Management Science, 1986, 32, 2, pp. 173-181 and, Cohen, W. M., Goto, A., Nagata, A., Nelson, R. R. and Walsh, J. P. R&D spillovers, patents and the incentives to innovate in Japan and the United States, Research Policy, 2002, 31, 1349–67.

22 Baldwin, J. R., Hanl, P. and Sabourin, D, "Determinants of innovative activity in Canadian manufacturing firms: the role of intellectual property rights", Working Paper No. 122, 2000, Ottawa, Statistics Canada; Arora, A., Ceccagnoli, M. and Cohen, W. "R&D and the patent premium", Working Paper No. 9431, 2003, Cambridge, MA: NBER; Bloom, N., Van Reenen, J. and Schankerman, M. "Identifying technology spillovers and product market rivalry", Discussion Paper No. 3916. London, 2005, CEPR.

23 Grabowski, H. and Vernon, J.M., "Returns to R&D on new drug introductions in the 1980s". Journal of Health Economics 13, 1994, 383–406. See Hall, B. H. and Ziedonis, R. "The patent paradox revisited: an empirical study of patenting in the U.S. semiconductor industry, 1979–1995", RAND Journal of Economics, 2001, 32, 101–28.

24 Lerner, J., 2002, "Patent policy shifts and innovation over 150 years", American Economic Review 92: 221–225.

25 Moser, P. "How do patent laws influence innovation? Evidence from nineteenth century world fairs", American Economic Review 95, 2005: 1214–36.

26 See above, Mansfield, 1986 and, Cohen et al, 2002.

27 Graham, S., R. Merges, P. Samuelson and T. Sichelman, 2009, High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey, Berkeley Technology Law Journal 24(4): 1255-1328.

28 See above, Lerner, 2002.

29 The study by Park and Ginarte that uses aggregate data for 60 countries from 1960-1990 and an index of the strength of intellectual property rights developed: "Intellectual Property Rights and Economic Growth", Contemporary Economic Policy XV, 1997, at 51-61.

countries. However, Park and Ginarte (1997) also show that the strength of IP rights in high-income countries can be predicted by prior R&D intensity, which tends to suggest that the demand for IP protection increases when a large share of the industrial base is engaged in innovative activities.

Qian (2007)[30] does find that stronger patent protection encourages more R&D in high-income countries, but only up to a certain level of patent protection, above which further strengthening of patent protection actually reduces R&D. This finding reflects concerns, particularly in advanced economies, about excessive uses of patents to block competition or to extract "extortionary" payments from innovative firms. The former concern refers to so-called "patent thickets", where firms file or acquire patents in order to make it more difficult for potential competitors to enter a given field.[31] Patent pools (where firms active in the same technology field cross-license their respective patents to each other) and the requirement to grant licenses on reasonable terms can be solutions to this problem. The latter concern refers to so-called "patent trolls", entities not engaged in R&D or production that acquire patents of often dubious value and use them to threaten to sue existing companies for infringement. In order to avoid the disruption to their business caused by lengthy patent law suits, these companies settle to pay royalties to the "troll". However, it is not always straightforward to distinguish between "trolls" and legitimate IPR intermediaries (non-practicing entities) playing a positive role in making markets for innovations.[32]

Relatedly, there are concerns about the recent explosion in patent applications and grants in many leading jurisdictions. Firstly, some observers are concerned that this explosion does not reflect an increase in underlying innovative activity, but an increase in strategic (ab-) uses of the patent system to put obstacles in the path of rival innovators. Secondly, there is concern that the resources available to patent offices have not kept pace with the increase in their case loads, and that, as a result, the quality of the patent examination process has suffered, leading to more patents of dubious merit being granted. If true, this in turn puts more strain on the court system to determine the validity of patents after they have been granted, and imposes higher litigation costs on innovative firms, exacerbating the potential problems with patent thickets and trolls.

On the other hand, the above research may only inadequately capture some of the key dynamic benefits of patent protection. The existence and strength of the patent system affects the organization of industry, by allowing trade in knowledge, which facilitates the vertical disintegration of knowledge-based industries and the entry of new firms that possess only intangible assets.[33] The argument is that, by creating a strong property right for the intangible asset, the patent system enables activities that formerly had to be kept within the firm because of

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30 Qian, Y., 2007, Do National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment? A Cross Country Analysis of Pharmaceutical Patent Protection, 1978-2002. Review of Economics and Statistics. 89(3): 436-453.

31 Greenhalgh, C. and M. Rogers, 2007, The Value of Intellectual Property Rights to Firms and Society, Oxford Review of Economic Policy 23(4): 541-567.

32 See Mayergoyz, A., 2009, Lessons from Europe on How to Tame U.S. Patent Trolls, Cornell International Law Journal, 42(2): 241-270 and Allison, R., M. Lemley and J. Walker, 2009, Extreme Values or Trolls on Top? The Characteristics of the Most Litigated Patents, Pennsylvania Law Review 158(1)):1-38 for recent discussions.

33 Hall, B. H. and R. Ziedonis, 2001, The Patent Paradox Revisited: An Empirical Study Of Patenting in the U.S. Semiconductor Industry, 1979–1995, RAND Journal of Economics 32: 101–28; Arora, A., M. Ceccagnoli and W.M. Cohen, 2003, R&D and the Patent Premium, NBER Working Paper No. W9431, available at: http://ssrn.com/abstract=368187.

secrecy and contracting problems to move out into separate entities. The little available research in this area supports this conclusion in the chemical and semiconductor industries.

In summary, the empirical evidence is that the patent system provides clear incentives for innovation in certain key, knowledge-intensive sectors. More generally, firms and industries respond to its presence, by making use of the system and where management practice is optimal by tailoring their innovative strategies to its presence. In this latter respect, benefits depend on the use to which the patent is put, which can include obtaining freedom of action, commercialising own inventions, licensing them to third parties, entering into cross-licensing agreements and attracting external finance.

III. Commercialization of Intellectual Assets

"The patent system adds the fuel of interest to the fire of genius."

Abraham Lincoln

A. Introduction

This chapter explains the commercialization process and the role of IPRs in that process. Intellectual property may be commercialized by sale or assignment, or by entering into various types of contractual business relationships such as licensing. The business vehicle by which this is done may be by way of partnership, joint venture or spin-off company. IPRs play a crucial role as the legal vehicle through which either the transfer of knowledge or the contractual relationship is effected. Alternatively, knowledge may be exploited in-house, in which case the role of IPRs is to block imitating competition.

Commercialization can be defined as the process of turning an invention or creation into a commercially viable product, service or process. Commercialization may require additional R&D, product developments, clinical trials or development of techniques to scale-up production prior to taking the results of research to market.

This is important because not all inventors or creators wish or have the resources, skills and appetite for risk to commercialize their own inventions or creations. Public research organizations (PROs) usually fall into this category.

B. Capacity to commercialize the invention

Not all entities, be they academic institutions or innovative businesses, particularly those in economies in transition, have the necessary financial and technical capabilities to take an invention or creation all the way to market by themselves.

For example, in the case of biotechnology, the main markets for such products tend to be international. In many situations, therefore, an organization that owns IP rights to an invention will need one or more commercial partners.

In commercialization of biotechnology innovation, lead times between commencement of commercialization activities and generation of significant revenues tend to be long. For this reason, sales revenues are unlikely to provide a significant source of funds in the short term. Similarly, financial institutions will be reluctant to provide loans to new entities that are unlikely to generate significant sales revenues within what is perceived to be a reasonable time, especially

when the risk of commercial failure may be perceived to be high. The following section enumerates the resources required for commercialization.

Resources required

Converting an original or new idea, concept or design to a desired product available in the marketplace requires:

- Time
- Funds (own or borrowed)
- Creative effort
- Innovative effort (own, of employees and of external collaborators, partners, advisors and consultants)
- Persistence
- Focused management of the entire process from idea to market. Spin-offs especially, need to consider the unique market characteristics with regard to the business concept and concept implementation (Nerkar and Shane, 2003).

Conditions necessary to obtaining a commercial return

To obtain commercial returns from IP, certain conditions must exist. These include inter alia:

- The existence of a customer or the ability to create customers; and
- An entity controlling the manufacture and sale of the resulting products.

The quality of IP management

The above overview of the resources required highlights the importance of skilled and effective management of the commercialization process. Considering the risks involved in commercialization, it is clear why intellectual property asset management and business planning are so important. The likelihood of commercial success increases when management ensures that, before R&D projects are initiated, there is clear customer demand for the new products or services and a profitable way to bring them to market (Jaruzelski et al., 2005).[34] The ability to create economic value from intellectual assets is highly contingent on the management capabilities of the public research organization or firm and the implementation of appropriate business strategies. There is now significant empirical work to support the view that effective use of intellectual assets and technologies depends on the quality of management. Business angels, venture capitalists and other providers of early-stage financing for innovative businesses likewise attach great importance to the experience and skill of the management teams of businesses they are considering for investment. One study shows that management practices, including management of human capital and technology, setting targets and reporting on performance, vary widely both within and between countries and within industries (Bloom et al., 2005).[35]

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[34] Jaruzelski, B., Dehoff, K., Bordia, R., and Hamilton, B. A., 2005. The Booz Allen Hamilton Global Innovation 1000: Money Isn't Everything. New York, 2005, www.boozallen.com and www.strategy-business.com.

[35] Bronwyn H. Hall, "Patents and Patent Policy", 2007, available at: http://elsa.berkeley.edu/~bhhall/papers/BHH07_OxREP_patents.pdf.

Often, it is only at the stage when IP protection has been secured that an organization confronts the task of commercialization. This belated, often superficial, market awareness is one of the main pitfalls to avoid as an IP owner. Technological and commercial merit of IP should be assessed at a very early stage in order that successful commercialization can occur. Leading firms have increased the efficiency of their R&D processes by linking internal R&D activities more closely to their business strategy and relying on external sources to gain access to complementary knowledge and round out technology portfolios.

Intellectual asset management should aim to realize value from patented inventions through licensing and sale, and to link patents better with innovation through incorporation into improved products and services (Kamiyama et al., 2006).[36] Such techniques are particularly important in competitive industries where innovative products become commodities rapidly through follow-on innovation and imitation.

Each situation should be analyzed taking into account the nature of the IP, the market conditions, the financial position of the IP owner and the available resources. The ability of the inventors or creators to assist further in the commercialization of the IP should also be assessed. Specific factors such as speed of market entry, the degree of control required and the potential for growth are considered important in selecting the appropriate commercialization vehicle.

In summary, market considerations should be introduced at an early stage in the IP commercialization strategy. In this way, the IP strategy will be, in part, shaped by that company's markets, customers, competitors, the nature of the technology and its relationships with research institutions, government departments and other organizations. A reasonable assessment of possible strategies for entering the market is also needed. Part of this assessment involves consideration of the levels of investment that will be required, and over what time period, for successful commercialization of the IP. At this point, an entity can form a tentative view of whether it may be feasible to commercialise the IP itself, or whether possible licensees or potential purchasers of the IP should be identified and approached.

C. Legal vehicles for the commercialization of IP[37]

There are two chief legal vehicles by which owners may commercialize their intellectual property (apart from in-house exploitation):

- To sell or assign the IP; and
- To license the IP rights.

Assignment or sale

When rights are assigned (other than partially), the recipient or assignee acquires ownership of all rights which previously belonged to the assignor, although the assignor may

[36] Kamiyama, S., J. Sheehan and C. Martinez "Valuation and Exploitation of Intellectual Property", STI Working Paper, OECD, 2006.

[37] The main focus of this section is on patents. However, in principle trademarks and copyright can also be the subject of assignment or (in the case of trademarks) licensing, and the issues arising are similar to the ones discussed in this section.

take a license back from the assignee. This can be done between two independent parties, but it can also be done on an internal level and form part of employment agreements and agreements with consultants or contractors. Assignments of intellectual property rights can be done either via sales or via transfers, i.e. with or without direct financial compensation.

Patent laws require the assignment to be in writing to effectively assign the intellectual property. Thus, it is common for the assignment to be implemented by a form of contract or deed. This is because:

- The parties wish to add other conditions to the transfer of the IP such as a license back to the seller, warranties concerning the IP or a restraint of trade clause; and/or
- The parties wish to clearly document their intention to transfer full title to the IP.

The difference in outcome between an exclusive license in IP and an assignment of the IP can be a fine one. Ultimately the distinction will depend on the content of the documentation that deals with the purported transfer of the IP. Factors which may influence the analysis include whether the right to sue infringers has been withheld, and the right to take advantage of the IP at a later date or under certain conditions.

Advantages of assigning compared to licensing

There may be occasions when an assignment is advantageous compared to licensing:

- If a patent is sold for a lump sum, you get the value immediately, without having to wait up to 20 years to realize that value progressively. You also avoid the risk that the patent may be invalidated in Court or superseded by another technology.

- In addition, assignment of the patent to a spin-off company may be a precondition for funding, if the patent does not belong to the company.

- The assignee assumes risk: After an outright sale of IP rights the assignor receives an immediate reward with no further risk or involvement or obligation to maintain the patent.

- The assignor only has to deal with a one-off transaction: The assignor will not have the burden of following up to make certain that proper royalty payments are made.

- The assignor does not have to monitor the assignee’s exploitation endeavours: The assignor will not have to determine whether or not the assignee is adequately exploiting the invention. In contrast, a licensor may be required to verify that a licensee is exploiting the invention in accordance with the license agreement.

- Circumstances may dictate assignment rather than licensing: Assignment rather than licensing may be appropriate if a patented product has been brought to market and it is doing very well but may have a relatively short remaining commercial life. Similarly, assignment may be appropriate if a customer wants a patented product to round out a line of its own products and portfolio of patents.

- Negotiations are typically simplified because they only involve two parties (whereas negotiations with several parties may be required in the case of non-exclusive licenses).

- The assignor may be able to negotiate a larger up-front fee for an outright sale as compared with the up-front fee for granting a license.

Disadvantages of assigning

- It is difficult to negotiate a sale amount: Since an assignment usually involves an outright sale of intellectual property rights for a fixed amount of money, it can be difficult to negotiate the terms of the sale.

- Assignment does not provide an opportunity to partake in additional profits if the invention turns out to be more valuable then anticipated: Once the transfer of rights is complete, the assignor will not profit further if the invention turns out to be more valuable than anticipated. An assignor must be prepared to accept the fact that the purchaser of its patent may make a substantially higher return than the sum the assignor received for the sale.

- There is a risk that the assigned patent may never be properly exploited or may not be successful in the market place because the assignor will be unlikely to be given the opportunity to be involved in the commercialization process, but may possess knowledge critical for successful commercialization. If the assignor has an interest in subsequently using the invention, a solution can be to license back the IP rights from the assignee.

- Part assignment: The assignee must be aware that joint ownership holds many pitfalls. A joint owner, regardless of the size of its interest, has full use of the patent. The joint owner may use or sell the patented invention for its own profit without concern or consultation with any other owner[s]. It may also sell its interest to any other party – but only with the agreement of the other owner[s].

- If an assignment involves the sale of a business then government duties may apply to the sale.

- Sale may affect existing license agreements and may have to include conditions guaranteeing maintenance of existing license agreements.

Checklist for assignment

The following tests may help an owner of IP determine whether they should assign the IP rather than grant a license. If the answer is ‘yes’ then the enterprise may prefer to relinquish ownership:

- Do you want to avoid having to enforce the IP?
- Have you determined that the IP is not a core asset for the conduct of your business, present or future?

- Do you want to avoid any future involvement with the IP, including in particular the ongoing costs and administration requirements in maintaining registration of the IP?
- Is any ongoing use of the IP likely to be for a limited time or purpose?
- Is the IP unlikely to establish or maintain a strategic market or alliance position for the enterprise?
- On balance, is there no alternative approach to commercialization better suited to your objectives?

Licensing

A public research organization or SME may not be in a position to undertake the direct exploitation of IP rights. Accordingly, assuming that the entity owns the intellectual property, in order to exploit the financial potential of an invention fully, it can consider finding an appropriate licensee for the IP. Licenses allow patent owners to share inventions or other intellectual property in a controlled manner and to receive revenue (e.g. royalties) or other benefits (e.g. access to another firm's knowledge). A patent for example is licensed when the owner of the patent (the licensor) grants permission to one or more entities (the licensee(s)) to use the patented invention for mutually agreed purposes in a mutually agreed manner. In such cases, a licensing contract is generally signed between the two parties, specifying the terms and scope of the agreement. In some countries, intellectual property laws require licensing agreements to be registered with the national registry.

Ownership of the IP remains with the licensor just as a landlord retains ownership when letting physical property. If a suitable licensee is found and the terms of the license agreement are properly drafted, such an arrangement can represent a secure source of income for the licensor while minimising costs and risk.

There is no generally best time to license the invention, as the timing will depend on the specificities of the case. However, for an independent entrepreneur or inventor, it is often advisable to start the search for licensees as early as possible in order to guarantee a revenue stream that will be useful to cover the costs of patenting. There is no need to wait for the patent to be granted.

In addition to timing, it is critical to find the right partner(s) to generate profits from the commercialization of the patented invention. The best licensee will probably have a direct strategic fit with the technology. Care should be taken when licensing to holders of competing technology since their interest may be driven by a desire to hold back the technology to be licensed thus ensuring the continuing success of their own. A licensee who seems to have complementary rather than competing technology and is looking to expand its product range is likely to be a more suitable partner.

While patent law does not provide for licensing IP such as "know-how" (confidential information), know-how is often included in a license agreement to facilitate the licensee to practise the invention. Technical information such as formulae, techniques and operating procedures, commercial information such as customer lists and sales data, marketing, professional and management procedures and, indeed, any technical, trade, commercial or other information, process or device occurring or utilized in a business activity may be capable of being protected and licensed.

Types of licenses

There are three main types of licensing agreements depending on the number of licensees who will be allowed to use the licensed intellectual property. A license may be exclusive, sole or non-exclusive as explained below:

- Exclusive license: a single licensee has the right to use the intellectual property, which cannot even be used by the owner. An exclusive license permits only the licensee and persons authorised by the licensee to exploit the invention.

- A sole license permits the licensee to work the intellectual property, prevents the grant of additional licenses, but allows the owner to also work the intellectual property.

- A non-exclusive license allows the owner to retain the right to exploit the licensed property as well as the right to grant additional licenses to third parties. Several licensees and the owner have the right to use the intellectual property.

Exclusive or non-exclusive license?

The decision on whether to grant exclusive or nonexclusive licenses hinges on the nature and maturity of the technology and on the licensor's business strategy. If the technology can become a standard that is needed by all players in a specific market to perform their business, a non-exclusive, widely held license would be the most advantageous. If the technology needs one company to invest heavily to commercialize the product (e.g. a pharmaceutical product that requires investments in performing clinical trials), a potential licensee would not want to face competition from other licensees, and may rightly insist on obtaining an exclusive license. In addition to exclusive sole and non-exclusive licenses, it is also possible to combine some elements of these in a single licensing agreement, i.e. to grant some rights on an exclusive basis and others on a sole or non-exclusive basis.

Advantages of licensing

From a licensee's point of view, licensing in can achieve the following objectives:

- Help a company make financial savings in R&D and effectively eliminate the risk of spending valuable resources going down an R&D "cul-de-sac".

- Ensure that a company's product range remains at the leading edge, which is particularly important in an environment where product life cycles are short and there is a danger of being left behind by the competition.

- Help a company to expand rapidly without the R&D effort and inevitable time-lag associated with going it alone.

- A fruitful licensing arrangement may also act as a catalyst for the formation of a longer-term strategic partnership between licensor and licensee.

- Another instance where a (non-exclusive) license may be desirable is where a company is already making and selling a product which is or may be infringing another party's patent. In this situation, the company may be interested in obtaining a non-exclusive license under the patent to remove the possibility of infringement action.

From the point of view of the licensor, the advantages of licensing out include:

- A source of much-needed revenue helping a company to continue developing, manufacturing and selling new products.

- In terms of marketing, licensing IP can expand customer awareness by entering new countries and markets.

- From a strategic point of view, licensing enables a company to take a product to market without the associated expenditure in terms of facilities and distribution networks that would otherwise be required.

- Licensing overseas helps to overcome the barriers involved in negotiating local government regulations and allows those who are familiar with local markets to maximise returns from the licensed product.

- Licensing can have the advantage of shaping future strategic relationships between the licensor and licensee which may lead to future licensing deals or partnerships.

- Finally, licensing can be a means of avoiding litigation in the event that one or both parties infringe the rights of the other. A one-time competitor can become a partner when sharing mutual benefits.

- A license (exclusive or non-exclusive) may ultimately deliver more money than an assignment. If the product’s value increases with the success of the license and with inflation, a license income can grow over a 20-year period to many times what would have been the sale value at the time of entering into the license.

- The licensor can regain the rights to intellectual property easily by not renewing the license (exclusive or non-exclusive) at the end of the license term (unless it is a perpetual license).

- Infringement/revocation proceedings are avoided, especially where a potential licensee is already selling a possibly infringing product.

- The patent owner can obtain ownership or license to any improvements made by the licensee if a suitable right to improvements can be negotiated by the patent owner in the license.

- The license terms (both exclusive and non-exclusive) can be flexible so as to suit both parties. A license can be limited territorially or only for certain types of products covered by the patent.

- The licensee (typically in the case of an exclusive license, but possibly also in the case of non-exclusive licenses) can be required contractually to maintain the patent and to be directly responsible for invalidity and infringement issues.

- Several non-exclusive licenses may permit more rapid nationwide marketing of the invention.

Particular advantages of exclusive licenses:

- Negotiations are with one party only. The main advantage of an exclusive license is that negotiations only occur with one party, who then has full responsibility to exploit the invention.

- The up-front payment and/or royalty rate is usually higher for an exclusive than a non-exclusive license. An exclusive license is more valuable than a non-exclusive license because it means that others, including the patent owner, do not have the right to exploit the patented invention.

- In an exclusive license, it is only necessary to monitor the performance of one party. When there are multiple non-exclusive licensees, the licensor will have the burden of monitoring the performance of each one.

The following table summarizes the most important benefits of licensing for both sides of the transaction.

Table 1. Summary of mutual benefits of licensing

Benefits to licensee	Benefits to licensor
Savings on R&D investment	Creates new revenue streams by realizing the full potential of the technology
Eliminates risks associated with in-house R&D	Expands customer awareness
Reduces time to market	Helps overcome the challenge of establishing the technology in foreign countries and lowers costs and risks
Ensures that products are leading edge	Provides savings on distribution and marketing expenses
Adds new product lines to a portfolio	Provides a means of avoiding litigation
Strategic partnerships can be formed	Strategic partnerships can be formed

Disadvantages of licensing

- If an exclusive license is in place, the patent owner cannot grant licenses to other parties and the patent owner cannot exploit the invention (unless the patent owner then obtains a license from the exclusive licensee): The drawback is that if the chosen licensee does not effectively promote or sell the invention, the patent owner cannot then do so, nor can the patent owner grant further licenses to others. Therefore, in negotiating an

exclusive license, it is very important to be sure that the licensing agreement sets forth clearly the efforts that the licensee will have to expend, as well as minimum acceptable levels of sales and/or royalty payments to the patent owner.

- In drafting a license agreement, one must take into account many conceivable events and influences that can affect the subject matter of the license so as to minimise future problems, costs and litigation. In drafting the license agreement, it is important that, as far as possible, all eventualities be anticipated and clearly defined, including both positive and negative changes over the course of the agreement's term. For example, if the sales volume is either greater or less than anticipated, what options do the licensee and licensor have to react to the circumstances? In the event that the licensee becomes insolvent, does the license automatically terminate at the option of the licensor?

- The performance of a licensee (exclusive and non-exclusive) may be difficult to monitor: Licenses (exclusive and non-exclusive) require constant attention and may be upstaged by other new developments. The performance of the licensee may be difficult to describe or monitor, but will need to be monitored by the licensor. It may be difficult for a licensor to satisfy a Court (if need be) that a licensee has not met a performance standard agreed to in the license.

- Ultimately a patent owner may end up negotiating with more than one party: A patent owner may have to negotiate license agreements with several parties, each of whom then has responsibility to exploit the patent owner's invention.

- The up-front payment and royalty rate for a non-exclusive license is typically lower than for an exclusive license because others may also have the right to exploit the patented invention. For the same reason, the up-front payment for an exclusive license is usually lower than for an assignment.

- Non-exclusive licensees cannot start infringement proceedings (unlike patent owners and exclusive licensees): Therefore, in the case of a non-exclusive license where there is an infringing third party, the patent owner would normally be responsible for commencing an infringement action.

Negotiations and payment

The basis of the negotiation will focus on financial compensation or "consideration" due for the grant of a license and will typically include the following:

- License initiation fees or up-front fees.
- Running royalties based on gross revenues received by the licensee through the exploitation of the invention.
- Minimum royalties, milestone payments, or other resource commitments by licensees to the commercialization of the invention.

Specific payment amounts and royalty rates will be determined by factors such as the nature of the invention, its value, the strength of its protection, its market and its cost of

manufacture. However, as a rule of thumb, a low selling price and high volume product equates to a lower royalty rate and a high selling price and low volume product equates to a high royalty.

Royalty rates

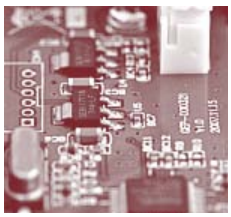
In licensing deals, the owner of the right is generally remunerated through lump-sum payments or through recurring royalties, which may be based on sales volume of the licensed product (per unit royalty) or on net sales (net sales-based royalty). In many cases, the remuneration for a patent license is a combination of a lump-sum payment and royalties. Sometimes, an equity stake in the company of the licensee may replace a royalty. While industry standards for royalty rates exist for particular industries and may usefully be consulted, it must be remembered that each licensing agreement is unique and the royalty rate depends on the particular and very distinct factors being negotiated. Some of these factors are whether the licensor is simply transferring the patent and prototype, or whether it is also contributing some significant know-how or other technical information, as well as the amount of mark-up that is typical for that type of product. Royalty rates, like the provisions of the licensing agreement depend upon negotiation. Given the number of potential pitfalls, it is advisable to seek expert advice when drafting and negotiating licensing agreements.

D. IPR enforcement as a pre-condition for successful commercialization

In entering into an intellectual property transaction, one of the most important assessments to be made relates not only to the validity and market-relevance of the asset but also the capacity to protect and enforce the IP. Once the new product is offered for sale and if it is successful in the market, it is likely that competitors will attempt to make a competing, cheaper product with identical or similar features. This may lead to undue financial pressure, particularly if the organization or partners have invested significantly in R&D for creating the product. This is where, in order to sustain a burgeoning enterprise, it is so important that the parties have recourse to the effective enforcement of IPRs.

The exclusive rights granted by patents give the owner the opportunity to obtain from the national courts one or more injunctions to prevent or stop the infringing activity. In addition to a final or permanent injunction restraining infringement, the patent owner and complainant may seek a temporary injunction on an urgent basis, pending a final trial, if it is suffering unquantifiable damage and acts without delay. It is also possible to obtain orders to have the infringing goods seized and destroyed and to obtain information as to the persons from whom the defendant obtained the supplies of the infringing material and the persons to whom the defendant in turn has supplied the infringing material. Courts also have the power to effectively freeze the defendant’s assets, thus preventing them from being removed from the jurisdiction or from being used up prior to the full trial. If and when the case goes to trial, the complainant then has the opportunity to claim damages or compensation for lost profits. In the alternative, following an injunction, the patent owner may be able to persuade the infringer to negotiate a licensing agreement for use of the invention. Whichever alternative is used, the opportunity for the patent owners or exclusive licensees to enforce their rights when they are advised that the invention is being copied is critical to maintaining their competitive edge, market share and profitability.

IV. Creating an Enabling Environment for the Transfer of Technology from Research Institutions to the Business Sector



"A number of meritorious patents given to the public absolutely free have never come upon the market chiefly because what is everyone's business is nobody's business"

Frederick Cottrell, inventor

A. Introduction

Historians of science tell us that we are witnessing 'a paradigm shift' in the way companies and public research organizations (PROs) commercialize knowledge.[38] Likewise, innovation research indicates that the way we innovate or take new ideas to market is undergoing a fundamental change from a model of closed innovation to one of open innovation.[39] Whereas the former model was directed by the notion that in order to prevent competitors profiting from its ideas, an organization must have full control of its intellectual property, the open model is built on the notion that organizations can benefit from others' use of their intellectual property, and they should buy or license others' intellectual property whenever it advances their own business model.[40]

As a corollary, the locus of innovation in many leading industries, notably biotechnology, pharmaceuticals, and ICT, is moving beyond the confines of central R&D laboratories of the largest companies and is spreading outwards to PROs, notably universities and their spin-off companies.[41] In fact, the level of PRO to business licensing shows that the two are becoming

38 Science historian Thomas Kuhn is cited in Henry Chesbrough, Open Innovation, The New Imperative from Creating and Profiting from Technology, Harvard Business School Press, 2003. Further see Dominique Guellec and Bruno van Pottelsberghe de la Potterie, "The Internationalisation of Technology Analysed with Patent Data", Research Policy 30(8), 2001, available at: www.ulb.ac.be/cours/solvay/vanpottelsberghe/resources/Pap_ResPol_1.pdf.

39 Ibid.

40 Ibid.

41 The OECD Science, Technology and Industry Scoreboard 2007, analyses shares of non-patent literature in citations across patent classes in order to provide insights into the technologies that are closer to scientific R&D and thus more dependent on the progress of scientific knowledge. An analysis of over 540 000 international patent applications (filed under the Patent Co-operation Treaty - PCT) published by the European Patent Office (EPO) shows that in the last 15 years the International Patent Classification (IPC) sub-classes with a higher than average share of citations to non-patent literature (over 15%) are mainly in the fields of biotechnology, pharmaceuticals, other fine organic chemistry and ICT. This is consistent with other observed patterns of science-industry linkages in these fields such as university spin-offs, industry-university cooperation in R&D and the tendency for biotechnology companies to cluster around universities. Report available at: http://www.oecd.org/document/8/0,3343,en_2649_37417_39529416_1_1_1_37417,00.html.

increasingly interdependent.[42] For business, long-term research is essential for innovation. For PROs, long-term research will only continue to exist if researchers are able to integrate opportunities for short-term exploitation of their research work.[43]

A key focus of innovation policy therefore is to better utilize the knowledge generated by public research and to help bring ideas out of the laboratories and into the market. This chapter identifies ways and means governments can use policy instruments to facilitate the transfer of technology from public research organizations to the business sector. This calls for improvements in the effectiveness of technology transfer from universities and other research organizations to the business sector for the successful commercialization of university-generated research results. Better management of IP by both research organizations and industries can be part of the solution.

In advanced economies, the transfer of technology and other intellectual property (IP) generated in universities and other public research organizations through the licensing of patents, as well as trademarks, designs and copyright, has increased in importance in recent years. Public research organizations are placing increasing emphasis on commercializing IP and generating revenues from it.[44] Apart from licensing of patented research results, there are several other modes of technology transfer, each with different requirements for IPR management. These include start-ups by university employees, industry-sponsored research, consulting, publications and presentations, and stimulating both local and regional innovation more indirectly through science parks and business incubators. Beyond revenue for universities, these activities are also desirable because they can generate significant positive spill-over effects for the local economy surrounding the university by stimulating additional R&D and job creation.[45]

What is the rationale for university patenting and licensing? Within industry, the rationale for patenting is that it creates incentives to invent and to disclose. However, within the norms of academic science, the predominant reward system is priority recognition. The careers of academic scientists depend on being the first to discover and publish a new result. It might therefore be argued that within an academic setting, there is no need for patenting to create incentives for invention and disclosure because the priority recognition system already provides these incentives.

However, survey results show that most academic research results are not at a stage where they would have an immediate commercial application.[46] Most academic research results are at the stage of proof of concept or laboratory prototype and require substantial further research and development before they can be turned into a commercially viable application. Survey results

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42 OECD, "Turning Science into Business, Patenting and Licensing at PROs", Science & Information Technology, 2003, pp. 1 – 307: available at: http://titania.sourceoecd.org/vl=1270545/cl=17/nw=1/rpsv/ij/oecdthemes/99980134/v2003n3/s1/p1l.

43 Similarly see Lu Wei & Dong Tao, "China's Intellectual Property System: Challenges and Policy Trends", Background Paper on High-Level Workshop on Intellectual Property Rights and Economic Development in China, 2004, at 15.

44 Siegel, D.S. and M. Wright, 2007, Intellectual Property: The Assessment, Oxford Review of Economic Policy 23(4): 529-540.

45 Siegel, D.S., R. Veugelers and M. Wright, 2007, Technology Transfer Offices and Commercialization of University Intellectual Property: Performance and Policy Implications, Oxford Review of Economic Policy 23(4): 640-660.

46 Thursby, J.G. and M.C. Thursby, 2007, University Licensing, Oxford Review of Economic Policy 23(4): 620-639.

also show that academic research results which are transferred to industry for commercialization have above-average failure rates. Thus the additional R&D required to commercialize academic inventions is expensive and risky.

As a result, university patenting, while not strictly necessary to provide incentives to academic researchers to invent and disclose, is still necessary to provide incentives for commercialization. If a research result is published, novelty is destroyed and no patent can be obtained afterwards.[47] Therefore, any company trying to commercialize this research result would have to undertake risky R&D without any exclusivity to the results. If the commercialization failed, the company would bear the costs. If it succeeded, imitators would quickly emerge to compete away its profit margin. Academic research results protected by patents are therefore much more attractive for commercialization.

Moreover, experience shows that even for published academic research results with significant commercial potential, there is no guarantee that industry will find them on its own and will be able to take them forward. It takes effort, expertise and resources to identify commercially promising results. Many promising research results have languished in academic journal articles without anyone trying to exploit them commercially. In addition, the success or failure of commercialization often hinges on whether the original inventors, i.e. the academic researchers, are involved in the process, because these researchers often possess tacit knowledge that is crucial to the success of the enterprise, i.e. knowledge that is difficult to communicate but which is complementary to the disclosed research result. Survey results indeed suggest that faculty often play a significant role in commercialization R&D after their original invention has been licensed.

To the extent that patenting and licensing generate revenues, it provides incentives for universities and their researchers to put efforts and resources into, and to develop expertise on commercialization, and thereby encourage technology transfer from public research organizations to industry for the benefit of society, which through its taxes is funding a substantial part of academic research.

The process of knowledge and technology transfer from universities and other public research organizations faces two particular challenges in many countries with economies in transition, related to the legacy of the pre-transition period. The first challenge arises from the intellectual property rights system itself.[48] Patents in particular were available in the Soviet Union only to foreign entities. For domestic inventors, the only form of legal recognition was a so-called "inventor's certificate". This certificate established the authorship of the inventors, and might entitle them to a modest reward from the research organization or enterprise they worked in. But unlike a patent, it carried no exclusivity over the use of the invention. Rather, the invention belonged to the state, and anyone was in principle free to use it. Given this legacy, it

[47] In the United States and some other countries, including Australia, Canada and Japan, there is a grace period of six to 12 months during which an inventor can file for a patent after public disclosure of the invention. However, public disclosure in any of the above countries would destroy novelty and hence patentability in any country where such a grace period does not exist, such as the member States of the European Patent Organization or the Eurasian Patent Organization.

[48] Karpova, N., 2003, Legal Protection and Commercialization of Intellectual Property in Russia, in: United Nations Economic Commission for Europe (ed.), Intellectual Assets: Valuation and Capitalization, Geneva and New York, pp.102-130.

can be a particular challenge to generate in research organizations support for and commitment to intellectual property management as a prerequisite for knowledge and technology transfer.

The second related challenge arises from the way research was organized in the pre-transition system. Neither universities nor enterprises played a particularly strong role in research in the Soviet system. Instead, the bulk of the applied research was carried out in industrial research institutes run by branch ministries.[49] Because of the highly centralized and hierarchical nature of the economic system, these institutes did not develop any expertise in technology transfer and commercialization in the current sense of the term. Moreover, because they were not doing any significant research of their own, the ability of enterprises to absorb and commercialize technology, and to cooperate with universities and other public research organizations, was underdeveloped at the onset of transition.

This legacy is still visible today in that enterprises on average spend less on research and development than their counterparts in advanced market economies, contribute far less to the funding of university research and cooperate far less with universities on joint research projects. For universities and other public research organizations, this means that they may face particular challenges in knowledge transfer and commercialization because the demand for new technologies and other knowledge from the enterprise sector may be lacking.

The present chapter is structured as follows. It first discusses the benefits and significance of university technology transfer and the strategic management of IP in this context. It then turns to issues of the costs and expected revenues from technology transfer, and the assignment of IP ownership with a view to creating effective incentives for technology transfer and commercialization. The chapter then discusses the available international evidence on how effective technology transfer and commercialization has been across selected countries and follows with sections on existing programs supporting research organizations in managing IP for technology transfer, and on IP management in cross-border technology transfer. The final section provides conclusions and policy recommendations.

B. Benefits of university technology transfer and the importance of strategic IP management [50]

Commercialization of IP can generate revenues for universities, for instance through sales or licensing of IPRs, although for most universities the potential may be easily over-estimated. Nevertheless, potential is there, and realizing it requires active IP management. This requires auditing the universities and their departments for research results with commercial potential, devising an IPR protection strategy, finding suitable industry partners, and negotiating appropriate contracts with them.

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[49] Graham, L., 1992, Big Science in the Last Years of the Soviet Union, Osiris 2nd Series, Vol. 7, pp. 49-71. Fundamental research was of course the realm of the Academies of Science.

[50] The Association for University Research and Industry Links (AURIL), the leading professional association for university technology transfer in the United Kingdom, has produced a comprehensive guide on strategic IP management for universities. It sets out why strategic IP management is important and how it benefits universities, it discusses financial expectations, i.e. the revenues and costs and net returns a university should expect, with due regard for the risks involved, spells out how to create the right incentives for IP management and technology transfer, elaborates on how to organize the IP management function within the university, covers cooperation among universities and between universities and external organizations, and offers good practices on monitoring and performance evaluation.

But beyond generating revenue directly by selling or licensing IP, a strong IP portfolio can also generate revenue by making the university more attractive to potential research sponsors from industry. Industry may want to sponsor collaborative or contract research in order to gain access to the university's IP and know-how, and seeing that the university has a sound IP management strategy in place may give potential sponsors more confidence that they will be able to find an agreement with the university to commercialize the results of sponsored or collaborative research.

Sound IP management can also help universities to recruit and retain top-level researchers and teachers because it can help them to earn additional income through shared royalties from commercialized research results, and because they may derive satisfaction from seeing their research results having a commercial impact.

More generally, by contributing to successful knowledge transfer and commercialization, sound IP management can raise the profile of a university and enhance its standing in the local, regional and national community and with funding bodies and sponsors.

Some reservations have been voiced against the trend towards university patenting and licensing. One is that innovation might actually become more difficult as universities patent a larger and larger share of their inventions. The result of this would be that firms trying to develop a new product by combining (parts of) several different inventions would have to obtain an ever greater number of licenses to patents owned by different entities. Such innovation might be hindered because of the costs and hassle of negotiating with many different IPR owners. Another reservation is that an increased focus on patenting and licensing might drive universities to focus more and more on applied rather than basic research, which might lead to more commercialization success in the short term, but to a lower rate of innovation in the long term. However, the available survey evidence does not corroborate this concern.[51]

Why strategic IP management is important

Strategic IP management is important because universities can derive significant benefits from a well-managed IP portfolio and because IP management can be effective only if it is coordinated with other goals and policies of the PRO.

PRO administrations face several strategic choices.[52] They need to decide on institutional goals and priority resource allocation, taking into account their resource endowments and scientific bases. They may need to choose between different priority technological fields. They may need to choose between focusing on technology transfer via licensing or via start-up companies (where the underlying IP might be owned by the company, and the university might hold a stake in the company). Related to this, a choice may have to be made as to how far to carry the research before seeking commercialization. If the goal is to license out, it may have to be taken to the proof-of-concept stage, because before that it is difficult to find licensees; if the

[51] Thursby, J.G. and M.C. Thursby, 2007, University Licensing, Oxford Review of Economic Policy 23(4): 620-639.

[52] Siegel, D.S., R. Veugelers and M. Wright, 2007, Technology Transfer Offices and Commercialization of University Intellectual Property: Performance and Policy Implications, Oxford Review of Economic Policy 23(4): 640-660.

goal is start-ups by researchers, this may be done on the basis of research that is not yet at the proof-of-concept stage.

Public research organizations need to develop clear IP and patenting strategies. Ownership of IP needs to be clearly established, the IP needs to be clean in the sense of making sure that the research does not infringe on third party IPRs, and it needs to be well-protected through formal IPRs before being offered for commercialization. This involves costs for hiring qualified IP professionals and obtaining qualified external advice, including expertise on identifying commercially promising research, and devising tailor-made commercialization strategies, including (exclusive or non-exclusive) licensing and start-up creation.

Another strategic issue is to align remuneration and promotion policies with the technology transfer goals of the university. Technology transfer can be successful only if the researchers cooperate. It is therefore important to reward such cooperation by integrating it into remuneration, promotion and recruitment criteria.

Table 2 gives an overview of some typical university activities and the types of IPRs that may be involved.

Table 2. University activities and IPR protection

Activity	Patents	Confidential information	Copyright	Design rights	Trademarks
Using others' research papers, publications, etc.		x	x		
Preparing or collating research and experimental results		x	x		
Publishing or presenting research results	x	x	x	x	
Contract research	x	x	x	x	
Consultancy projects	x	x	x	x	x
Starting discussions on collaborative or contract research	x	x			
Using computer software		x	x		x
Developing computer software	x	x	x		x
Preparing notes for lectures		x	x		

Source: Adapted from Theros IP Guide (www.theros.uk).

Effective IP management is essential for a university to be successful at knowledge transfer. Increasingly, universities in the United States and the European Union are being measured in part against this criterion, as society expects tangible economic benefits from the funding it provides for university research and teaching. In many instances, knowledge will most effectively be transferred simply by putting research results into the public domain, or through the university's teaching and professional development activities. Consulting by university researchers can also be an important and effective conduit for knowledge transfer. Even though these activities do not require the university to file patents and to license them, they still require IP management, for instance in order to protect teaching materials through copyright, or to avoid infringing on third party patents, trademarks etc.

This being said, most technologies resulting from academic research will require substantial – and risky – investment before they can be turned into commercially successful products, services or processes. Public research organizations may need to obtain patents in order to be able to grant (temporary) exclusivity to the firms which undertake these investments.

Public research organizations will have to decide on how many resources to devote to patenting as opposed to other aspects of IP management more closely related to knowledge transfer activities other than licensing and spin-offs (such as teaching, consulting, contract research, etc.). This decision will depend on the university's overall knowledge transfer strategy, which in turn will depend on its relative strengths in research, teaching, and consulting.

More broadly speaking, the IP strategy and the knowledge transfer strategy in general need to be in line with the mission of the university. Public research organizations are not businesses, and for a reason. Their primary mission remains to educate and to expand the frontiers of human knowledge through fundamental or basic research for the advancement of science. Breakthroughs in fundamental research are the foundations of the next generations of "game-changing" innovations and whole new industries. An excessive short-term focus on generating revenues from the commercialization of research results would carry the danger of leading researchers to focus excessively on projects of application-oriented research at the expense of curiosity-driven fundamental research.

By the same token, the potential of different fields to produce research results with immediate commercial potential, and to obtain patents and to generate licensing revenue, can be very different. This poses the challenge for university management of how to provide incentives for commercialization to researchers in fields with high potential while at the same time maintaining a funding balance between the various fields which is consistent with the overall mission of the university.

As with resources, so with incentives. Adequate incentives need to be provided for researchers to engage in knowledge transfer and commercialization. This means that researchers participate in any licensing income accruing as a result of successful commercialization, and that the university takes due account of a researcher's knowledge transfer and commercialization successes when deciding on tenure or promotion. Another aspect which needs to be covered in the university's IP strategy is how to resolve any disputes over IP that may arise between staff members or between professors and students, or among students. However, the incentives provided to university staff (researchers and staff of knowledge transfer offices) need to be consistent with the overall knowledge transfer strategy and mission of the university. A

university whose primary strength and avenue of knowledge transfer is teaching should reward its staff primarily for creating original materials that do not infringe third party IP, rather than for filing patents.

In this context, public research organizations also may need to develop policies on how to avoid or manage potential conflicts of interest that might arise when staff make decisions e.g. on what kind of research to undertake, which third parties to cooperate with, whether to put IP into the public domain or whether to seek exclusive commercialization deals, etc.

Successful knowledge transfer will require having a sound IP strategy in place which is supported by the top management of the university. Among other things, the strategy needs to provide for training of researchers to educate them about the need to evaluate research results for patentability before publication.

At the same time, care needs to be taken when using IPRs in knowledge transfer to industry in order to make sure that the university and its researchers retain access rights necessary for future research and teaching, and possibly for future commercial applications in other fields.

Similarly, IP management is important in order to guard the university against the consequences of infringing on third parties' IPRs, including the risk of litigation. In many countries, so-called research exemptions exist which, to varying degrees, allow academic researchers to use third party patents for non-commercial research and teaching purposes. In some countries, such as Germany, the research exemption is interpreted in a very liberal way, covering essentially all non-commercial research activities. In other countries, such as the United States, the scope of the research exemption is very narrow ("for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry"), except when the research is carried out for the purpose of preparing for regulatory approval of a drug or food item.[53]

If and when research has a commercial component (such as may be the case with contract research or research collaborations with industry), or if teaching materials are published and sold, IPR infringement will be a concern in all countries. It is the job of IP management to educate university staff about this and to see to it that third party IPRs are respected.

IP management is a continuous challenge. The IP strategy needs to evolve along with the university and needs to be adapted in light of experience and in response to changes in the mission, profile or environment of the university. A systematic approach to monitoring and evaluating the IP strategy is helpful in this regard.

From an organizational point of view, some universities have put their knowledge transfer activities into separate private law companies, whereas others have put them into departments or offices within the central administration of the university.

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[53] For a recent international comparison of research exemptions in advanced economies see Dent, C., P. Jensen, S. Waller and B. Webster, 2006, Research Use of Patented Knowledge: A Review, STI Working Paper 2006/2, Organisation for Economic Co-operation and Development, Paris, available at: http://www.oecd.org/dataoecd/15/16/36311146.pdf.

C. Financial expectations and budget management

It is important for public research organizations to recognize that bringing research results to market requires substantial investments and carries substantial financial risks. This has clear implications for negotiating commercialization agreements with industrial partners. Public research organizations can expect to receive compensation for the research funding they put in, but if the bulk of the investment is made, and hence the bulk of the financial risk is born by the industrial partner, then the latter will have to also receive the bulk of the (potential) financial rewards.

Public research organizations may consider making investments of their own into the proof-of-concept stage of promising research results in order to improve their negotiating position with industrial partners and to retain a greater share of future returns. Some governments and some public research organizations have set up seed funds for this purpose. But it needs to be recognized that the prospect for a higher share of future returns comes at the price of also taking on more of the risk associated with commercialization. Managing such seed funds requires financial expertise and therefore does not come cheap. For many universities with limited research capacities and hence a limited deal flow of promising technologies, an option may be to create a seed fund in cooperation with other universities in the same region.

Given the high risks inherent in the commercialization process, any financial returns will be highly variable from year to year. Therefore, financial performance targets for knowledge transfer offices should be set at medium-to-longer time horizons, such as three years or more. The smaller a university's research capacity, and hence the smaller the commercialization "deal flow", the more variable it is likely to be in the short term, and therefore the longer should be the time horizon over which it is being evaluated.

Expectations both for licensing income and for the number of spin-offs created should be realistic. Surveys carried out by AUTM for the United States and by ASTP for Europe provide some rough guidance as to how much can be expected based on the number of research staff or research funding available to a university.

How big a budget should a university devote to the commercialization of IP, i.e. to patenting, licensing and the creation of spin-offs? Once again, the answer to this question will depend significantly on the profile of strengths of the university and on its mission and knowledge transfer strategy. One rough guideline comes from the UK National Health Service which suggests that in the field of medical and health R&D, an average "yield" of licensing income from research expenditure might be 2.5 %. By this standard an IP management budget of 2.5 % of research expenditures would be the break-even point (over a medium-term horizon). However, this calculation ignores any benefits from IP management that do not accrue through licensing. On the other hand, returns may be lower in other fields than in medical and health sciences, and may depend on whether the university is big enough to reap economies of scale from its knowledge transfer operation.

Most research universities in leading economies have created technology or knowledge transfer offices in recent decades. These offices serve as intermediaries between the suppliers of inventions (the university scientists) and the entrepreneurs, firms, business angels and venture capitalists who can commercialize them into successful innovations.

Some universities have been able to generate substantial revenues from their technology transfer operations. For example, Stanford University earned US$ 336m from its sale of Google stock in 2005.[54] However, the reality is that these revenues are extremely concentrated, both in the sense that there are very few universities that actually generate significant revenues from their technology transfer operations, and in the sense that for those universities that do generate revenues, the vast bulk of those revenues is generated by very few highly successful technologies, whereas the vast majority of transferred technologies generates little or no revenues.

In fact, when taking into account the costs of running a technology transfer office and the legal costs of patenting, many universities may actually spend more than they earn on technology transfer, at least when only licensing revenues are considered.[55]

These costs include:

- Inventor compensation;
- Legal fees associated with patent prosecution (filing fee, search fee, examination fee, attorney's fees, translation, patent grant fee, etc.);
- Patent annuity/ maintenance fees;
- Legal/business fees associated with patent licensing; and
- Legal fees associated with patent enforcement.

Thus, revenue generation from patenting and licensing is typically not the main motivation for universities to engage in technology transfer. Rather, they reap additional benefits in terms of industry-sponsored research funding which they are able to attract because of their successful record of technology transfer, their higher visibility and the better reputation derived from being the source of significant technologies and spawning new firms, products and jobs. Universities successful in technology transfer will also be able to attract better students and faculty and to improve their access to public funding, which may depend on a commitment to knowledge transfer to the surrounding economy, etc.

Experience shows that few research results generated at public research organizations are immediately ready for commercial exploitation. Most require substantial further development and investment by the private sector, and licensing revenues and royalties, if any, only materialize after long time lags. IP revenues can be highly volatile, depending not only on research breakthroughs but also on the state of the business cycle. Public research organizations therefore need a stable source of public base-line funding. From the point of view of public welfare, technology transfer programs are investments, the returns to which should accrue to the economy and society at large, and policy should reflect this aspect.

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[54] Google started from research performed at Stanford in 1996 by two of its graduate students in the Computer Science Department, Sergy Brin and Larry Page. The prototype search engine was developed in 1997. The company was founded in 1998 with US$ 1m external financing from a business angel and from friends and family. A patent was filed for the search algorithm and was granted in 2001 to Stanford University, which then granted an exclusive license to Google. In 1999, the company raised US$ 25m from venture capital funds. It became profitable in 2001 and went public in 2004.

[55] Thursby, J.G. and M.C. Thursby, 2007, University Licensing, Oxford Review of Economic Policy 23(4): 620-639. See also the section on Technology Transfer Performance, below.

D. Assignment of rights to IP resulting from research

Intellectual property rights came to the fore in technology transfer from research organizations to industry with the pioneering Bayh-Dole Act of 1980 in the United States.[56] This piece of legislation made it possible for universities to obtain ownership of patents resulting from research which was financed by federal government agencies. At the same time, the act required universities to take active steps to commercialize these research results by licensing them to industry or helping faculty and students to create start-up companies.

The Bayh-Dole Act established the prevailing model of technology transfer from PRO to the private sector in the United States as far as government-funded research. Bayh-Dole legislatively created a uniform patent policy, under which universities with approved patent policies and procedures are allowed to retain the rights to government funded research and license these inventions on a non-exclusive or exclusive basis. In short, the Bayh-Dole model of technology transfer enables universities to obtain protection for and commercially benefit from the results of research conducted using public funding. This is intended to give the national economy, and potentially the world, the benefit of commercializing the technologies and to give the university the benefit of the financial return on the technology.

Under this model the university establishes a centralized technology transfer office (TTO), although some universities, like the University of California, have different offices serving different campuses. Since Bayh-Dole was enacted, technology transfer offices have been set up in almost every US research university. The technology transfer offices are charged with evaluating inventions, filing for patent applications on behalf of the university, and licensing patents. The technology transfer office performs patent searches, patent filings and finds a suitable licensee within the business sector. The modern technology transfer office is staffed by a combination of professionals with backgrounds in science, law, marketing and business development.[57] Thus, all university-industry cooperation that may involve patents is coordinated by the technology transfer office. Most technology transfer office operations therefore conform to a “patent agency” model of operation where the focus is on selling patentable inventions to industrial adopters. This model of technology transfer has become a standardized institution supported by governance structures and policies.

The Bayh-Dole model of innovation for government-based funding has been widely adopted in industrialized countries worldwide. It is credited not only with expanding technology transfer from universities to industry but also enabling cross-sector R&D collaborations.

Before the Act was passed, US government agencies owned 28,000 patents resulting from federally sponsored university research, but only 4% of them were licensed to industry.[58] The rest were not being used commercially, which meant that society was not getting direct commercial benefits from the tax payer money that had been used to finance the underlying research.

It has been estimated that for every dollar’s worth of academic research that results in a patent, US$ 10 to US$ 10,000 of private capital investment are needed to develop that patent into

[56] Bayh, B., 2006, Bayh-Dole : Don’t Turn Back the Clock, Les Nouvelles, December 2006, pp. 215-218.
[57] Levine, D. Re-inventing the Workplace, Washington, Brookings Institute, 1995.
[58] See above, Bayh, 2006.

a commercially viable product, service or process. The success of commercialization often depends on getting the researchers involved who made the original discovery because they often have complementary tacit knowledge without which the project would fail. By providing for revenue sharing between the university and its researchers, the Bayh-Dole Act strengthened the incentives for researchers to become entrepreneurial and to participate actively in the commercialization process.

University patenting and licensing has been rising substantially in the United States and more recently in other countries at the frontier of innovation and knowledge-based development, in part as a result of legislation such as the Bayh-Dole Act,[59] which gives public research organizations the right of first refusal on claiming IPRs to the results of their research. This is the case e.g. in the United Kingdom, Japan, Germany, Austria, France, Denmark, China, or the Republic of Korea.

However, this is not an imperative for successful technology transfer, since in some of the leading innovative countries of Europe, such as Finland (until 2007) and Sweden, researchers or their faculties own the IP generated in public research organizations.[60] By the same token, copyright is universally retained by the faculty members or students who authored the work in question.

What is important is that public research organizations retain the flexibility to negotiate alternative ownership arrangements where appropriate (for example, when the industrial partner has made significant contributions to the research) and that they are assigned a responsibility to actively work towards the commercialization of the IP, while considering retaining a public right to request a non-exclusive license.

E. Empirical evidence across countries on how effective they are at transferring technology from research institutions to the business sector

University patenting, licensing, and start-up companies based on university-generated IP have been on the rise in the United States, in Western Europe and Canada.[61] However, survey evidence suggests that the European Union has been lagging behind the United States.

The significance of university patenting for the economy as a whole should not be overstated. For instance, the top patentee among US universities, the University of California system, ranks number 57 in US patents granted in the period 1969-2008.[62] But no other

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59 Thursby, J.G. and M.C. Thursby, 2007, University Licensing, Oxford Review of Economic Policy 23(4): 620-639.

60 Since 2007, Finnish universities automatically have ownership of inventions generated through contract research. However, individual researchers retain ownership of inventions resulting from research funded entirely by the university. See Geuna, A. and F. Rossi, 2010, Changes to University IPR Regulations and the Impact on Academic Patenting, Working Paper no.15/2010, Department of Economics, University of Torino, available at: http://www.de.unito.it/web/member/segreteria/WP/Momigliano/2010/15_WP_Momigliano.pdf.

61 Siegel, D.S., R. Veugelers and M. Wright, 2007, Technology Transfer Offices and Commercialization of University Intellectual Property: Performance and Policy Implications, Oxford Review of Economic Policy 23(4): 640-660.

62 United States Patent and Trademark Office (USPTO), Historic Data, All Technologies (Utility Patents) Report, part B, Ranked List of Organizations with 1,000 or More Patents Granted During the Period 1969-2008; url: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_at.htm#PartB.

university is in the top 100. All US universities taken together received 2,891 US patents in 2008 (the latest year for which data are available), which amounts to just 1.8 % of all patents granted by USPTO in that year, and 4.1 % of patents granted to US entities other than the Federal Government.[63] Relative to other entities, the patenting activity of US universities peaked at 2.2 % in 1999 before the burst of the dotcom bubble and has since declined. However, it still has more than doubled since the passage of the Bayh-Dole Act. At the European Patent Office, five % of patent applications (5,000 filings) come from universities.[64] In terms of international filings under the Patent Cooperation Treaty, universities accounted for more than 10 % of filings in 2009 in Ireland, Spain and Singapore, but for significantly less in all other countries (top 25 filing countries). The top 50 universities accounted for 1.9 % of all applications worldwide. The University of California system was again the most active institution, and the only one ranked in the top 100 among applicants from all sectors. Only American, Japanese and Korean universities were among the 20 most active in 2009.[65]

The main indicators to assess the performance of universities and other public research organizations in the management of patents for knowledge and technology transfer are invention disclosures, patent applications, patent grants, licenses executed, and licensing income earned (Box 3).

The Association of European Science and Technology Transfer Professionals (ASTP) publishes an annual survey on the activities of its member institutions.[66] As part of the survey, it also compares knowledge transfer outcomes in Europe to those in the United States as measured by the annual survey of the Association of University Technology Managers (AUTM). The latest ASTP survey available at the time of writing reflects responses from 25 countries for fiscal 2008 (Arundel A. and C. Bordoy 2010).[67]

Almost 75 % of respondents work for institutions that own all the patents associated with research results. In the other institutions, patents are either owned jointly by the institution and the inventor, or exclusively by the inventor.

The outcomes suggest that universities undertake more R&D agreements with industry than do other public research organizations (almost 200 as compared to 76 on average), and universities establish more spin-offs (three on average as compared to less than one). Universities are also slightly more active on average in disclosing inventions, filing and obtaining patents. However, other public research organizations on average execute significantly more license deals (19 compared to 11 for universities) and earn significantly more licensing income (US$ 2.5m compared to US$ 1.6m). This also holds broadly when measuring

63 United States Patent and Trademark Office (USPTO), U.S. Colleges and Universities – Utility Patents Grants 1969-2008; url: http://www.uspto.gov/web/offices/ac/ido/oeip/taf/univ/asgn/table_1_2008.htm.

64 Van Pottelsberghe, 2009, Lost Property: The European Patent System and Why It Doesn't Work, Bruegel Blueprint series, vol. IX, http://aei.pitt.edu/11263/01/patents_BP_050609.pdf, p.22.

65 World Intellectual Property Organization (WIPO), World Intellectual Property Indicators 2009, Geneva. Url: http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/pdf/941_2010.pdf.

66 Their website www.astp.net also contains dedicated country pages with some useful summary information on knowledge transfer in individual countries.

67 Arundel A. and C. Bordoy, 2007, ASTP Summary Respondent Report: ASTP Survey for Fiscal Year 2006. Report produced by UNU-MERIT for the Association of European Science and Technology Transfer Professionals (ASTP). http://www.astp.net/Survey/Summary_2007_ASTP_report.pdf, accessed 22 March 2010.

productivity per 1,000 research staff employed (except that other public research organizations obtain more licenses).

Box 3. Metrics measuring the effectiveness of technology transfer

To measure the effectiveness of technology transfer, an Expert Group convened by the European Commission is recommending the following metrics:

Core Performance Indicators:
Number of:

- Research agreements
- Invention disclosures
- Patent applications
- Patent grants
- Licenses executed
- Licensing income earned
- Spin-offs established.

In addition, basic data that are needed to assess performance include:

- Type and number of public research organizations affiliated with the knowledge transfer office;
- Size of the knowledge transfer office (number of staff);
- Total budget of the knowledge transfer office;
- Outsourcing of knowledge transfer office services (i.e. does the knowledge transfer office outsource the drafting of patent applications or of research or licensing contracts; yes or no); and
- Research expenditures of affiliated public research organizations.

Supplementary indicators that might be used to complement the core performance indicators include:

- Knowledge transfer involving SMEs
- Knowledge transfer involving domestic vs foreign firms
- Knowledge transfer involving the region where the PRO is based
- Exclusive licenses
- Share of the (valid) patent portfolio that has ever been licensed
- Patent share of licensing income
- Areas of technology where patents have been obtained.

Source: European Commission (2009).

Thus, it seems that the knowledge transfer activities of universities are more focused on research cooperations and spin-offs, whereas those of other public research organizations are more focused on licensing.

Across all performance measures, a relatively small fraction of institutions account for the bulk of the outcome. For the most part, the closer an outcome is to the market, the higher the degree of concentration. For instance, the top 10 % of universities account for over 80 % of all university licensing income, but only 32 % of invention disclosures. The exception is spin-offs, where the top 10 % of universities account for "only" 40 %. The degree of concentration is more uniform across performance measures for other public research organizations (roughly between 50 and 70 %), with the exception of R&D agreements and patent grants.

Older knowledge transfer offices produce fewer invention disclosures, patent applications and grants than younger offices. However, older offices produce larger licensing revenues, in part because they are more successful in finding licensees for their patents. Thus, it seems that as

knowledge transfer offices gain in experience, they get better at weeding out research results with poor commercial potential and focusing their patenting activities on fewer but more commercially promising results.

The comparison of performance between European and American knowledge transfer offices was possible only for fiscal 2007. European knowledge transfer offices were creating more spin-offs per US$ 1m research expenditure. Conversely, American knowledge transfer offices produced more invention disclosures, patent applications, grants and license agreements relative to research expenditure (Table 3). These results are broadly stable from an earlier comparison.[68]

Table 3. Performance of American and European technology transfer offices, fiscal year 2007

	United States (AUTM)	Europe (ASTP)
US$m PPP research expenditure to produce 1 spin-off	87.9	53.8
US$m PPP research expenditure to produce 1 patent grant	11.1	13.2
US$m PPP research expenditure to produce 1 licensing agreement	13.5	19.1
US$m PPP research expenditure to produce 1 patent application	4.1	11.2
US$m PPP research expenditure to produce 1 invention disclosure	2.5	3.8

Notes: AUTM is the Association of University Technology Managers; ASTP is the Association of Science and Technology Transfer Professionals.
Source: Arundel A. and C. Bordoy (2010), ASTP Summary Respondent Report: ASTP Survey for Fiscal Year 2008. Report produced by UNU-MERIT for the Association of European Science and Technology Transfer Professionals (ASTP), http://www.astp.net/Survey/Summary%20report%202009.pdf.

The above comparison provides performance measures scaled by the research expenditures of participating institutions. It thus informs not only about the size of technology transfer activities, but about their efficiency as well, in the sense of showing how much "input" of research expenditures is required in different countries to produce a given technology transfer result.

A broader survey which allows comparisons also over time in addition to across countries is being conducted by ProTon Europe (Table 4). It shows invention disclosures, priority patent applications, patent portfolios, executed licenses, licensing revenues and the number of spin-off companies per responding technology transfer office.

[68] See above, Arundel and Bordoy, 2007. See also, DeVol, R. et al., 2006, Mind to Market: A Global Analysis of University Biotechnology Transfer and Commercialization, Milken Institute, September 2006, for a similar comparison focusing on biotechnology.

Table 4. Intellectual property protection and commercialization results in Europe and the United States, 2006-2009

	ProTon Europe				ASTP			AUTM			
	2006	2007	2008	2009	2006	2007	2008	2006	2007	2008	2009
Disclosures	18.3	20.2	19.9	19.9	33.3	38.7	36.7	99.9	102.7	105.3	112.2
Patent applications	8.7	10.7	10.0	10.6	13.2	14.9	13.8	61.5	61.1	67.6	66.9
Patent portfolio	40.9	52.6	67.0	70.6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Executed licenses/ options	11.2	12.6	12.4	16.4	12.6	11.0	13.0	26.3	26.3	26.4	29.4
Licensing revenues (€ thsd)	267.5	213.3	246.9	262.3	n.a.	929.2	n.a.	7,000	10,100	12,900	9,200
Spin-offs created	1.6	1.8	1.6	1.5	2.7	2.8	2.5	2.9	2.9	3.1	3.3
Number of respondents	325	323	305	320	100	140	99	189	194	191	181

Note: Data show average values per responding Knowledge Transfer Office (fiscal years).
Source: Piccaluga, A., C. Balderi, A. Patrono (2011), The ProTon Europe Seventh Annual Survey Report (fiscal year 2009). Available at: http://www.autm.net/AM/Template.cfm?Section=Documents&Template=/CM/ContentDisplay.cfm&ContentID=5951.

The first thing to note is that results vary even within the European region depending on the sample of respondents. In particular, the respondents in the ProTon Europe sample tend to produce fewer invention disclosures, patent applications, licensing revenues and spin-off companies than those in the ASTP survey. In part, this can be explained by the fact that the ASTP survey covered fewer but larger offices, and offices more specialized in technology transfer, rather than knowledge transfer more broadly.

The comparison between Europe and the United States based on the average performance per knowledge transfer office broadly confirms the above results based on performance per million US$ in research expenditure: US knowledge transfer offices produce more disclosures, patent applications, licensing deals and revenues, and spin-off companies. To a significant extent, this difference can be attributed to the higher average age of US knowledge transfer offices, and therefore to their greater experience. Over the period 2006-2009, the ProTon Europe survey shows a significant increase in patent portfolios and executed licenses, but not yet in licensing revenues. It should also be noted that the average licensing revenues was €262,300 in the ProTon Europe survey for 2009, but the average knowledge transfer office also incurred €160,700 in costs for the protection of its intellectual property.

There is a large variation in technology transfer performance across individual countries (Table 5). Within the European Union, invention disclosures in the average knowledge transfer office range from as low as 3.6 (France) to as high as 23.9 (United Kingdom). The variation is smaller in patent applications, but transfer offices in the European Union are much less active in patenting than their counterparts elsewhere. The Republic of Korea, China and Japan are particularly active. The United Kingdom and Spain have the largest patent portfolios, in part reflecting the higher age of their knowledge transfer offices. In terms of executed licensing deals,

the United Kingdom exceeds the other European countries in the table by a wide margin and is on a par with the United States and Japan.

Table 5. Intellectual property protection and commercialization results in selected countries, latest year available

	Disclosures	Patent applications	Patent portfolio	Executed licenses/ options	Licensing revenues (€ thsd)	Spin-offs created	Age of Knowledge Transfer Office
Italy	8.7	5.0	52.9	1.5	33.1	1.2	5.9
Spain	18.3	10.0	60.0	3.1	48.4	2.1	17.7
Denmark	22.4	9.9	8.4	5.7	857	0.6	10.9
Ireland	17.5	6.0	41.0	4.2	n.a.	1.4	5.1
UK	23.9	13.3	90.9	28.2	350.3	1.5	17.0
France	3.6	3.3	32.9	1.7	130.3	1.5	n.a.
United States	112.2	66.9	n.a.	29.4	9,188.6	3.3	18.5
Canada	51.9	23.6	n.a.	16.8	1,201.9	1.3	12.2
China	n.a.	51.9	338.5	1.7	91.9	4.3	n.a.
Japan	48.8	47.2	32.5	30.4	38.5	4.0	n.a.
Korea	n.a.	52.3	n.a.	6.8	84.3	0.4	4.2
Australia	16.3	10.9	151.9	7.6	1,866.9	0.5	n.a.

Note: Data show average values per responding Knowledge Transfer Office in the most recent fiscal year for which data are available; the most recent year for which any of the indicators is available is 2009 for all countries except for France, the Republic of Korea and Australia, where it is 2007.
Source: Piccaluga, A., C. Balderi, A. Patrono (2011), The ProTon Europe Seventh Annual Survey Report (fiscal year 2009). Available at: http://www.autm.net/AM/Template.cfm?Section=Documents&Template=/CM/ContentDisplay.cfm&ContentID=5951.

Equally comprehensive and comparable data unfortunately does not exist for the group of countries with economies in transition. Anecdotal evidence suggests considerable variation in technology transfer strategies and results. In Albania, 11 % of patent applications in 2008 came from universities.[69] In Uzbekistan for the period 2004-2006, out of 325 licensing agreements, only seven were granted by the Academy of Sciences, and none by universities or other research organizations.[70] A survey carried out by the World Intellectual Property Organization found that the most common way for public research organizations in economies in transition to transfer technology was the assignment of IPRs to third parties free of charge. Licensing agreements

[69] Elezi, S., 2009, Presentation given at the UNECE Subregional Seminar on the Commercialization and Enforcement of Intellectual Property Rights, Skopje, The former Yugoslav Republic of Macedonia; available at: http://live.unece.org/fileadmin/DAM/ceci/ppt_presentations/2009/ip/Skopje/elezi_enf.ppt.

[70] Spasic, O., 2009, Intellectual Property and Technology Transfer - WIPO Capacity Building Programs and Tools, presentation given at the UNECE Subregional Seminar on the Role of Intellectual Property Rights in Technology Transfer – Problems & Solutions, Examples from Turkey and World, Ankara, Turkey, available at: http://live.unece.org/fileadmin/DAM/ceci/ppt_presentations/2009/ip/Ankara/spasic.pdf.

were only the second most common transfer strategy, ahead of the creation of spin-off companies.[71]

F. Programs to support public research organizations in IPR management and technology transfer

Training in intellectual property awareness and management is vital to the generation of technology transfer between PRO and business. Government sponsored training programs in aspects of intellectual property for business and training in negotiating licenses have become foundational to the innovation infrastructure in industrialized economies. Patent searches, patent filings and finding a suitable licensee are matters of legal, technical and business acumen. Constraints on the capacity of TTOs will constitute a potential barrier to generating increased licensing activity. Lack of awareness about the intellectual property system may be seen as one of the primary constraints on innovative capacity and as a potential barrier to generating increased licensing activity. The following short checklist indicates the importance of government intervention to provide the necessary training in the management of intellectual property:

- Does the TTO have an adequate number of professional licensing staff?
- Are there sufficient experienced TT practitioners, particularly patent attorneys to act as mentors and share good practice?
- Are there sufficient opportunities for continuing education for practitioners with some experience on advanced topics?

Liaison with business and management schools

TTO capacity for creating business partnerships and handling patent applications may be increased by working with business and management schools. TTO capacity might be increased with support for education and training in the management of intellectual property. For example, the government may create programs that work with Business Schools and Management Institutes to develop curriculum material and case studies to aid the teaching of the skills supporting the management of high tech, fast growth businesses, as well as new product development.

Linking competitive government funding with good intellectual property practice

Government policies and programs for innovation can also work to facilitate IP protection. For example, as part of receipt of funding within the European Framework Programme for Research and Technological Development (RTD),[72] the EC requires that participants complete a consortium agreement and model contract with the EC. Both agreements require participants to

[71] World Intellectual Property Organization (WIPO), Management of Academic Intellectual Property and Early Stage Innovation in Countries in Transition, version I, Division for Certain Countries in Europe and Asia, Geneva 2010.

[72] The European Framework Programme for Research and Technological Development (EU RTD/ FP) is the main instrument for supporting and encouraging collaborative, transnational research, development and innovations in science, engineering and technology. The Framework Programme (FP7) was launched on 22 December 2006 and covers the period.

explain how they intend to handle the existing and the resulting intellectual property from their collaboration.

In this way, governments can help promote best practice and facilitate the optimal exploitation of the resulting knowledge. As part of its Framework Programme for RTD, the EC provides guidelines for the management of IPRs. The model has proved effective. The Participation Rules on innovation state:

- Where knowledge is capable of industrial or commercial application, its owner shall provide for its adequate and effective protection …
- The participants ... shall use or cause to be used the knowledge which they own ... in accordance with the interests of the participants concerned. The participants shall set out the terms of use in a detailed and verifiable manner.
- If dissemination of the knowledge does not adversely affect its protection or use, the participants shall ensure that it is disseminated within a period laid down by the Community.

In other words, protection, use and dissemination of knowledge are mandatory. Participation rules require that the proposals shall be evaluated not only according to the excellence of the innovation but also with regard to the "quality of the plan for using and disseminating the knowledge, potential for promoting innovation, and clear plans for the management of intellectual property."

Recipients are therefore required to have a plan for:

- IP protection: protection of the knowledge resulting from the project (including patent searches, filing of patent (or other IPR) applications, etc);
- dissemination activities beyond the consortium: publications, conferences, workshops and Web-based activities aiming at disseminating the knowledge and technology produced; and
- activities promoting the exploitation of the results: development of feasibility studies for the creation of spin-offs, etc, take-up activities to promote the early or broad application of state-of-the-art technologies.

Facilitating adoption of advanced IP strategies

The participation rules within the European Framework Programs for research show that it is possible to facilitate the implementation of advanced IP strategies. For example, since publication prior to the grant of a patent normally constitutes a disclosure detrimental to patentability, a contractor may only publish knowledge generated under the project, provided that this does not affect the protection of that knowledge. This permits RTD Performers (and in certain cases the SME contractors in a collective research project or the other enterprise or end user in a cooperative research project) who do not own the knowledge but have generated it to publish it or allow its publication.

By way of further example, in the European Framework RTD programs, the use of IPRs to block access to up-stream knowledge necessary to the execution of the project is prohibited by the rules. Thus, in the case of Collective and Cooperative research projects, "RTD performers

shall grant access rights to the other contractors to pre-existing know-how necessary for the execution of the project, on a royalty-free basis".[73]

Box 4. Raising intellectual property awareness: the EU IPR-Helpdesk

Research and business entities receiving EU research funding are required to conclude the 'Model Contract with the European Community', that includes inter alia provisions concerning the protection and management of intellectual property.[74] In addition, participants are required to enter a Consortium Agreement[75] including a Technological Implementation Plan. This necessitates setting out a plan for the protection, 'use' and 'dissemination' of knowledge generated by the contractors to include:

- Allocation and exercise of joint ownership;
- Setting out the terms of 'use' as to who will exploit what, when and how and any potential access rights which may be necessary; and
- Granting additional or more favourable access rights to consortium members, including access rights to third parties.

The IPR-Helpdesk guides participants on how best to deal not only with the protection of intellectual property but also good management practices such as:

- Undertaking research and locating appropriate consortium partners;[76]
- Accessing patent databases and exploring the state of the art to check if the proposed development is really new;[77]
- Licensing existing know-how and;
- The strategic use of patents.[78]

The evidence shows that the IPR Helpdesk not only benefits EU RTD participants, but also the wider research and SME communities. In striving to be eligible for EC research funding, researchers and entrepreneurs alike must come to terms with the basics of intellectual property protection, ownership and licensing, albeit in the context of the Commission's rules and official texts.

The IPR-Helpdesk raises awareness about IPRs through a website containing information about intellectual property rights and a free helpdesk service that is accessible to the public by telephone or email. It does not give a professional legal advice. Where this is necessary, for example in the event users request assistance with drafting a patent specification or specific clauses of a licensing agreement, the Helpdesk would refer them to a private attorney.

The IPR Helpdesk does not only use virtual means of raising awareness about IPRs, it provides seminars and workshops, organized with the help of local IRCs.

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73 Articles III.7 of Annex III to the EC Model Contract for SME specific actions.

74 See: http://www.cordis.lu/fp6/stepbystep/home.html.

75 The rules for participation and for dissemination in the Framework Programme - Regulation 2321/2002 of the European Parliament and of the Council, available at: ftp://ftp.cordis.europa.eu/pub/documents_r5/natdir0000030/s_4884005_20051007_141055_6FPL021890en.pdf.

76 Partner search facilities: the Commission's CORDIS server (http://www.cordis.lu) offers a number of services and information sources which may be useful in partner search for participation in RTD programs, as well as a list of organizations which have already expressed an interest in participating in such programs.

77 In particular see the patent database "esp@cenet".

78 On the importance of teaching PROs about general patent strategies see Background Information Document prepared by the SMEs Division of the WIPO, Research and Innovation Issues in University Industry Relations, 2002 at http://www.wipo.int/sme/en/documents/pdf/fp6.pdf.

In order to facilitate SME cooperation with research organizations policymakers may need to consider special measures. This is because the short time-to-market requirements of most SMEs will be incompatible with the intended shift in the Framework Programme to longer-term RTD via larger Integrated Projects. Possible measures include:

- Revising contractual requirements so as to help SMEs protect their IP. This may also require formalisation of the 'Consortium Agreement' to ensure equitable exploitation potential when projects are completed.

- Establishing a fast-track process for small projects, in particular if coordinated by SMEs. This should include a commitment to an 80-day process from proposal submission to contract.

- Simplifying application and evaluation procedures to make it quicker and easier for SMEs to benefit from these measures.

Considering a micro-finance scheme for those who applied via their financial institution.

G. Management of intellectual property in international research cooperation

The number of patents owned by an entity headquartered in a country different from the country of residence of the inventor (cross-border ownership) has been increasing globally. The same is true of the number of patents filed by at least two inventors residing in different countries (cross-border co-invention), and of the number of patents owned by at least two entities headquartered in different countries (cross-border co-ownership). These trends suggest that increasingly the research that leads to patent filings is being carried out by international teams, that the financing of research increasingly comes from international sources, and that the market for patents is getting increasingly international.

However, according to a Green Paper by the European Commission, one of the main reasons why Europe trails the United States in the commercialization of university research is that research activities and the supporting legal and policy frameworks are excessively fragmented, making cross-border collaboration difficult and preventing the EU from reaching critical mass and fulfilling its innovation potential:

- "Researchers still see career opportunities curtailed by legal and practical barriers hampering their mobility across institutions, sectors and countries.

- Businesses often find it difficult to cooperate and enter into partnerships with research institutions in Europe, particularly across countries.

- National and regional research funding (programs, infrastructures, core funding of research institutions) remains largely uncoordinated. This leads to dispersion of resources, excessive duplication, unrealized benefits from potential spillovers, and failure to play the global role that Europe's R&D capability would otherwise allow, notably in addressing major global challenges.

- Reforms undertaken at national level often lack a true European perspective and transnational coherence."[79]

Fragmented national research and innovation systems often prevent national universities and research organizations from specializing according to their international comparative advantage and reaching the critical mass necessary to become centres of international excellence. This is a problem not only for the Member States of the European Union, but even more so for the countries with economies in transition in the UNECE region. One consequence of this shortcoming is that multinational enterprises prefer more integrated locations for their international investments in research and development.[80]

To overcome these problems, the European Union is pursuing the creation of a European Research Area, in which researchers will be able to move with ease within the EU, cross-border research and development cooperation will be strengthened, and national and regional research programs will be opened up and developed in coordination. Current intellectual property rights regimes are considered a major obstacle to the full realization of the European Research Area. This pertains to inconsistent national rules regarding the management of intellectual property, particularly when it results from public funding, as well as to the high costs of obtaining and enforcing national patents in a Europe of 27 Member States.

The European Commission has identified good practice and models of knowledge-sharing between the public research base and industry which will serve to inspire further action at both EU and national levels.[81] Among them is the programme "Putting Knowledge into Practice" to help create a European framework of knowledge transfer. It has created and now promotes Good Practice Guidelines based on exchanges of experience and transnational policy learning. The European Commission is also working with several of its Member States to promote the professionalization of the knowledge transfer function and to develop EU-wide recognition of qualifications. The European Commission is also supporting transnational partnering of technology transfer offices and other public and private partners, including SMEs, for instance through its network of Innovation Relay Centres, in an effort to create a pan-European market for university-industry knowledge transfer. Also, the European Commission has been supporting staff mobility between universities and industry through its "Marie Curie Industry-Academia Strategic Partnership" programme. It also supports national initiatives in this area. European Commission State Aid Regulations on research, development and innovation for instance allow Member States to subsidize the temporary deployment of academic researchers to innovative SMEs. Structural and Cohesion Funds funding can also be used to support a range of knowledge transfer activities.

EIRMA, EUA, EARTO and ProTon Europe (see Box 5) have published a guide of good practices on cross-border collaborative research and knowledge transfer between universities and industry to complement existing national guides on government-funded research. Outsourcing in

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79 See Green Paper "The European Research Area – New Perspectives", http://ec.europa.eu/research/era/pdf/era-greenpaper_en.pdf, p. 7.

80 2005 EU Survey on R&D Investment Business Trends, http://iri.jrc.es/research.

81 See Commission communication 'Improving knowledge transfer between research institutions and industry across Europe: embracing open innovation' – COM, 2007, p. 182, 4.4.2007 - and accompanying staff working document SEC, 2007, p. 449.

2005 accounted for around 10 % of business R&D in the EU (out of a total of more than €100b). The trend is increasing.[82] The guide contains ten voluntary guidelines for universities, businesses and governments to engage in "responsible partnering", i.e. a programme to improve the effectiveness of long-term university-industry research collaboration.

Box 5. EU-level associations and organizations active in knowledge transfer

The European University Association (EUA) is an organization of European universities and their national rectors' conferences. It aims to promote a coherent system of European higher education and research for the benefit of society through active support and guidance to its members.

ProTon Europe is a European network of technology transfer offices linked to public research organizations. It is supported by the European Commission and aims to boost the commercialization of publicly funded R&D throughout Europe by developing the skills of technology transfer professionals.

The European Association of Research and Technology Organisations (EARTO) is the trade association of Europe's specialized technology and research organizations. Its members support product and process innovation in all branches of industry and science.

The European Industrial Research Management Association (EIRMA) aims to enhance innovation through more effective market-oriented research and development through networking, exchanges of experience and benchmarking among companies.

The Association of European Science and Technology Transfer Professionals (ASTP) groups over 500 knowledge-transfer professionals from universities and other public research organizations from 35 countries and provides professional development and networking opportunities.

The guide affirms that effective IPR management is central to the success of such collaborations, and that both partners must protect their IP in a way that is conducive to creating value for both sides. This may require some changes in the way universities handle IP. Experience from the United States and Europe shows that it is possible to create sustainable, long-term "win-win" cooperations that generate valuable IP, but that a lack of professional management of IP is among the most common causes of failed cooperations.

The importance of IPR management for cross-border cooperation in research and development and for technology transfer to flourish is also increasingly recognized in emerging economies and countries with economies in transition (Boxes 6 and 7).

[82] Actually, in the 19th and early 20th century, almost all research was carried out outside firms in universities and other public (and private) research organizations. By the 1960s, this had changed completely, and almost all research was done in-house. Starting towards the end of the 20th century, a renewed emphasis on sourcing inventions from outside emerged. Today, many of the leading multinational companies pursue "open innovation", i.e. to complement in-house research capabilities with external sources of ideas and technologies, through licensing, buying of patents and whole companies, and cooperative R&D arrangements with universities and other companies.

Box 6. Country experiences – Relevance of IPR in cross-border open innovation – IT in India

NASSCOM, the trade association of the information technology outsourcing sector in India, has recognized the importance of IPRs for the future development of the industry. NASSCOM argues that India needs to further improve its IPR environment by for instance establishing a National Patent Fund or encouraging existing funds to provide (more) financial support to high-technology start-ups to manage patents over their entire life-cycle, establishing more local branches of the patent office, making the patent office more efficient, and upgrading the IPR enforcement capacity of courts and prosecutors, passing Bayh-Dole-type legislation to encourage the commercialization of research results created with government funding, and encouraging public research organizations to engage in market-oriented research by linking part of their funding to their success in patenting and licensing.[83] NASSCOM also has developed a voluntary code of conduct on IPRs for outsourcing companies.

Box 7. Country experiences – relevance of IPR in cross-border open innovation – The Belarus High Technologies Park

This science park located in Minsk hosts over 50 companies mostly in the software industry. These companies perform development work for some of the world's leading multinational firms, such as Microsoft, SAP, Oracle, Novell, BEA, Sun Microsystems, IBM and others. Managing IP is one key element in the success of these relationships. EPAM Systems, the biggest company in the Park, for instance states its IP policy in the following way: "To respect the client's IPR and to ensure the highest security level, our ODCs are set up and operated in strict compliance with the world's security and protection standards, as well as the client's internal policies regulating personnel, data, infrastructure, facility, and intellectual property handling."

The goal of IPR protection for universities is to encourage economic applications of their discoveries to the benefit of the public and to make the research function more attractive and better supported. But a "blanket patent protection policy" is unlikely to be optimal because patents have to be drafted, filed, managed and enforced to create value, and the associated costs will be worthwhile only for discoveries with clear and significant economic potential.

Collaborative research agreements should specify:

- how to handle confidential information;
- the financial and in-kind contributions of the partners and how the rights to the results will be allocated;
- rules on the publication of research results in academic journals; publication should be delayed within reasonable limits (e.g. six months, but this depends on the country and the specific case) to allow filing for patent protection;
- access rights to "background" information, including IPRs, owned by the partners and necessary to perform the research; this will include stipulating any licensing fees and

[83] See NASSCOM-BCG, Innovation Report 2007, available at: http://www.nasscom.org/upload/53197/NASSCOM-BCG%20Innovation%20Report%202007-%20Exec%20Summary.pdf, accessed 11 December 2009.

royalties to be paid; this will also have to include verifying that the envisaged research does not infringe on third-party IPRs;

- ownership rights to the "foreground", i.e. to the IP generated during the research collaboration; this will typically include specifying the terms under which each party can gain access and use the research results; a starting point for negotiations may be that each party owns the research results generated by its employees or on its premises. Joint ownership often leads to situations which are difficult to manage ex post;

- which partner will be responsible for protecting and enforcing IPRs; again, a starting point is that each partner will do so for their own results; but differences in capabilities should be taken into account; e.g. patent enforcement can be expensive, and so if one partner does not have the resources to enforce, it may be better to assign the duty to enforce to the other partner, for instance as part of a licensing agreement;

- how the parties will share the returns to successful commercialization; this may involve non-exclusive licenses to several licensees or an exclusive license to one of the research partners; exclusivity can pertain to the field of use and/or the geographical area in which the invention will be practiced; compensation can take the form of license fees, royalties, either running or depending on reaching certain milestones of commercial success, or profit sharing; IPRs can also be assigned by one partner to the other subject to a "grant-back" of a (non-exclusive) license to the original owner; sub-licensing should generally be permitted to enable maximum use of the invention; where exclusive licenses are granted, the agreement should include a due diligence clause under which the license can be revoked if the licensee does not diligently pursue the commercialization of the invention; and

- the terms on which the research organization can use the results of research collaborations for research and teaching purposes.

These issues can be addressed in legal agreements such as:

- Contract research agreement
- Collaborative research agreement
- Material transfer agreement
- Confidentiality agreement
- Participation agreement
- License agreement.

H. Conclusions and recommendations

Successful innovation in a modern economy is a complex process involving cooperation and feedback between academic research, industrial research and development, as well as marketing and customer relations. Ideally, public research organizations and firms should forge long-term relationships, where both sides draw benefits that do not depend on the success of any individual research and development project. Such benefits include firms using public research organizations as recruiting grounds for talented staff and researchers using collaboration with

industry as a source for new ideas for scientific research. Governments can empower and support public research organizations in partnering with industry by granting them sufficient autonomy and resources to be able to recruit experienced technology transfer staff on a competitive basis, by encouraging the pooling of technology transfer resources across universities, and by promoting academic career appraisal criteria that take into account successful technology or knowledge transfer activities, such as patenting and collaboration with industry.

While a thorough understanding of technology transfer needs is a prerequisite for all research institutions, this might not entail a fully-fledged technology transfer office in every research institution. Institutions are well-served by critically assessing their needs and exploring a range of models, in order to identify the structure most appropriate for them.

Effective programs for technology transfer from public research organizations require insulation from short-term political pressures. Policymakers must be prepared to tolerate some "failures" (i.e., investments that do not pay off) and learn from them as private sector entrepreneurs do. In light of the inherent uncertainty in innovation processes, government policies should generally support a suite of options rather than one specific design.[84] A balanced policy portfolio must support not only R&D, but also promote diffusion of knowledge and deployment of new technologies.

When the decision is made to establish a technology transfer office, it is necessary to have clear objectives that preferably should be drafted in conjunction with stakeholders in order to obtain the commitment of the broader university research community. Due to tensions inherent in the transfer of technology from public research organizations to business with the norms of open science, it is essential to have not only agreed objectives but also firm principles for dealing with the potential conflicts of interest. Establishing a committee of stakeholders where alternative perspectives on technology transfer are acknowledged, is a means of providing constructive, ongoing feedback concerning the factors which promote success and those which inhibit it.

A good practice identified in country experiences is governing knowledge transfer by two principles: maximizing the beneficial use of knowledge generated by research organizations (through excellence in scientific research, protection and use of IP, and cooperation with industry), and responsible use (sustaining the scientific research capability of public research organizations, making sure the use of the knowledge benefits society). IP management is a tool to be used in the pursuit of these principles, not an end in itself.

Only part of the knowledge generated in most public research organizations is patentable and hence could be exploited through licensing. In their knowledge transfer activities, public research organizations should avoid an excessively narrow focus on the protection and management of intellectual property. A broader approach, including tacit knowledge, skills and know-how in addition to patentable technologies, is often preferable. This point is of particular relevance in many countries with economies in transition, where research organizations have a legacy of focusing predominantly on generating technologies to the detriment of knowledge absorption, adaptation and diffusion capabilities.

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[84] John A. Alic and David C. Mowery, "Lessons for Climate Change", Pew Center on Global Climate Change, University Of California, Berkeley, November 2003, available at: http://www.pewclimate.org/global-warming-in-depth/all_reports/.

By the same token, the focus of IP policies in the context of knowledge transfer should not be narrowed only to patents. Some universities have considerable commercial success from knowledge transfer, for example through distance or e-learning activities, which are protected by copyright.

Governments should set up clear guidelines on the management of IPRs in industry-university research collaborations where the government is a co-sponsor to ensure that the ownership of the resulting IP is clear and that proper incentives and obligations to commercialize it are provided.

Likewise, top-level university management should develop a clear IP policy which gives priority to creating long-term cooperative relationships with industry and which recognizes that commercializing any single piece of university IP is risky and expensive, and that therefore the ex-ante value of such IP should not be over-estimated.

In a similar vein, top-level industry management should set clear guidelines for IP negotiations with universities recognizing the goals and needs of a non-profit research institution and focusing on establishing mutually beneficial long-term cooperations.

Country experience indicates that public research organizations usually face several challenges regarding the use of IP in technology transfer to industry, such as perceived conflicts with academic culture and the mission of public research organizations to do basic research; poor IP management; and conflicts over IP ownership and the distribution of revenues.

At the level of the PRO, effective IP management raises several issues, such as:

- How to secure adequate funding for IP management and technology transfer offices given that the returns, if any, will materialize only in the long term (10 – 25 years)?
- How to provide the right incentives for PRO staff to exploit IP and how to keep these incentives consistent with other avenues of technology transfer?
- How to avoid or resolve potential conflicts of interest, for example, between using funds for basic versus applied research, between open access to knowledge versus exclusion to generate revenue, or staff benefiting individually from decisions they take on behalf of the PRO?

These challenges are often compounded in the case of cross-border collaboration. Government policy can play a critical role in meeting these challenges.

Professional and industry associations can also play a very useful role in addressing these challenges. For instance, in some countries, associations of technology transfer professionals and industry associations are working together to create model contracts and codes of conduct covering the ownership, management and exploitation of IP in PRO-industry cooperations.[85] These model contracts and codes of conduct reflect good practice and can be used as starting

[85] Some examples are the Association of University Technology Managers (AUTM) in the United States, the Association of University Research and Industry Links (AURIL) in the United Kingdom, the European Association of Research and Technology Organizations (EARTO) in Brussels, the Rèseau C.U.R.I.E. in France, or the Techtrans Network in Denmark.

points for negotiations between public research organizations and companies on a voluntary basis.

Governments can support and encourage the use of model licensing contracts and codes of conduct covering strategic IP management at public research organizations, for instance, by giving preference in their public research funding to public research organizations that document good IP management as evidenced by their compliance with good practice.

There is also significant scope for exchanges of experience and lessons learned in this regard among UNECE Member States. Several national and subregional professional technology transfer organizations are offering training and advice in this regard.

Policymakers in countries with economies in transition might consider facilitating the participation of technology transfer professionals in IP training by providing funding for such activities and by including the qualification of technology transfer professionals among the criteria to assess the quality of PRO IP management when allocating research funding.

Policymakers can also enhance the quality of IP management in public research organizations by promoting the recognition and accreditation of professional technology transfer courses.

Another avenue to foster knowledge transfer in the long term is by strengthening the relationship between public research organizations and industry. Policy can contribute to this through appropriate regulations enabling business executives to teach at universities, and enabling academics to serve as non-executive directors in companies. More generally, policy could envisage schemes that facilitate the mobility of people between academic and business careers and across national borders.

As to the sharing of revenues from the commercialization of IP generated in public research organizations between the PRO, the researchers involved, and the industry partners, there is no universal rule. The sharing of revenues between the PRO and the industrial partner will always be subject to negotiations. Good practices suggest that both sides be realistic about the value of the IP, recognizing, on the one hand, the costs of carrying out the research that generates the IP and, on the other hand, the costs of turning that IP into a successful product. The sharing of net revenues from licensing deals within the PRO is typically fixed as part of the public research organizations technology transfer or IP policy or strategy. Typically, the researcher and/or their faculty will receive 25 – 50 %, and the university including the technology transfer office receiving 50 – 75 %. Sometimes these percentages differ depending on the size of the net royalty stream.

Any revenues from the licensing of IP generated in public research organizations should be shared fairly between all parties involved, while taking a realistic view of the additional costs and risks in bringing the licensed technology to market.

Since innovation is increasingly global, it cannot be managed effectively within strictly national boundaries. Overcoming the difficulties of technology transfer and PRO-industry cooperation, which are compounded when they take place across countries (due to variations in IP systems and related legal regulations), calls for increased international cooperation. There are

initiatives and efforts, for example, at the level of the European Union, to push for more harmonization through voluntary codes and other forms of soft regulation, both as far as IPR systems and as far as how public research organizations do business with industry. Governments of countries with economies in transition need to pay attention to areas where their own local regulations might be a hindrance to cross-border collaboration among public research organizations or between public research organizations and business, and may wish to consider working towards harmonizing those regulations.

In order to be able to fully participate in the opportunities of open innovation across borders, countries with economies in transition need to eliminate regulations that could be a hindrance to cross-border R&D collaboration among domestic and foreign public research organizations or between public research organizations and industry.

V. IP Commercialization Strategies for Entrepreneurs and SMEs

"I haven't failed. I have found 10,000 ways that don't work."

Thomas A. Edison

A. Introduction

Empirical data show that small and medium-sized enterprises (SMEs) represent over 90 % of businesses in most countries worldwide. SMEs also typically account for a large share of overall employment, often over 60 %. On average, however, SMEs are neither very dynamic, nor very productive or innovative. And they are not very active users of the intellectual property system.

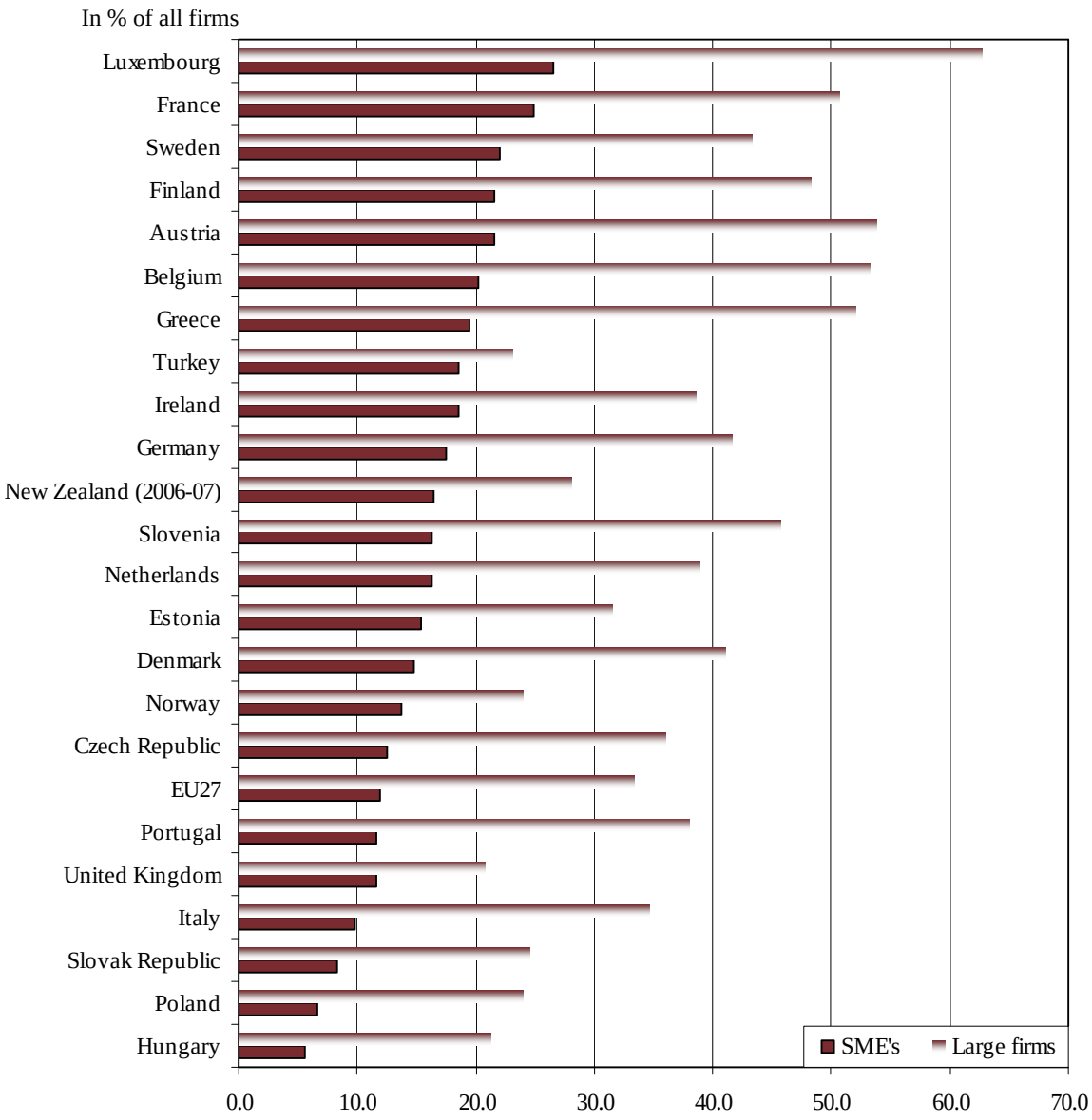
The most recent Science and Innovation Scoreboard published by the Organisation for Economic Co-operation and Development (OECD) compares the innovation performance of SMEs to that of large firms across over 20 market economies, including several of the new EU Member States. It shows that in all countries, SMEs on average are less likely than large firms to bring new products to the market (Figure 1).[86]

Similar gaps are found for innovations generated in-house (rather than being sourced from outside the enterprise). This holds for both product and process innovations (Figures 2 and 3).

The pattern is somewhat less pronounced for so-called non-technological innovations, such as innovations in marketing or in internal organizational structures. While SMEs tend to trail large firms also on this measure, the gaps are typically much smaller than in product or process innovations (Figure 4).

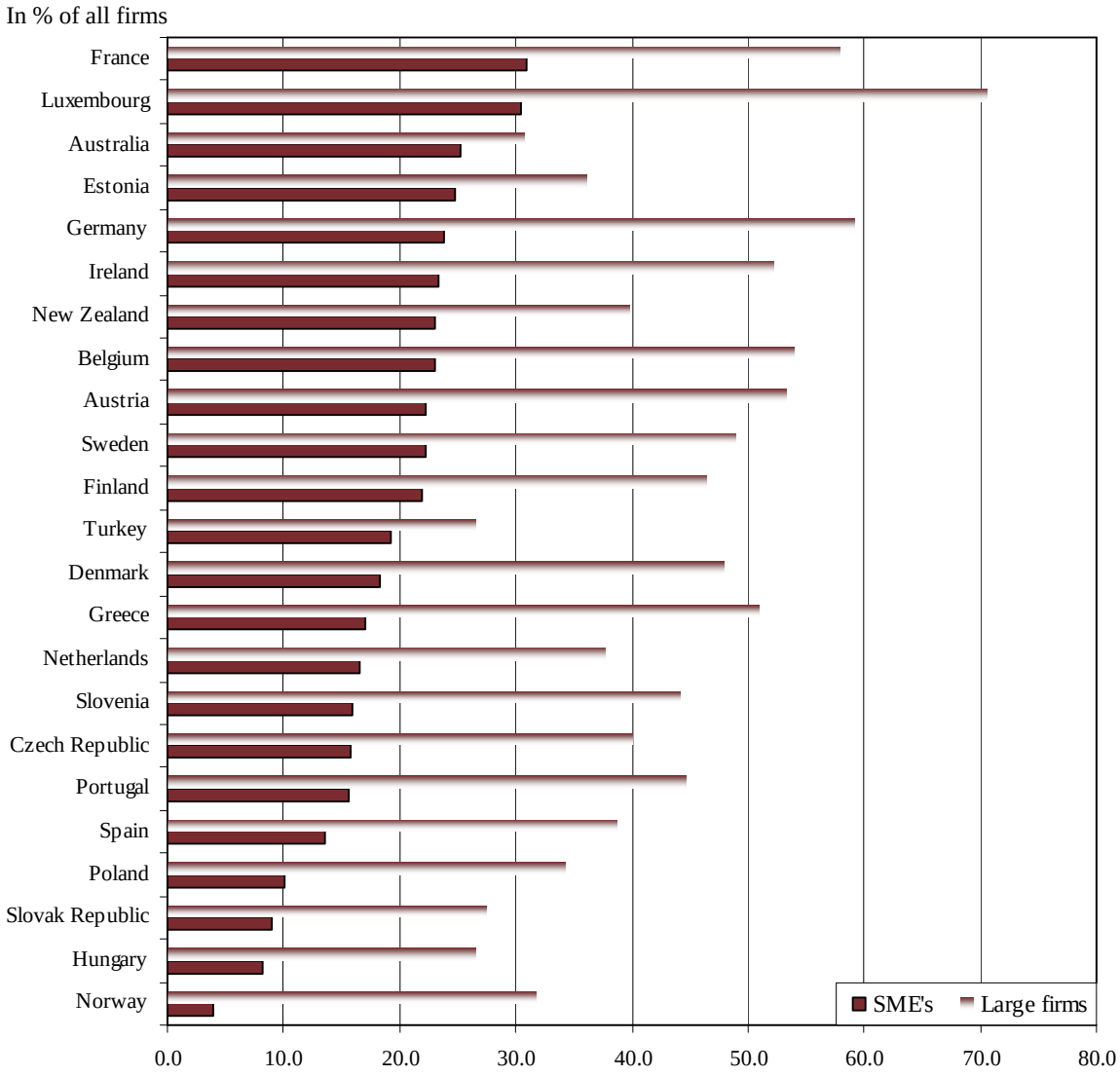
[86] This review focuses specifically on intellectual property issues. It therefore does not discuss in detail what determines the innovation performance of SMEs in general, and what policy options are available to improve it. These issues are covered inter alia in the thematic areas Entrepreneurship and Enterprise Development and Innovation and Competitiveness Policies of the UNECE Committee on Economic Cooperation and Integration (http://live.unece.org/ceci/welcome.html). See in particular UNECE, 2008, Developing Entrepreneurship in the UNECE Region (http://live.unece.org/index.php?id=2137) and UNECE, 2009, Enhancing the Innovative Performance of Firms (http://live.unece.org/index.php?id=2123).

Figure 1. Firms with new-to-market product innovations by size, selected countries, 2004-2006



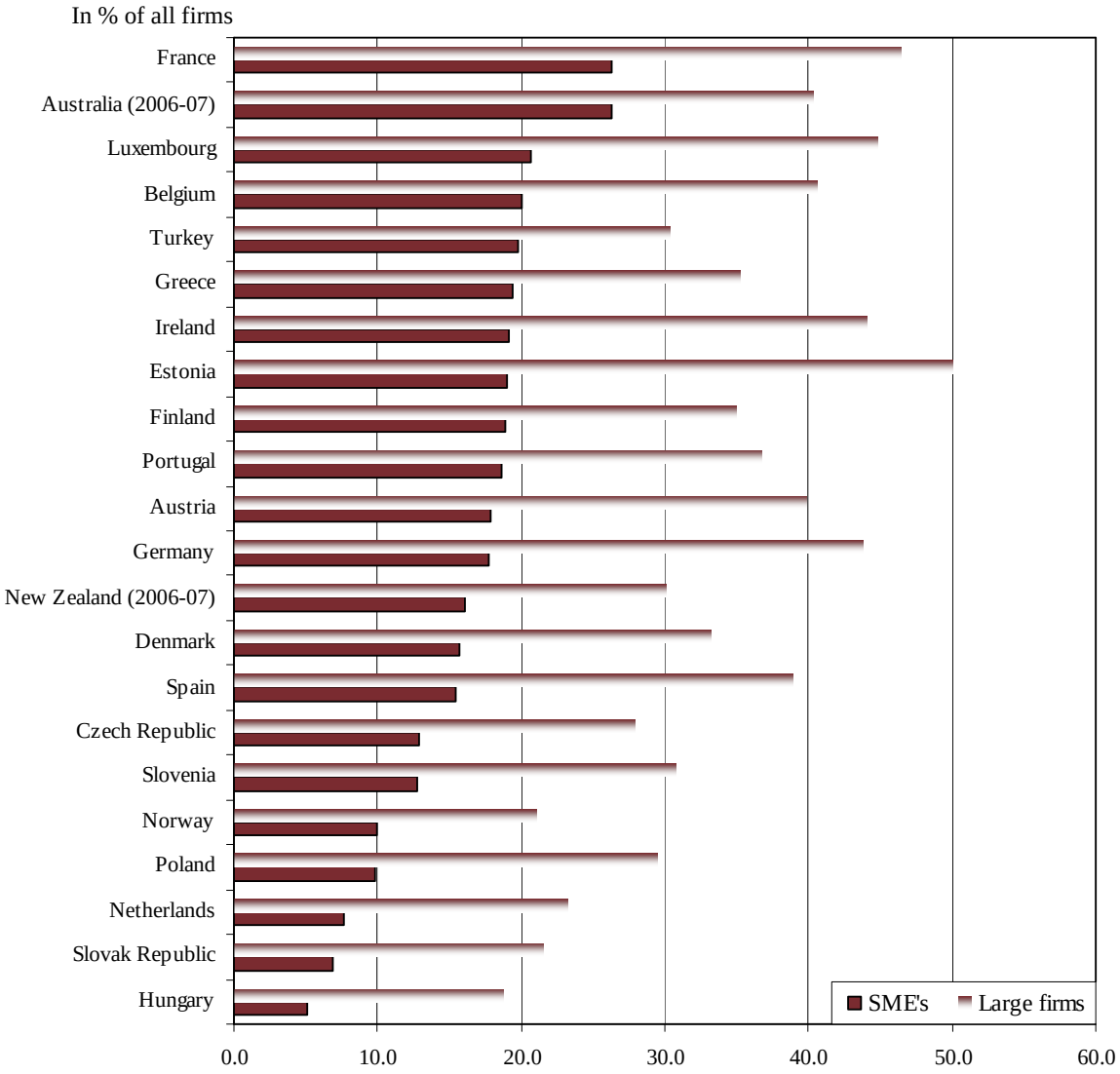
Source: OECD, Science, Research and Industry Scoreboard 2009.

Figure 2. In-house product innovators by size, selected countries, 2004-2006



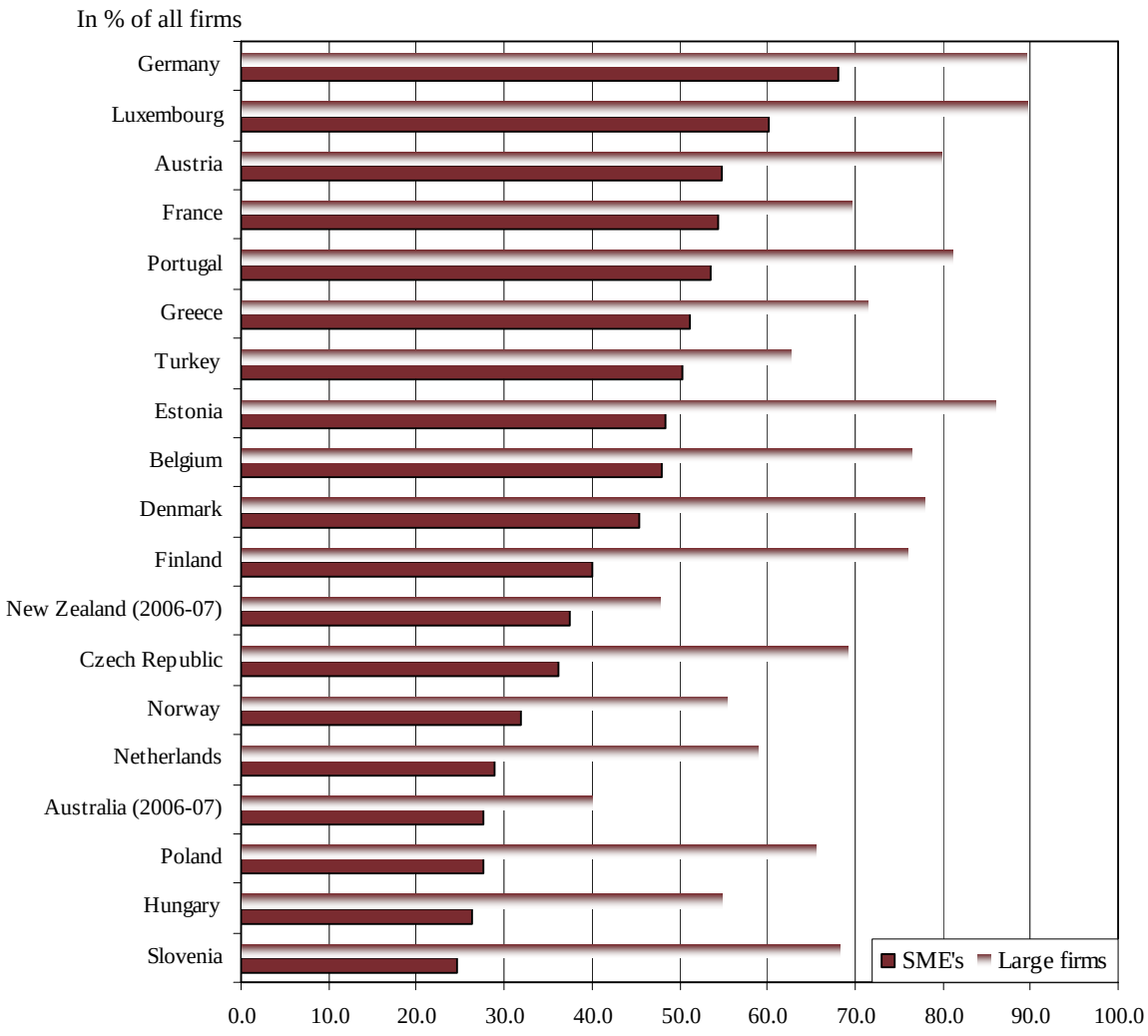
Source: OECD, Science, Research and Industry Scoreboard 2009.

Figure 3. In-house process innovators by size, selected countries, 2004-2006



Source: OECD, Science, Research and Industry Scoreboard 2009.

Figure 4. Non-technological innovations by size, selected countries, 2004-2006



Source: OECD, Science, Research and Industry Scoreboard 2009.

For countries with economies in transition, the available evidence suggests that, if anything, the gaps between large and small enterprises are even larger. A study by the World Intellectual Property Organization on a number of CIS countries found that over 20 % of large enterprises showed "good" innovation performance, but only roughly 10 % of medium-sized enterprises, and no small or micro enterprises did so.[87] SMEs were also found to be particularly weak on in-house innovations, and on product and process innovations.

[87] Recommendations for Strengthening the Role of Small and Medium Innovation Enterprises in the Commonwealth of Independent States, World Intellectual Property Organization, Division for Certain Countries in Europe and Asia, available at: http://www.wipo.int/export/sites/www/dcea/en/pdf/tool_6.pdf.

At the same time, there are usually a few recently founded SMEs, often less than 1% of all firms in the economy, which are highly dynamic. These so-called "gazelles" achieve very high growth rates and often account for the bulk of new jobs being created in the economy, especially during and after recessions. These highly dynamic SMEs are often very innovative, and they are more likely than other SMEs to participate in international value chains.

In fact, when looking only at *innovative* firms within the two size classes, the OECD Science and Innovation Scoreboard finds that the share of turnover generated by new products is frequently comparable and sometimes even higher in innovative SMEs than in innovative large firms (Figure 5).

The focus of the present chapter will therefore not be on SMEs in general, but on the - relatively small - subset which are, or have the potential to be, innovative and to contribute significantly to the creation of new jobs and to economic growth in the medium term.

Throughout this chapter, reference will be made to a number of studies, reports and publications written or commissioned by reputable international organizations, such as WIPO, OECD, the European Commission and national Intellectual Property Offices and SME organizations in the UNECE region, and materials presented by distinguished scholars in publications and conferences concerning the topic of SMEs and intellectual property rights.

The various studies and material dealing with intellectual property commercialization strategies for entrepreneurs and SMEs have one fundamental issue in common: they all concur with the fact that despite the importance of SMEs for the vitality of the economy and the potential offered by the IP system for enhancing SMEs competitiveness, SMEs tend not to exploit the formal IP system to its full potential, a trend which is visible across the whole UNECE region. Even SMEs that are classified as innovative consistently use formal IP rights significantly less frequently than large innovative firms do.[88]

At the same time, there are large differences across industries, reflecting differences in the sources of competitive advantage, the nature of the dominant innovation processes, and the extent of competitive pressures. These differences across industries can often be more important than differences between SMEs and large firms in the same industries. For instance, it has been found that in the UK informal means of protecting IP (in particular lead time advantages and secrecy) dominate formal means for both large firms and SMEs.[89] In terms of formal IP rights, SMEs generally lag particularly far behind larger firms in their tendency to obtain patents. Yet in high-technology manufacturing industries, highly-innovative SMEs tend to use patents just as much as larger firms and produce even more patents on a per-employee basis. Indeed, many start-up companies in these fields rely on patents or patents filed as their single most important assets.[90]

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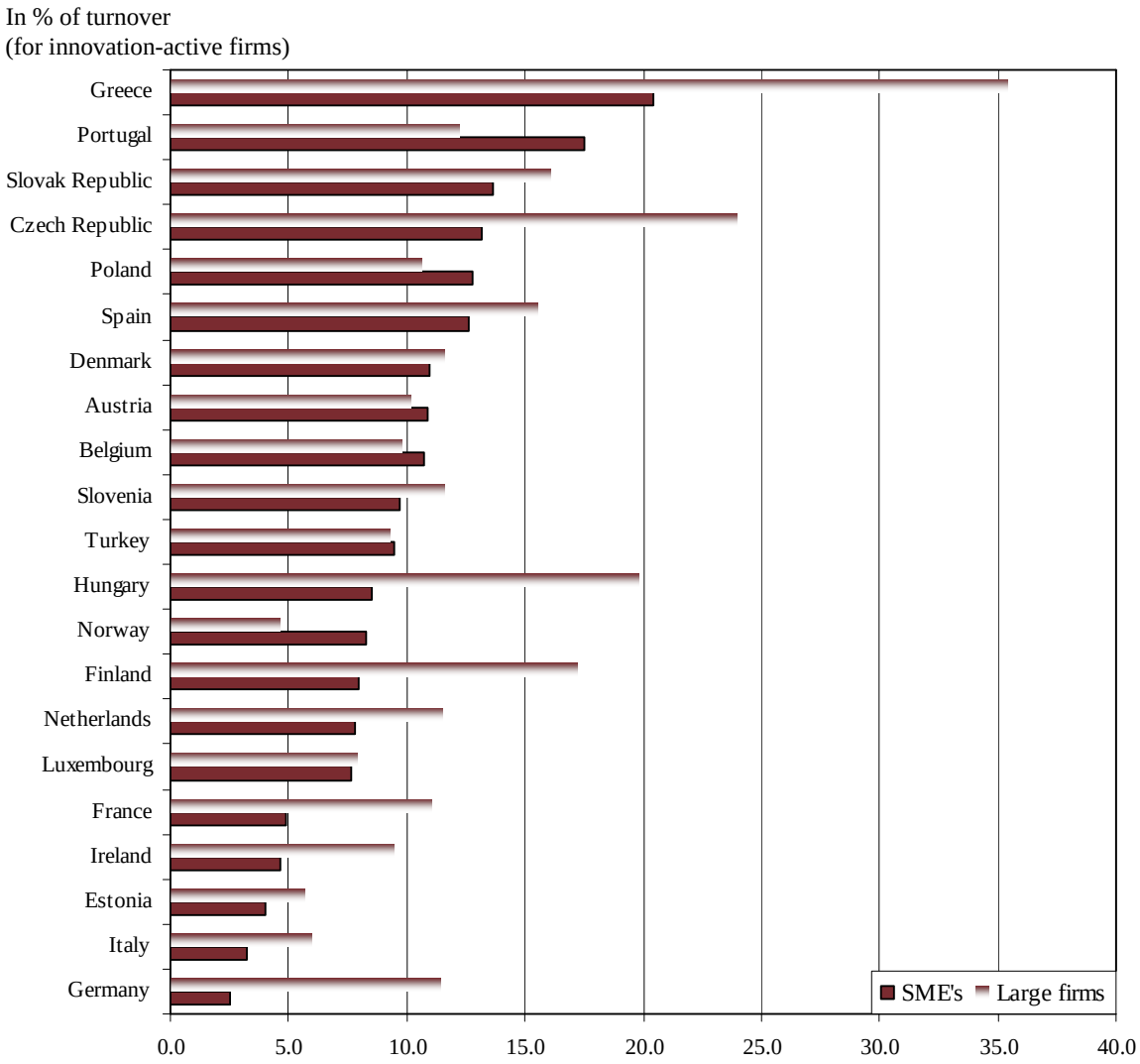
88 OECD, Paris 2011, SME Innovation and Intellectual Asset Management in Creative and Selected Manufacturing and Service Industries, Final Report, Working Party on SMEs and Entrepreneurship.

89 Hughes, A. and A. Milna, 2010, The Impact of the Patent System on SMEs, UK Intellectual Property Office Report.

90 See above, OECD, 2011.

Figure 5. Share of 2006 turnover due to new-to-market product innovations introduced in 2004-06, by firm size, selected countries



Source: OECD, Science, Research and Industry Scoreboard 2009.

Given these considerable differences across SMEs in their innovative potential and in the IP protection strategies appropriate for different sectors of the economy, the goal of policymakers should not be to push all SMEs into filing more patents or using the formal IP system more actively. Rather, the goal should be to make SMEs and individual entrepreneurs more aware of the potential use of the IP system and the importance of having an in-house IP strategy, including both formal and informal means, that responds to their specific and individual needs.

A number of studies tend to refer to SMEs in general and do not distinguish between the very small (or micro), the small, and the medium-sized businesses. Before immersing into the core part of this chapter, it would be useful if this distinction were made. Using the European

Commission's classification[91] as a guide, companies which employ fewer than 250 persons are considered SMEs. Furthermore, within the SME category, a small enterprise is defined as an undertaking employing fewer than 50 employees, while a micro enterprise is defined as an undertaking employing fewer than ten people.

The remainder of the chapter explores the reasons why SMEs tend not to use the formal IP system (section B), then covers a selected number of examples of government programs supporting SMEs in protecting and enforcing formal IP rights (section C), and provides some policy options and recommendations (section D).

B. SMEs and the IP system: why do SMEs underutilize the formal IP system?

Various studies[92] have consistently shown that the reasons for the underusage of the formal IPR system, even by potentially or actually innovative SMEs, are primarily twofold: first and foremost, the high costs of protection and enforcement; and, secondly, the lack of awareness by SMEs on how the IPR system works. These two broad issues will now be considered in depth.

Costs

All major studies on the topic lead to the conclusion that the costs related to protection and enforcement of IPRs, particularly patents, are considered by SMEs as a formidable barrier to the use of the formal IP system. In their budgeting, besides the costs related to the acquisition of the registered IPRs (that is, fees related to application, publication, and maintenance), there are other costs that need to be considered, such as those related to the preparation of the applications and possibly translation expenses. The problem of costs is further exacerbated in Western Europe, where the cost of patenting reaches as much as 2.5 to 3 times that of the United States or Japan.[93] These elevated costs are mostly attributed to translation expenses and/or to patent protection across Europe via the European Patent Office. These costs are perceived by many SMEs as by far exceeding the prospective benefits that derive from protection, especially when considering that most of these costs are incurred before the products reach the markets and thus before the realization of any income or profits. The most common remarks made by SMEs interviewed by the Nordic Innovative Centre[94] were related to costs, and varied from comments that registering for patents was too expensive, and that *prior art* patent surveillance should be cheaper, to an outright demand for a reduction of IPR-related expenses.

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91 See Article 2 of the European Commission Recommendation marked 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises.

92 In date order, starting from the earlier: "CIPO Outreach Program: Strategic Plan 2002-2006", Canadian Intellectual Property Office, 31 July 2002; "Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises", WIPO, June 2004; "Networks, Partnerships, Clusters and Intellectual Property Rights: Opportunities and Challenges for Innovative SMEs in a Global Economy", OECD, June 2004; "Intellectual Property Rights and Nordic SMEs: a study of IPR practise in the IT and Biotech sectors", Nordic Innovation Centre, February 2005; and, "Benchmarking National and Regional Support Services for SMEs in the Field of Intellectual and Industrial Property", Austrian Institute for SME Research, PRO INNO Europe, report prepared on behalf of the European Commission, DG Enterprise and Industry, 2007.

93 Report by the Austrian Institute for SME Research, op. cit., p.1.

94 See "Intellectual Property Rights and Nordic SMEs: a study of IPR practise in the IT and Biotech sectors", op. cit., p.26.

Once SMEs decide to invest in registering their IPRs and thus overcome the 'protection' financial hurdle, they soon face another formidable challenge: to successfully enforce their newly-acquired IPRs. The latter are an asset to the SME as long as they are enforceable. However, scarce financial and human resources might prove fatal for SMEs to enter into litigation procedures, especially with larger and better funded companies. Various studies have shown that although a considerable number of SMEs are faced at some point in time with infringements of their IPRs, resulting in considerable strain on their revenue streams, only a handful of these companies are financially strong enough to successfully litigate,[95] especially cases involving patent infringement. The dilemma that SMEs face is that while IP protection is fundamental to protect their inventions and intellectual creations, the same IPRs can harm the business undertaking unless it possesses sufficient resources to enter into litigation procedures.

Different studies have shown how patent litigation in the European Union is an extremely expensive process, especially for SMEs and individual entrepreneurs. Litigation costs, which include courts fees, fees of lawyers and patent attorneys, as well as costs related to witnesses, investigations, appeals and translations (in case of different jurisdictions), vary enormously even across the European Union. The European Commission gave an account of this disparity in patent litigation fees in four EU Member States (Box 8).

Box 8. Indicative costs of patent litigation (for a sum in dispute of €250,000)[96]

Germany:	€50,000 at first instance and €90,000 at second instance;
France:	between €50,000 and €200,000 at first instance and between €40,000 and €150,000 at second instance;
The Netherlands:	between €60,000 and €200,000 at first instance and between €40,000 and €150,000 at second instance; and
United Kingdom:	between €150,000 (fast-track procedure) and €1,500,000 at first instance and between €150,000 and €1,000,000 at second instance.

It transpires very clearly from the figures in Box 8 that the United Kingdom has by far the most expensive litigation costs in Europe. The legal system (common law), as well as the more elevated costs of lawyers and patent attorneys, account for the higher costs in the UK when compared to other civil law systems in Europe. Paradoxically, large international companies tend to prefer litigating their major cases in the UK, while SMEs prefer to litigate their European patent infringement cases in other (less expensive) jurisdictions.[97]

A study[98] conducted for the European Commission among 600 SMEs owning at least one patent in Europe and/or the United States shows that about 400, or two-thirds of these companies, experienced problems with the unauthorized copying of their patented inventions. Larger companies were responsible for these patent infringements in about 25% of cases, while

95 Report by the Austrian Institute for SME Research, op. cit., p.1.
96 Source: Communication from the Commission to the European Parliament and the Council, "Enhancing the patent system in Europe", Brussels, 4 April 2007, p.8.
97 Idem.
98 Kingston, William, «Enforcing Small Firms' Patent Rights», report commissioned by the European Commission, Brussels, 2000.

over 20% of SMEs declared that they had sustained very serious financial damages as a result. The study also confirms earlier findings that larger companies tend to use their superior resources available for litigation to intimidate smaller companies and individual entrepreneurs. While 80% of disputes were settled out of court, arbitration was hardly used by SMEs. Some 14% of SMEs interviewed had taken patent litigation insurance (see also Box 9), but only a small fraction of claims (2%) were successful.

Box 9. Patent litigation insurance

Patent litigation insurance is a relatively new phenomenon and insurance schemes remain predominantly offered by large private sector insurance companies. This renders them pretty expensive and out of the range of a considerable number of SMEs, especially the micro and small among them. Various models are available on the market, especially in Europe, covering anything from reimbursement of a capped sum for legal advice, to more exhaustive legal fees, as well as damages and liabilities resulting from breaches of contract with contractual agents.

One of the main advantages of these insurance schemes is that they enable SMEs, especially the smaller one or start-ups, to defend their patents against larger companies without having to settle or license. Furthermore, having an insured patent portfolio is likely to help attract investors, while possessing patent insurance strengthens a patent owner's ability to license its patents to corporate entities who want to commercialize certain aspects of the patented technology.

A series of studies commissioned by the European Commission[99] showed that these private sector insurance schemes had very limited impact. Furthermore, SMEs were sceptical towards the idea of having a mandatory system in place (which will have the effect of lowering the insurance policy fees), which the study commissioned by the European Commission proposed as a means to make the system more inclusive and attractive.

Lack of awareness

Successive surveys among SMEs have consistently indicated that SMEs do not make sufficient use of the formal IP system because they lack good quality advice. One such survey is the Community Innovation Survey,[100] which showed that SMEs constantly report less use of both formal IP and informal protection methods when compared to large companies, due to lack of information on the IPRs. Similar results emerge from a survey conducted among UK SMEs, where it was found that SMEs and the mass of micro enterprises are unaware of the IP system.[101] To quote but one example, the same survey found that only 11.2% of micro enterprises and 33% of companies with more than 250 employees knew that publishing before filing will invalidate a patent application.[102] These findings are corroborated by the survey conducted by WIPO among IP Offices and SME support institutions, which showed that awareness raising and training in IP

[99] In date order: "Patent Litigation Insurance: A study for the European Commission on the feasibility of possible insurance schemes against patent litigation risks", by CJA Consultants Ltd, June 2006; "Enhancing the patent system in Europe", Communication from the Commission to the European Parliament and the Council, 4 April 2007; and "Summary report of replies to the public consultation on the follow-up study on patent litigation insurance", CJA Consultants Ltd, 11 June 2007.

[100] The latest of the Community Innovation Surveys (CIS4) is available online at: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF-07-116/EN/KS-SF-07-116-EN.PDF, site last visited on 4 March 2008.

[101] "UK Intellectual Property Awareness Survey 2006", commissioned by the UK Intellectual Property Office, April 2007.

[102] Ibid., p.7.

are one of the main activities identified at the national level to facilitate a wider and more effective use of the formal IP system by SMEs.[103]

Besides patents, innovative SMEs should have basic knowledge of the whole gamut of the formal IP systems, including copyright, trademarks, industrial designs, geographical indications, utility models (or petty patents), trade secrets, and the relevant aspects of unfair competition legislation (or their equivalent in some common law jurisdictions, notably in the UK), as well as of informal means of protecting their competitive advantage (see Box 10). According to the Canadian Intellectual Property Office, smaller businesses are not aware of the benefits and the financial and strategic value of IP, and that in general, innovators and creators are not aware of most or all the categories of IP just mentioned, and of the benefits associated with each type of IP protection.[104]

Box 10. Alternative means available to innovative SMEs to protect their competitive advantage[105]

Secrecy: information classified as a trade secret (or undisclosed information) usually exhibits three traits: it is not generally known to a relevant portion of the public; it has commercial value; and reasonable action is taken to maintain its secrecy. One of the most famous trade secret is the one held by Coca Cola regarding the recipe of its main soft drink. Although trade secrets are not protected by law in the same way as patents or trademarks, trade secrets may still enjoy some level of legal protection (though the extent to which this is granted varies from one jurisdiction to another). One should generally distinguish between lawful means to obtain a trade secret (such as, by the process of reverse engineering), and improper means (such as by industrial espionage) - which entails legal liability for the party acquiring it.

Lead-time advantage: such a strategy is fundamentally based on a behaviour by which the company is consistently more innovative than its competitors. In other words, the company is constantly in the lead with regard to its innovative activities. By applying such a strategy, the inventing company always has an enhanced version of its products ready for release before a competitor has the time to successfully copy the product that is currently available on the market.

Complexity of the design: a company may rely on the complexity of its products when their composition and structure is such that it renders copying by competitors unattractive. As is the case with a lead-time strategy, registering the invention as a patent could prove counter productive, as this would provide the blueprints of the invention to unlawful copiers. However, as is the case with trade secrets, there is always the danger that the competitor reverse engineers or re-adapts the invention, and possibly, in a worst case scenario, obtains a patent on the invention, in which case the original inventor risks patent infringement in such circumstances.

Defensive Publishing: such a strategy entails that the company makes the blueprints of its inventions available to the public, for example by publishing it in a specialist journal. Although this would entail that everybody would be free to use the invention, the main advantage lies in the fact that nobody would be able to patent the invention as it becomes part of the state of the art, and all novelty claims – one of the fundamental pre-requisites for patentability – will be defeated. Large companies such as IBM and Siemens operate their own journals for the purpose of defensive publishing.

[103] See “Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises”, op. cit., p.11.
[104] See “CIPO Outreach Program: Strategic Plan 2002-2006”, op. cit., p.3.
[105] The alternative means of IP protection mentioned in this Box are those most cited in reports and studies, including in a most recent report by the Austrian Institute for SME Research on behalf of the European Commission, op. cit., pp. 20-21.

C. A selection of government programs promoting the use of the IP system by SMEs in the UNECE region

Several countries in the UNECE region have devised a number of programs to address the two main factors that successive studies and reports have identified as the main reasons for the under-usage of the IP system by SMEs and individual entrepreneurs, namely, costs and lack of awareness. The next few paragraphs will provide an illustration of a selected number of these programs.

Programs aimed at cost reduction

Initiatives by government entities generally aimed at reducing the cost of acquiring and maintaining IPRs by SMEs and individual entrepreneurs vary significantly. However, a close consideration of a number of these initiatives reveals that in general there are two main traits: general fee reduction or exemption, and subsidies.

General fee reductions or exemptions

The United States and Canada have opted for a general fee reduction and/or exemptions for SMEs, or a certain category thereof, when acquiring IPRs, especially, and sometimes exclusively, patents. The United States since 2004[106] affords a 50 % reduction to SMEs and individual entrepreneurs on a variety of patent-related fees, such as fees related to basic filing, search, examination, and maintenance of the patent. A similar system ('small entity fee') is also employed in Canada by the Canadian Intellectual Property Office (CIPO).[107]

Some recent studies[108] have questioned the provision of general fee reductions or exemptions, arguing that this was not the best approach to tackle the issue of high costs in acquiring and maintaining IPRs. Western European countries have adopted a different approach to that employed in North America, and have opted for subsidies and other fiscal incentives instead.

Subsidies

Although the initiatives in a number of countries in Western Europe vary from one country to the other, the scope remains that of subsidising the cost of IPRs, usually patents, incurred by SMEs and individual entrepreneurs. These initiatives may take various forms, such as grants, or soft and interest free loans. Box 11 serves to illustrate and compare a number of these schemes.

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[106] United States Code: Title 35, Section 41(h)(1).
[107] For more details of the 'small entity declaration tool', visit CIPO's website available at: http://strategis.ic.gc.ca/sc_mrksv/cipo/patents/pt_sedt-e.html.
[108] Notably that commissioned by the Commission of the European Communities, "Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises", op. cit.

Box 11. A Selection of subsidy programmes for SMEs in Europe[109]

Germany: ***INSTI SME Patent Action***
A subsidy of up to € 8,000 is provided to first time patent applicants. This amount is paid out in different instalments over the patenting process, and can be used to cover costs such as those related to patent agents or for international patent applications.

Ireland: ***Intellectual Property Assistance Scheme (IPAS)***
Offered by Enterprise Ireland, the funding scheme is a highly selective one, and is only provided once Enterprise Ireland ensures that the prospective invention is patentable and has commercial potential. Once these criteria are fulfilled, the grant is paid directly to the patent agent/attorney dealing with the patent application. In general, the subsidy amounts to circa €30,000, but could reach a maximum of €150,000 in the case of SMEs that are considered to have high growth potential.

France: ***"First Patent" service (1er brevet)***
This is a service offered by the Technology Network Service, and in the main, it consists of a service subsidy of up to €5,000 that can be used by SMEs to pay consultancy fees related to the filing of a patent. The subsidy is paid directly to the consultant in charge of providing IPR advice, and is only available for first-time patent applicants.

Finland: ***Finnish Foundation for Inventions***
Subsidies of up to €10,000 are available to SMEs in Finland to cover costs of patent protection and its commercialization. The subsidy is re-paid back to the Foundation depending on the success of the patent and on the revenue streams. There is no obligation by the patent owner to refund the subsidy in case of commercial failure of the invention.

Spain: ***Promotion of Industrial Property in Galicia***
A subsidy is made available for SMEs in a particular region of Spain: Galicia. This subsidy is allocated to cover up to 70 % of a variety of IPR-related costs, including those related to patent and trade mark applications, up to a ceiling of €36,000 (in 2006). This service proved very popular with SMEs wanting to register their trademarks.

The subsidy initiatives illustrated in Box 11 could be divided into two categories: those aimed at SMEs that are seeking patent protection for the first time (Germany and France), and those open for all SMEs (Ireland, Finland and Spain). Furthermore, with the exception of Spain, all the schemes are limited to patent protection and its commercialization. Spain, on the other hand, provides a scheme available to SMEs based in the region of Galicia, and empirical research[110] has shown that it was mostly used by SMEs to register their trademarks.

Integration of R&D funding with IP protection

Grants for R&D in favour of small, high technology businesses that are prepared to engage in collaborative commercial ventures, can play a significant part in promoting intellectual property protection. The goal is to educate SMEs and entrepreneurs to think in terms of how best to utilize intellectual property assets by ensuring that rules for government funding also promote their strategic use of intellectual property. For example, as part of its Framework Programme for RTD, the EC provides guidelines for the management of IPRs. The model has proved effective. Participation rules require that the proposals shall be evaluated not only according to the

[109] Commission of the European Communities, "Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises", op. cit.
[110] Ibid., pp. 149-160.

excellence of the innovation but also with regard to the "quality of the plan for using and disseminating the knowledge, potential for promoting innovation, and clear plans for the management of intellectual property."

A similar national initiative, the Scottish Expertise Knowledge and Innovation Transfer (SEEKIT) programme, provides support for research-based industry interface and outreach activities. Its goal is to foster projects which encourage productive knowledge transfer activities between SMEs and PROs and associated technology transfer offices. Alternatively, a financial incentive is offered for investigating innovative ideas. This can help SMEs to look objectively at their ideas for innovative products, services or processes and to draw up an action plan, including the strategic use of intellectual property, to take the idea forward.

D. Programs aimed at raising awareness

A number of countries in the UNECE region have been involved for a number of years now in activities aimed at raising awareness. Audiences for such campaigns have typically included students, teachers, consumers, law enforcement officers, researchers, SMEs and individual inventors. Some countries, such as Denmark, are also assisting others in devising and implementing their awareness strategy.[111] In the next few paragraphs, a number of approaches to awareness raising campaigns aimed at SMEs and individual entrepreneurs will be discussed. Although these approaches vary, they can be grouped into two categories: basic awareness initiatives, whereby the IPR system is introduced; and, more in-depth training programs, generally aimed at an audience with a basic knowledge of IP.

Basic awareness raising programs

Among the awareness raising activities that are offered, the most common include roadshows,[112] open days, and printed and online material. All three activities serve the purpose of providing the uninitiated with basic information on the IP system, which would include both protection and commercialization of IPRs.

Roadshows are one of the easiest activities to organize with a target audience of SMEs and individual entrepreneurs (Box 12). These roadshows are typically held at different locations lasting from a couple of hours to a full-day event. The secret for successful events is for the audience to take a pro-active role and actively participate in the discussion and in topics which typically focus on the basic notion of IPRs. Discussions tend to be very practical and devoid of excessive legal jargon. The main message is to transmit information on how IPRs are protected, including familiarization with the registration process of the various industrial property rights (patents, trademarks and designs). Roadshows should provide a good flavour of the IP system and prepare the audience for more specialised training programs.

[111] For more information on the Danish international projects on IP awareness, please visit the Danish Patent and Trademark Office website at: http://int.dkpto.dk/partnerships/international-projects/competencies/ip-awareness.aspx.

[112] Short events held in different locations.

Box 12. Roadshows in the United Kingdom - The "What is the Key?" (WITK) awareness programme[113]

The UK Intellectual Property Office runs an IPR awareness raising campaign called "What is the Key?" in partnership with other UK-based organizations (including the Chartered Institute of Patent Agents, the Institute of Trademark Attorneys, Business Link Offices and regional development agencies). The main thrust of the campaign is to raise awareness among businesses vis-à-vis their intellectual assets and their potential, while offering information and support on how to protect them. A WITK event is usually staged in one day, and is divided into two parts. The first part comprises a general introduction to IPRs, including recent developments, and available support services both at the national and at the regional/local levels. Part two is made up of case studies providing details of local 'success stories', including how local businesses successfully benefited from the IP system. Each part is followed by a question and answer session, providing ample opportunities for SMEs to raise IPR-related issues and concerns. WITK events are held regularly across the United Kingdom.

Open days are another popular and effective form of awareness raising activity. This is essentially where the IPR service-providing entity, such as the IP office, opens up its premises to interested SMEs, while at the same time provides information on its activities and on the beneficial aspects of the IP system. Parallel activities, such as exhibitions and audio visual presentations, are usually held throughout these activities.

Another effective way of raising IP awareness is through printed and online material. Brochures covering the various categories of IPRs and website presentations of material have been effectively used by IP offices to promote the IP system among various stakeholders, including SMEs and individual entrepreneurs. Internet-based tools have contributed to the dissemination of traditional printed material, and websites are a useful source of information, especially if acting as a 'one-stop-shop' for IP information in a single country, or in a number of countries within the same region. One such initiative is the Linking Innovation and Industrial Property[114] portal illustrated in Box 13. Another noteworthy example of Internet-based tools is that provided by the Canadian Institute for Intellectual Property (CIPO). *IP Toolkit*, as it is called, contains information, instructional modules, links and highlighted glossary terms that answer most IP-related questions asked by businesses and entrepreneurs. It also explains what IP is, why it is useful, how it fits as part of a business strategy, how to obtain it and how to use it effectively.[115]

[113] For details on WITK events, please consult the events calendar of the UKIPO, available online at: http://www.ipo.gov.uk/about/about-ourorg/about-contact/events.htm. Details of the scheme are contained in "Science and Innovation Investment Framework 2004-2014: Annual Report 2007, Department for Innovation, Universities and Skills, UK, July 2007, p.43, and "Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises", op. cit. p.68.

[114] Information on this project is available at: http://www.liip.org/.

[115] The IP Toolkit is available at CIPO's website: http://strategis.gc.ca/sc_mrksv/cipo/toolkit/main-e.html.

Box 13. Linking innovation and industrial property – The National Intellectual Property Assistance Platform[116]

This is an initiative adhered to by four EU Member States: Luxembourg, Greece, Italy and Spain. This Internet-based platform allows SMEs and individual entrepreneurs to address all their questions regarding IPRs to a single contact point.

The platform consists of a joint collaboration between the respective IP offices of these four countries and at least one other partner organization from each country working directly with SMEs in the fields of innovation, technology transfer, enterprise development and IP.

The aim of the initiative is to be a 'one-stop-shop' for answering IP-related questions, for providing IP information and for assisting SMEs to better understand IP issues with a view to efficiently implement IP polices in their business strategies.

The role of the participating organizations is mainly to assist innovative SMEs in the following activities:

- to create awareness for a better use of IP; and
- to address IP issues with respect to concrete projects or other innovation activities.

Advanced awareness raising programs

More thorough and specialized training programs, which are generally aimed at SMEs and individual entrepreneurs possessing a basic knowledge of IP, are considerably less in number when compared to initiatives of general IP awareness raising. These more advanced training activities include first-time comprehensive IP services. Such services, which include IP audits, are usually provided in a one-to-one consultation process conducted by an experienced IP professional, who introduces the SME to different IP tools and methods of protection. Besides advising the SME on its IP strategy, the IP professional also carries out an initial assessment of the value of the company's IPRs. Two such programs, illustrated in Box 14, are the 'IP Pre-diagnosis' in France and the 'Intellectual Assets Centre' in Scotland.

[116] The National Intellectual Property Assistance Platforms network was created with the assistance of the European Commission. 'Linking Innovation and Industrial Property' is a project supported by the European Commission, DG Enterprise, co-financed within the fifth framework programme of the European Community as part of the Innovation and SMEs programme.

Box 14. A selection of advanced IP services for SMEs

France ***Pré-diagnostics propriété industrielle*** **(IP Pre-diagnosis)**[117]
This service is provided by the French Industrial Property Office (*Institut national de la propriété industrielle*) to SMEs based in France. The IP pre-diagnosis provides SMEs with a standstill which facilitates the analysis of the challenges of IP in a holistic way, by setting IP within the context of the SME's development. The aim is to underline the value of an IP policy and to assess the benefits of the IP system. The service includes a pre-diagnostic report compiled by an IP expert following on-site visits to the SME. The expected gains for the SME at the end of the exercise are:

- a diagnosis of the current state of the SME concerning its needs vis-à-vis industrial property issues; and,
- a set of recommendations and actions necessary to make the SME more IP-savvy.

The cost of the pre-diagnosis, estimated at €1,500, is covered by INPI and the service is offered to SMEs free of charge.

Scotland Intellectual Assets Centre (IA Centre)[118]
The Centre is supported by the Scottish Executive, and was developed in response to the demand from businesses to learn more about their intellectual assets. The Centre offers a range of services to SMEs based in Scotland, including an interactive website with its many resources and tools; one-to-one advice and guidance, group activities including conferences and workshops; publications and research. Activities with individual SMEs aim to look at their intellectual assets from a historical perspective i.e. from just prior to incorporation to present day.

E. Policy options and recommendations

Any policy recommendations geared towards improving the access of SMEs and individual entrepreneurs to the IP system, both formal and informal, should take into consideration the two towering themes which continue to feature in all major studies in this area and which were treated in this chapter, namely, costs and awareness raising. Another overarching issue relates to cooperation and coordination at the service level. Effective cooperation and coordination at the level of service providers, mainly among IP offices and national SME institutions, is fundamental for the optimal delivery of the services provided.

There are no fixed models in tackling these issues. Instead, there is a basket of options from which to choose the programs that best suit the environment within which SMEs operate.

Costs

As illustrated above, an option available to policymakers to tackle the costs of IP protection and maintenance is by reducing fees related to registration and maintenance of IPRs, or by exempting categories of applicants, such as SMEs and individual entrepreneurs, from paying such fees.

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[117] Additional information on this programme is available on INPI's website (in French) at: http://www.inpi.fr/?id=2413. An overview of this programme in English by Antoine Rety, INPI Lyon, is available at: http://www.wipo.int/edocs/mdocs/sme/en/wipo_insme_smes_ge_06/wipo_insme_smes_ge_06_www_64178.ppt. See also a submission by Cécile Hugo, INPI Lille, to WIPO available at: http://www.wipo.int/sme/en/best_practices/france_awarenss_raising.htm.

[118] Additional information on the activities of the IA Centre is available at: http://www.ia-centre.org.uk/.

As with most initiatives, there are arguments for and against such measures. On the plus side, a blanket fee reduction or exemption for SMEs has the potential of being indiscriminate and relatively easy to set-up and maintain. All that such a system would entail is merely an additional box in the IPR registration form that is ticked off by those fulfilling the necessary criteria. On the flip side of the coin, such a blanket measure could result in a reduction of income of IP offices generated through IP registration, which may in turn result in a lower quality of the IPRs granted. In the long term, such a scenario could be detrimental to SMEs, since 'weak' IPRs are more susceptible to be challenged during litigation procedures. The extent of the reduction is crucial as it has a bearing on the perceived benefits. On the one hand, if the reduction is too low, SMEs might not be encouraged to take the plunge and embrace the formal IP system. On the other hand, if the reduction is too high, SMEs might be encouraged to file lower quality IPRs, mainly patents and utility models (petty patents), which as some studies have argued,[119] would result in additional strains on IP offices, most of which are already overwhelmed with the increasing number of IP applications.

Adopting a carefully-planned system of general fee reductions and exemptions that will not overburden the resources of IP offices (both financial and human) is certainly a possible approach to tackle the costs of IPRs. Targeting financial support to innovative SMEs whose inventions have commercial potential is another option for policymakers. This would ensure that the support is more focused, although such a scheme would necessitate dedicated human resources to assess the probability of commercial success of all inventions described in the applications that are filed.

As far as the subsidies programs are concerned, the examples illustrated above focus mainly on patents, perhaps at the expense of other IPRs. The only recorded exception is the Spanish initiative, which proved to be very popular with SMEs in their trade mark registration. The fact that this is also open to other types of IP protection other than patents, and that in effect the scheme was mostly used for trade mark protection, serves to highlight the importance of approaching IP in a holistic way, without solely and exclusively focusing on patent protection.

Awareness raising

There are a number of factors which studies have shown that can have a bearing on the successes or failures of awareness raising campaigns, and which policymakers should take into consideration when devising and implementing awareness support services in the realm of IP.

Single one-day events are useful in raising general awareness, but experience has shown that only a limited number of issues can be tackled in these short events. Such one-day events could serve the purpose of 'whetting the appetite' of SMEs for more detailed IP training programs, seminars and workshops, which could be delivered at a later stage. The information contained in visual aids and take-home printed material should also be commensurate to the limited number of issues that could be raised in these events given the time constraints. Printed material should be appropriately adapted to these one-day events as it may be counterproductive to include more substantive information than that covered in the training seminar.

[119] See, for example, "Intellectual Property Rights and Innovation in Small and Medium-Sized Enterprises", op. cit.

Training seminars and printed material should ideally target and distinguish between different categories of SMEs. The latter differ considerably in terms of knowledge of the IP system: there are the complete beginners; there are those only looking for answers to specific questions; there are others needing solutions to practical problems in the registration process; while still others will be seeking information on the latest changes in legislation, administrative regulations and the like. Studies have shown that successful campaigns rely on the segmentation of SMEs in terms of level and depth of the information sought.

Besides the detailed legal technicalities of application and registration procedures of acquiring IPRs, awareness raising training seminars aimed at SMEs and individual entrepreneurs should also address the reasons why and when the formal IP system is to be used, and what are the advantages/disadvantages when compared to using informal IP measures instead. Furthermore, it should be pointed out that there could be instances when both the formal and the informal systems could be used at the same time, such as a combination of information disclosed to attain a patent (formal IP: limited in time) and related-information that is kept secret (informal IP: valid as long as the information remains secret), to give the applicant/right holder a competitive edge, especially when the patent expires. In a nutshell, both the 'how to protect' and the 'why and in what way to protect' should receive equal importance in awareness raising campaigns.

While devising IP-related awareness campaigns, policymakers need to consider the whole gamut of IPRs, both formal and informal, and should resist temptation to focus solely on patents. SMEs should be offered the necessary skills and tools to be able to manage effectively the different categories of IP – formal and informal, including trademarks, copyright and related rights, designs, utility models, trade secrets, and the various aspects of unfair competition legislation.

General considerations

Qualified, highly motivated and well trained staff, and close collaboration and coordination among service providers, are key factors to a successful programme aimed at IPR promotion among SMEs. Such an optimal equilibrium is however elusive in many instances.

Research has consistently shown that a combination of a lack of academic programs and career opportunities, coupled with the public sector salary structures have proved to be a formidable deterrent for qualified individuals to take up public sector careers in IPR support. Policymakers can play a significant role in attracting skilled staff by, for example, fostering educational initiatives at universities outside the 'traditional' faculties where IP was taught. Business and technical faculties should provide a sound knowledge of IP to students. Furthermore, the secondary level educational system could also introduce and increase the general awareness of IP among students. Career progression and salary structures are usually addressed more broadly, as part of the general public sector system. However, where career progression and salary structures flexibilities are available in the system, these should be properly exploited by human resources managers to entice qualified individuals to take up a public sector career in IP support.

Harmonious coordination and cooperation among the various SMEs service providers could be a challenge to policymakers. Traditionally, the IP office has been regarded as a place

where IPR registration is sought and were IPR-related disputes are raised. However, over the years, most IP offices in the UNECE region have expanded their service remit to include programs designed exclusively for SMEs and individual entrepreneurs. By doing so, IP offices have become a key, albeit new, player in SME service provision.

This development creates a number of factors which policymakers might well want to keep in mind when considering policy options. A clear and mutually-agreeable division of labour between IP offices and SME support institutions enhances cooperation and coordination among these institutions. Both parties should acknowledge their comparative advantages and should endeavour to strengthen their links. One way of doing so is by devising staff exchange programs between the two organizations. A clear understanding of the other institution's operations is conducive to enhance the level of services provided to SMEs. Furthermore, the historic development of IP offices and SME institutions, as well as the fact that the services provided by the latter are better known to SMEs, make SME institutions the natural entry point for SMEs when it comes to SME-related service. This fact should be acknowledged, and it would be advisable if SME institutions were to act as entry points for all publicly-funded SMEs services, even for those provided by other institutions, such as the IP offices.

Somewhat linked to all this is the acknowledgment of the important role played by private practitioners in the realm of IP service provision for SMEs, especially the patent attorneys. Considering that patent attorneys are often the first point of contact for SMEs seeking IPR-related information, they play a role in the dissemination of information on publicly-funded programs, while in some of the examples illustrated above (Ireland and France), patent attorneys and IPR consultants play a more active role considering that grants and subsidies are paid directly to them by the government entity.

VI. Intellectual Property Audits, Accounting and Valuation

"If you can't measure it, you can't manage it."

Attributed to Peter F. Drucker

A. Introduction

Today, it is widely recognized that intellectual property assets are a primary source of value-added growth and competitive advantage for the business sector.[120] This recognition that the value of a commercial enterprise resides in an organization's intellectual property is a result of the shift in corporate composition from physical-capital intensive sectors towards knowledge-based industries[121] including R&D activities, pharmaceuticals, biotechnology, and telecommunications equipment, whose value is in intangibles. Governments, public research organizations, and innovative businesses are therefore working to connect R&D more explicitly to their commercial strategies and break down the cultural barriers that have historically existed between the science laboratories and the business sector, with a view to ensuring that research efforts result in intellectual property that is capable of commercialization.

The role of intellectual property is crucial to the successful management of both technology transfer and innovative businesses in general. The present chapter discusses how public research organizations and innovative businesses can identify valuable intellectual property by means of IP audits, how businesses, including small and medium-sized enterprises, can account for intellectual property and can activate it in their balance sheets, and how to put a meaningful value on intellectual assets.

B. Intellectual property audits

In order to develop the capability to manage intellectual property successfully, a clear view of the organization's current position is needed. The actual and potential IP that is held by an organization should be identified and recorded by conducting an audit. Only an audit of intellectual assets will reveal those areas of the IP portfolio that:

[120] OECD Science, Technology and Industry Scoreboard 2005 - Towards a knowledge-based economy, 2005, OECD available at: http://masetto.sourceoecd.org/vl=400929/cl=30/nw=1/rpsv/scoreboard/.

[121] The term "knowledge-based industries" usually refers to those industries which are relatively intensive in their inputs of technology and/or human capital: OECD STI Scoreboard of Indicators, 1999 available at: http://www.oecd.org/dataoecd/42/34/2087188.pdf.

- the organization owns and are effective in supporting commercial activities;
- are insufficiently protected by IP;
- have no relevance to the commercial activities of the organization.

What intellectual property does the organization own or license?

Having a coherent view of the intellectual property that the organization does or does not own is a major challenge. To know the value that either resides in, or can potentially be delivered from the exploitation of existing IP either by means of a spinout company or a private partnership with business, presents a further challenge.

Objectives and aims of an IP audit

The chief objective of an audit is to ascertain the existence of intellectual property. An IP audit should identify all the IP generated by the particular department/s in question, whether existing in registered or unregistered form without breaching confidentiality.[122]

What kinds of questions should be asked?

One way of carrying out an audit is through a questionnaire administered to the organization's staff and contractors or collaborators involved in generating intellectual assets. When formulating the questions that will go to staff the general objectives of the IP audit must be kept in mind. They are to:

- Clarify the terms under which IP is being accessed and to determine whether the terms of access impose restrictions on the institute’s ability to pursue its strategic objectives in respect of its own IP;

- Identify where and by whom IP is being generated in order to identify areas in which IP access and ownership may have to be re-examined to ensure compliance with the organization’s current IP policy;

- Assess the importance of the IP to the organization’s activities; and

- Identify potentially new IP being developed by the organization.

Scope of an audit

The scope of the audit will depend on the remit and resources as determined by the board of management at a given time. A newly established KTO will undertake a comprehensive audit of those departments which are likely to reveal the most fruitful sources of intellectual property. Alternatively, an audit of a particular department may be commissioned by a prospective private partner or investor.

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[122] On the registration of patents and trademarks see WIPO Intellectual Property Handbook, Chapter 2 - Fields of Intellectual Property Protection.

Apart from identifying relevant IP, an audit can provide a significant amount of general and specific intelligence which will prove valuable for the organization, for instance in establishing the procedures necessary for optimal IP management and ultimately the formulation and amendment of the IP Policy.

Implementing an audit

Documentation to be collected from staff involved in generating IP may include the following:

- Completed questionnaires
- Disclosure forms
- Material transfer agreements (MTAs)
- Licensing agreements
- Collaboration agreements
- Employment contracts
- In the case of PROs, agreements with funding bodies and donors.

Methodology

How the above information is harvested is a matter of the size of the organization and the scope of the audit. Generally, the audit may be conducted by means of:

- On-line surveys of senior administrative and research staff with the aim of identifying the agreements and activities which might have IP implications.
- Follow-up interviews with the above staff with the aim of clarifying the information disclosed by the on-line surveys.
- Analysis of contracts, MTAs and other documents.
- Requesting the submission of disclosure forms (ROI forms).

In addition to these formal means of collecting information, informal networking between staff responsible for IP management and staff involved in generating IP can be very effective. This can include research discussion meetings and running internal competitions (e.g., on research ideas) so that potential IP can be identified early before problems occur and an effective strategy for IPR protection can be implemented.

Ideally, in a truly well-run organization, IP audits are not required on a regular basis as the management should be constantly up-to-date with what is happening. Efforts can therefore be spent on individual projects/items that require more attention and resources.

Organizing the results of the audit

Identification of intellectual property: an audit should identify the actual and potential sources of intellectual property associated with the organization’s research, including:

- Patents
- Design rights

- Trade secrets
- Copyright, database rights and know-how associated with publications, computer programs and databases
- Trademarks.

Ownership and exploitation of intellectual property: An audit should establish the ownership of IP with the aim of determining

- Unauthorized use of third party IP and the potential liability of the organization for infringement of IP belonging to third parties.
- Legitimate (co-) owners of IP, which may not be limited to the organization and its employees especially where there is collaboration.
- How the organization's intellectual assets might be optimally maintained and exploited commercially.

Creation of intellectual property registers and databases: The wealth of information that can be drilled out of an organization through an IP audit should be captured in a form that enables constant use and maintenance. Setting up a database on the Intranet of the organization will help management to systematically analyze the results of the IP audit.[123]

In particular, the following objectives and functions are relevant to developing an IP database:

- To group patents together in accordance with specific parameters such as the type of product or service; business model or industry.

- After centralizing patent assets in a business unit, the KTO can review existing and potential licensing contracts with a view to assessing the feasibility of earning additional income in licensing fees.

- To identify intellectual property investment opportunities within public or private sector research institutes.[124] For example, IP management may discover a significant revenue opportunity in the purchase of complementary technology which itself may immediately become a new source of licensing revenues.

- To identify IP that has value, but is not providing an optimal return, with a view to selling or donating it, e.g. to charities or universities. Immediate savings may be achieved in taxes and maintenance fees on patents that are not associated with core technologies.

- To identify intellectual assets which have no immediate commercial value but may still be valuable to society at large; then devise a strategy in making use of such assets, including but not limited to scientific publication (most useful for building and

[123] IP audit software facilitates the process of database creation and analysis. An example may be found at: http://www.cpaglobal.com/software.

[124] Hale, K., 1998, Creating the Portfolio Database, P. Sullivan (ed.), Profiting from Intellectual Capital, John Wiley and Sons.

strengthening an organization's reputation and obtaining government/public funding for research), and/or as a basis for other research projects and/or academic development.

- To see that the IP is regularly policed and maintained (e.g. that follow-up applications for patents and renewal of trademark registrations are duly scheduled and executed.)

C. Accounting

The main purpose of accounting and financial reporting is to provide a precise and accurate view of a business' *past* achievements, i.e. its growth and its profitability. This provides important information for the management of the business in the future. But it is conceptually distinct from the valuation of a business (or an asset within a business), which involves a projection of the businesses' likely *future* achievements, in that the value of a business (or an asset) is essentially the discounted present value of future expected profit streams.[125]

Because the principal goal of accounting is to provide a precise, factual view of a firm's past achievements, accounting standards and practices tend to avoid resorting to assumptions about future performance. Historically, they have therefore tended to focus in balance sheets on *tangible* assets, such as machinery and equipment. It is relatively straightforward to account for tangible assets on a replacement cost basis or a purchase price basis, i.e. on the basis of objectively observable quantities, and without having to resort to assumptions about future developments.

By contrast, there has been an historical reluctance to include IP as a separate asset on a company balance sheet because it is often conceptually more difficult to arrive at a meaningful quantification of IP for balance sheet purposes without resorting to assumptions about future developments. For instance, tangible assets can be amortized on the balance sheet as a function of the normal wear and tear of using them. Intangible assets by contrast do not wear down physically. They will depreciate only to the extent that the knowledge they embody is made obsolete by technological or organizational innovations in the future, which can be vastly different from one piece of intellectual property to the next. Similarly, and unlike the case of tangible assets, the economic significance of intangible assets such as IP often depends only loosely on the costs of creating these assets, but does depend heavily on the context in which they are being used, including on complementary human capital (which cannot be accounted for separately).

However, with the growth of the knowledge economy and the increasing importance of intangible assets, including IP, for the success of companies, it is now increasingly accepted that IP is an asset which has to be and can be accounted for separately. Traditionally, IP was included on a balance sheet only in the category of goodwill, the latter being seen to represent future economic benefit of unidentifiable assets, including staff skills, process knowledge and professional contacts or customer relations.[126]

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[125] Ghafele, R., 2004, Getting a Grip on Accounting and Intellectual Property, available at: www.wipo.int/sme/en/documents/ip_accounting.html.

[126] The market value is based on expectations of future earnings, the book value on historical data.

More recently, IP has been viewed as separable from goodwill and thus included as a separate asset on the balance sheet. By this means IP such as patents and trademarks can be identified and sold separately without disposing of the business as a whole and will generate future economic benefits.

Among the changes that have been introduced in international accounting standards and principles is the impairment test, which has replaced the general amortization of intangible assets as a part of a company's goodwill. The impairment test is an assessment of the extent to which the usefulness of an intangible asset has been impaired, either through competing innovation or through litigation, which may challenge the validity of patents.

Another important change that has been introduced is the principle of fair value accounting, which requires that IP and other intangible assets be included in the balance sheet at a price which could be obtained in a voluntary transaction (i.e. in a transaction other than a forced liquidation).

However, significant problems still remain unresolved. In particular, it is still not generally possible to activate on balance sheets in a systematic way intellectual property which has been generated in-house, as opposed to having been bought on the market. Clearly, this potentially distorts management decisions and market valuations of companies. Also, strictly speaking, intangible assets can be activated only if an identifiable revenue stream can be attributed to them. Thus it is relatively straightforward to account for patents that have been licensed out and are generating royalty revenues. It is more difficult to account for patents which are being used internally and which contribute to revenues and profits, but only in combination with the company's other tangible and intangible assets. These and other related issues are often particularly problematic for SMEs.

Box 15. Tools on auditing and accounting

A variety of tools are available to assist companies, particularly SMEs, and public research organizations in performing intellectual property audits. For instance, the Scottish Intellectual Assets Centre provides an Intellectual Asset Audit Tool, an accompanying questionnaire, an interactive Benchmarking Tool, and a series of case studies.[127] The Nordic Innovation Centre has put together a guideline "Putting Intellectual Capital Into Practice" for SMEs to assess, measure and report intangibles which includes assessment procedures, harmonized indicators for measuring performance, a template for reporting Intellectual capital and case studies.[128] The European Commission's RICARDIS study includes an appendix with guidelines, case studies and tools from several European Union member countries as well as Japan and Australia.[129]

[127] Available at http://www.ia-centre.org.uk/.
[128] Available at http://www.nordicinnovation.org/.
[129] European Commission, RICARDIS: Reporting Intellectual Capital to Augment Research, Development and Innovation in SMEs. Directorate General for Research 2006. Available at: http://ec.europa.eu/invest-in-research/pdf/download_en/2006-2977_web1.pdf.

Box 16. International accounting standards and practices

The International Accounting Standards Board (IASB) provides International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS). IAS 38 covers the treatment of intangible assets, including intellectual property. For intangible assets that are acquired externally, either separately or as part of a business combination, IAS 38 provides for their inclusion in the balance sheet at acquisition cost or fair value. For internally generated intangible assets, IAS 38 allows their recognition in the balance sheet if they meet certain criteria on separate identifiability of the asset itself and its cost. Inter alia, it holds that intangible assets can arise not from a research project alone, but only from a development phase. As a consequence, the standard allows for development costs but not research costs to be included in the balance sheet as the cost of internally generated intangible assets.

IFRS 3 on business combinations provides for the possibility of recognizing intangible assets, including intellectual property rights, separately from general goodwill in the case of business combinations, to the extent that the asset in question can be identified separately. Among other things, this means that an intellectual property right which could not have been activated in the balance sheet before the business combination, because the asset was generated internally and did not meet the conditions of IAS 38, can possibly be activated in the balance sheet of the combined business.

The IASB has also published International Financial Reporting Standards (IFRS) for Small and Medium-sized Enterprises (SMEs) (http://eifrs.iasb.org/eifrs/sme/en/IFRSforSMEs2009.pdf). These standards are based on the general IFRS and IAS but provide certain simplifications to make them more accessible to SMEs. They cover inter alia the accounting for intangible assets other than goodwill, i.e. including intellectual property. Like the general IFRS and IAS, they allow for activating intangible assets that have been acquired either separately or as part of a business combination, a government grant or an exchange of assets. In all these cases, the intangible assets enter the balance sheet at acquisition cost. In contrast to IAS 38, the IFRS for SMEs do not allow for activating any internally generated intangible assets but require all costs of generating them, including most notably costs of research and development (R&D) to be treated as current expenses. The reason for excluding internally generated intangibles is the view that their value cannot be measured reliably on a cost basis. However, in order to still give SMEs an opportunity to reflect internally generated intangibles in their accounts, the IFRS recommends that R&D costs that have not been capitalized into a tangible asset may be disclosed separately. The European Union is discussing whether to integrate these standards into EU legal accounting frameworks. The IFRS Foundation provides training materials free of charge, conducts training workshops and runs an Implementation Group which is developing guidelines for SMEs on the implementation of the standard.

D. Valuation

An intellectual property valuation is an essential part of using intellectual assets internally and in making intellectual property transactions. It is relevant whenever an organization is "licensing in" technology in order to commence a new research project, or "licensing out" or assigning (selling) the technology to as part of its strategy for commercialization, or using the intellectual property as collateral for a loan, or securitizing the intellectual property, or raising finance on the capital market (e.g. by means of a bond issue), or donating the intellectual property to write-off taxation, or in a worst case scenario, in cases of bankruptcy or infringement litigation accounting for a loss of revenue.

The "paradox of valuation" is that while most organizations are aware of the potential value of their intangible property they invariably neglect to determine its value with any accuracy. Patent protection can only contribute to a successful transaction if the intellectual property is valued with an eye to the market, at a realistic price. Both public and private investors in R&D stand to gain from more systematic valuation of intangible capital. Investors can

optimize their intellectual property portfolios and increase their returns with more realistic valuations. It allows firms the potential to capture greater market share through better pricing in high-growth, knowledge-intensive segments assuming that is, they value intangible assets efficiently. The value of the patents therefore must be assessed as a prerequisite to investment by third parties.

SMEs in particular often lack information about the returns on investments in intangible assets. Individual misallocations are the result, or misdirected investment strategies. Moreover, business and PRO alike are missing an important element of the image they wish to portray to investors, lenders and public sponsors (leading to inordinately high costs of capital for knowledge-intensive service providers and manufacturers of R&D-intensive goods in particular), to customers (to whom innovation or cost leadership could be communicated more transparently) and to the labour market (which is often especially receptive to a company's "soft values").

Most importantly, companies aware of the value of their intellectual property can better trade the intellectual property assets. Where there is insufficient information on value, IP assets will remain undervalued by capital markets and intellectual property transaction will not progress. Valuation is therefore an important step in determining if the intellectual property transaction is feasible. Particularly in the case of securitization, where the sale price of the IP-backed bond is the discounted future earnings, these need to be accurately projected and stressed by consideration of any number of contingencies which will affect the income stream of the IP. In short, public and private organizations need to employ valuation tools which can accurately capture the worth of their intellectual property assets.

Studies based on large samples of granted patents consistently show that the distribution of patent values is highly skewed, i.e. that within any sample of patents, there will be very few with very high value, accounting for the bulk of the total value in the sample, whereas the vast majority of patents have moderate or low value. For example, a large-scale survey of patents granted at the European Patent Office in eight EU countries (PatVal-EU) showed that the arithmetic average value of patents in the sample was €3 m, but the median was only €300,000, i.e. half the patents in the sample had a value of less than 10 % of the arithmetic average, implying that the high sample average was driven by the very high values of very few patents.[130]

Advantages of an IP valuation

An intellectual property valuation will assist in making informed decisions concerning the alignment of intellectual property development or acquisitions. In particular it is essential to:

- knowing which is the valuable IP (perhaps within a large portfolio) and which needs to be protected fully, and which is the IP of no significant value, which might be sold or abandoned;

- creating new and diverse revenue streams, especially from underused IP;

[130] Gambarella, A., P. Giuri, and M. Mariani, 2006, Study on evaluating the knowledge economy: what are patents actually worth? The value of patents for today's economy and society. Tender no. MARKT/2004/09/E, Lot 2, final report 23 July 2006.

- achieving lower overall costs associated with IP development or acquisition, protection and utilization;

- creating a greater awareness among staff of the significance of IP to the financial viability of the organization;

- establishing a realistic price, if you are negotiating a license with a private sector developer. In that case the appraised value can represent the base value around which the buyer/purchaser or licensor/licensee negotiate the final agreed price;

- utilizing the patent for securitization or an IP-backed loan, if you are considering creating a spinout company; and

- deciding whether to commence litigation to protect a patent.[131]

Concept of intellectual property valuation

As a separate asset, IP must be attributed a value. An intellectual property valuation may be made for various purposes, each of which is reflected in the four major concepts of valuation:

- **Replacement cost**: The value of the IP to the owner frequently determines the price in negotiated transactions as indicated by the owner's view of its replacement cost.

- **Market value**: The basis of market value is the assumption that if comparable property has fetched a certain price, then the subject property will realize a price something near to it.

- **The fair value concept**: This is, in essence, the desire to be equitable to both parties. It recognizes that the transaction is not in the open market and that vendor and purchaser have been brought together in a legally binding manner.

- **Tax valuation**.[132]

- **Investment value**, liquidation value and the value of the IP as a going concern are related concepts which impact upon the value of the asset.

Methodologies for valuing IP

The monetary valuation of intangibles, like that of other assets, can in principle be carried out using the cost approach (what would production of the asset analyzed cost today?), the market approach (what does a liquid and transparent market pay for comparable assets?) and the

[131] Further on the need for IP valuation see Gordon V. Smith, Russell L. Parr, Intellectual Property: Valuation, Exploitation, and Infringement Damages, Wiley, 2005, p. 6.

[132] See generally, Gordon V. Smith, Russell L. Parr, Intellectual Property: Valuation, Exploitation, and Infringement Damages, Wiley, 2005, Ch. 6 "Tax Issues".

income approach (what is the current value of the potential earnings stream or cashflow from the asset?).

The value of IP, particularly a patent, depends on the predicted future cashflow to be derived through the exploitation of that patent. This, therefore, entails the determination of the value contributed by the intellectual property and is often assessed by determining the volume of the product sold and the margin on that product to obtain the total profit made.

There are basically three available methodologies for valuing intellectual property that has been registered or is the subject of statutory protection, such as patents, computer software, databases and trademarks. The valuer will generally use either one or a combination of them depending on the circumstances and the available information.[133]

Market-based: the market-based value uses other recent similar market transactions as a reference to obtain the comparable market value of the intellectual property. The basis of the market value is the assumption that if comparable property has fetched a certain price, then the subject property will realize a price something near to it.

Cost-based: The cost-based methodology attempts to determine the value of the IP by means of determining the actual historical cost of generating the intellectual property or its replacement cost. In the latter case valuation is determined by what it would cost to substitute or "design around" the intellectual property protection.

Income-based: The value of IP, particularly a patent, depends on the predicted future cash flow to be derived through the exploitation of that patent. This, therefore, entails the determination of the cost or value contributed by the intellectual property and is often assessed by determining the volume of the product sold and the margin on that product to obtain the total profit made.

These determine the value of the IP by estimating future profits attributable to the IP and discounting such a revenue stream to a present net value. Where it is not possible to give specific value to the commercialization of an invention, this method is, of course, not useful.

Valuation is determined from anticipated revenue which is discounted at a rate according to risk factors which could affect revenue projections. This provides the net present value. This is the most common method used for valuations prior to securitization, but there are a number of variations within this approach.

Future economic benefits may be assessed broadly through two methodologies:

The discounted cash flow method is frequently used to assign a cash value to individual intellectual property rights. The future earnings from these intellectual assets will be derived from market royalties.[134] Clearly, a high discount rate will apply to patents which are at a very

[133] Further concerning the categories of intangible assets that must be individually accounted for under International Financial Reporting Standard (IFRS3) on business combination valuation allocations and International Accounting Standard (IAS38), see Kelvin King, "Valuing IP, Intangible and Goodwill", Ch. 8.1.

[134] DCF mathematical modelling allows for the fact that one monetary unit in your bank account today is worth more than one unit next year.

early stage commercially, e.g. pre-clinical trials, whereas an established patent with a commercialized product will have a smaller discount rate and, therefore, an increased value. The prediction of profits must take into account such conditions as the raising of capital, production scale, personnel and management quality, ability to apply and develop technology, etc. For example, a very valuable patent may not produce the expected profit if it is transferred to a commercial enterprise with small capital and limited technology commercialization ability. Further, the income resulting from a patented invention is generally tied to the total income of a particular entity and determining the contribution of the patented invention to the total profit is, therefore, often difficult.

The royalty rate method is the most comprehensive of the valuation techniques. This method values patents by assessing the turnover attributable to a patent and using this as the royalty base. The turnover is basically estimated as outlined above. The royalty rate is assessed by examining either previous or current licenses relating to the patent, as this gives the market value of the patent (assuming the previous license is comparable to the current situation, for example, in duration, territorial limitations, exclusivity or otherwise). If no previous license is available, an industry standard rate can be taken and adjusted up or down.

Alternatively, the royalty rate may be assessed by allocating economic benefits deriving from the licensee's use of the patent. This involves the projection of the turnover/profit margins by also considering working capital, marketing and anything else contributing to the exploitation of the IP. This method analyses the risks borne by the licensee and licensor and they are reflected in the royalty rate. The appropriate royalty rate is derived by finding a rate which yields a royalty stream over time which is equivalent, when discounted back to the present day, to a net present value which is the anticipated capital value of the license.

Assessment of the above methods

Market approach: while the market value is normally favoured by independent assessors, in the case of intellectual property, it is somewhat problematic due to the unique nature or lack of comparability of one patent with another. This approach is seriously limited where there is not a dynamic market in the industry for the type of IP and where there are consequently few cases with which to compare the purposed transaction. On the other hand, there are many places to look for data, including litigation documents and published documents pursuant to an acquisition.

Cost-based methodologies: these assume that there is some relationship between cost and value. This approach has very little to commend itself other than ease of use. The method ignores changes in the time value of money and ignores maintenance.[135] In fact, this is not often used given the difficulty in apportioning R&D expenditure relating to the specific IP and the lack of any correlation between the amount spent on creating IP and its market value at any given time in the future. In terms of the replacement cost, unless the patent is narrow in scope, it may not be possible to "design around" the patent without infringing.

By the same token, the historical production costs (or their replacement costs) approach rarely makes sense for intangible assets because these factors correlate only weakly with the

[135] Kelvin King, "Valuing IP, Intangible and Goodwill", op. cit.

potential benefit, if only because of the high earnings risk. Assume, for instance, that R&D department A was to develop model Alpha to simplify its internal processes and R&D department B was to develop an identical model Beta at half the development costs. Applying the cost approach, Beta would be worth half of Alpha – although the process cost reductions anticipated from both Alpha and Beta and the probability of their realization would be identical and, moreover, Beta would have been produced more efficiently. In this fashion, a multiple is arrived at after assessing a patent in the light of factors such as validity or strength, market share, internationality, trend of profitability, marketing and availability of protection. Not only does this method have the drawback that it takes little account of future trends, but the notion of historic earning capability is itself somewhat problematic.

Income-based methodologies: prospective methods are usually based on a discounted cash flow (DCF) analysis, with only that part of the future cash flow being discounted that is ascribed to intangibles. This cash flow splitting, in addition to forecasting the cash flow itself and estimating an adequate discount rate is one of the most difficult steps in a DCF analysis. Nonetheless, DCF analysis is probably the most comprehensive of the valuation methods. The DCF or analysis of the value of the money over time is calculated by adjusting expected future returns to today's monetary values using a discount rate. The discount rate is used to calculate economic value, and includes compensation for risk and for expected rates of inflation. The choice of a proper discount rate is more of an art than a science.

The assessor will consider the operating environment of the patent in question with a view to determining its potential for increasing returns in the relevant market. Its potential market power will be assessed by reference to the life of the patent and its marketability, expenses and its residual value or terminal value, if any. This method recognizes market conditions, likely performance and potential, and the time value of money. The DCF is highly regarded and widely accepted by the financial community.[136]

In reality, the income approach is partly retrospective (or based on historical earnings data), since, in order to obtain earnings forecasts, historical earnings data are usually taken as the starting point. Estimates of future changes based on the past in output, processes and framework conditions are entered into the equation.

Ipso facto, there will also be difficulties with predicting future income and profit. In the first place, the economic term of a patented invention will usually be less than the legal term of 20 years. Reasons for this include the rapid development in the biotechnology area which affects the life cycle of the patented product. Additionally, other competitors may have designed around the patented technology or used equivalent technology and the patented technology is then not able to realize large profits and its value decreases.

Moreover, in the case of intellectual assets, they come with a set of unique, potentially destabilizing factors. There may be increased difficulty in predicting future cash flows due to a variety of specific risk factors including:

[136] The discount rate to be applied to the cash flows can be derived from a number of different models, including common sense, the build-up method, dividend growth models and the capital asset pricing model utilizing a weighted average cost of capital. This appraisal technique will probably be the preferred option.

- Unforeseen technological developments (in the case of drug patent royalties, a new entry into the marketplace could make the patent obsolete);
- The possibility that the patent will be declared invalid through litigation;
- Public opinion or fashion trends (especially in the case of music or film royalties); and
- Moral hazard (inventors or creator's actions will cause a reduced royalty stream).

In summary, while the market-based approach in principle would be the ideal, to date, there are insufficient liquid and transparent markets. For intangibles as so often for tangible assets, the income approach is most commonly utilized. Based on an expanded discounted cash flow analysis, a company's intangible assets can be valued in monetary terms as an aggregate on the basis of publicly available information. With that caveat, the valuation of IP is an important management tool which provides managers with a means of monitoring performance and ultimately increasing returns to shareholders.[137] The processes outlined above can prove fruitful if, together with IP lawyers and in-house accountants, management undertakes a due diligence process, in order to quantify the intellectual property's useful life and decay rates.[138]

Box 17. Training and certification by professional valuation associations

In a number of countries, valuation experts have formed professional associations which provide training and certification on business appraisal in general and the valuation of intangible assets in particular. Examples include the National Association of Certified Valuation Analysts (www.nacva.com) and the Institute of Business Appraisers (www.go-iba.org) in the United States, or the Institute of Business Appraisers (www.idw.de) in Germany.

In countries with economies in transition, there exists a tradition from pre-transition times of professional value appraisals of real estate. The professional associations emanating from this tradition have to some extent branched out to also incorporate the valuation of businesses, including intangible assets. The Russian Society of Appraisers and the Belarus Society of Valuers (www.acenka.by), among others, offer education, quality control and valuation standards. The Council of Valuers Associations of the Commonwealth of Independent States (CIS) is an umbrella organization that groups several national associations.

Box 18. Commercial valuation services

In developed economies, there is generally a large number of commercial providers of valuation services available, ranging from databases that collect information on market transactions for benchmarking purposes, to software tools for the valuation of whole businesses or intangible assets, to publications on valuation topics, to professional advice and actual valuations. Such services are also increasingly available in some countries with economies in transition, including the Russian Federation, Kazakhstan, Ukraine, often in cooperation with or as subsidiaries of internationally operating providers.

[137] A website that provides a useful programme for the valuation of IP is located at www.autm.net/.
[138] This is done using a modest growth rate (say inflation) at the steady state year, but also discounting this forecast to the valuation date.

Non-monetary patent valuation

Alternatively, the valuation of intellectual property may be based upon a non-monetary value, which nonetheless, permits comparisons, sufficient as a value metric or industry benchmark. Non-monetary patent valuation methods are based on a comprehensive analysis of the company's intellectual assets which may take the form of process efficiency or staff motivation, or partial aspects thereof. Whether a monetary valuation is called for or whether an alternative non-monetary value metric will suffice depends on the valuation objective. Generally speaking, this type of analysis is mostly applied to internal patent management and resource planning for R&D departments. For example, such non-monetary valuations may encompass a range of factors that have the capacity to influence the future income of the patent, including the scope of the patent; its validity; the quality of the organization's human resources; the training, skills and technical abilities they possess in order to make an economic success of the patent; the share of the patented technology in future product earnings; market growth and; market position.

Econometric models may also be used for non-monetary patent valuation, particularly in highly aggregated analyses for political planning or scientific and academic purposes. Normally, the bases of econometric methods include factors such as: citation rate data; the degree to which the patent is valuable for other technologies; patent renewal data (which may be used to determine whether the patent is worth the costs of re-registration); and litigation data (reflecting the fact that only economically valuable patents will be the subject of litigation).

A non-monetary analysis of this kind creates a basis for credible external communication of the company's intangible assets, for example, for such purposes as raising a loan or canvassing for business partners. In the event valuation by independent experts proves too costly, the application of non-monetary methods can provide a practicable, if reduced, means that can be used to enable: (a) more informed use of interpretative scope in the classical overall monetary valuation or; (b) serve to provide a more structured preparation of the monetary valuation of intangible assets; and (c) an indication of the organization's commercial potential to financial institutions.

However, it is necessary to keep in mind that selection and granulation of the individual assets is organization-specific and critically hinges on the valuer's viewpoint. For this reason non-monetary analyses are incapable of delivering a universally valid valuation of a company's intangible capital. Nonetheless, these methods provide an acceptable means of allocating resources more efficiently within the organization. In this way they may contribute towards optimal preparation for monetary project valuation.

IP asset-backed securitization

As valuation tools, which can accurately capture the worth of intellectual assets, have developed in methodological sophistication and gained acceptance by investors, IP securitization has expanded dramatically. Asset-backed securitization began in the 1960s with credit card receivables, expanded to mortgages in 1981, and since the turn of the century major intellectual property securitization deals in the entertainment, biotechnology and pharmaceutical industries have been backed by future royalties from IP intensive products. Today IP is being increasingly used as security to raise finance (by way of loan or mortgage) or to trade in securities (e.g. bonds).

The increasing openness to IP commercialization coupled with periodic squeezes on liquidity have increased the trend for firms to turn to considering IP-backed securitization as a means of raising finance. In a typical IP securitization, the royalty stream is transferred to a special-purpose, bankruptcy-remote vehicle (SPV). The transaction is tailored to be a "true sale" rather than a form of lending secured by the transferred assets. This step is taken to ensure that the issuer, the SPV, and its assets will not be affected by the originator's bankruptcy. The SPV then issues securities to capital market investors. Usually the bonds are privately placed to institutional investors, such as pension funds or insurance companies, not to the general public. The transfer to the SPV places the IP assets out of reach of the originator's unsecured creditors. A portion of the capital obtained from the issuance of the bonds may need to be placed in a debt service reserve fund. Ratings are assigned to the securities by a rating agency or agencies such as Standard & Poor's or Moody's. Typically, rating agencies accept three to five years of history with a particular company's portfolio as being sufficiently reliable data to project future performance. Before the IP is securitizable, it may be necessary to obtain residual protection, such as insurance for deals in the event of under-performance of the royalties.

Box 19. The UNCITRAL Guidelines on Security Rights in Intellectual Property

At its forty-third session in 2010, the United Nations Commission on International Trade Law (UNCITRAL) adopted the Supplement on Security Rights to Intellectual Property to the Legislative Guide on Secured Transactions, noting that intellectual property was increasingly becoming an extremely important source of credit and should not be excluded from a modern secured transactions law. The Legislative Guide on Secured Transactions provides recommendations to assist UN Member States on developing modern secured transactions laws with a view to improving the availability of investment credit to enterprises, including access to foreign credit. In recognition of the increasing importance of intellectual property as assets which drive business success, the Guide contains a Supplement which specifically deals with the treatment of intellectual property in credit securitization. It covers inter alia the creation of securities based on intellectual assets, systems for registering such securities, the order of priority of claims based on such securities, the rights and obligations of the parties to the transaction, the enforcement of rights arising from these securities, and the impact of insolvency of licensors and licensees.

Source: http://www.uncitral.org/pdf/english/texts/security-lg/e/10-57126_Ebook_Suppl_SR_IP.pdf.

Advantages of IP securitization as a financing method

Although IP poses some difficulties as a means of raising finance, IP-backed securitization offers the following advantages to investors:

- It allows investment in an otherwise unavailable niche.
- It permits investment in IP narrowly rather than in a company as a whole (the venture capitalist approach).
- A company, which securitizes its IP, can obtain a greater amount of revenue than from a loan based on that future revenue. Securitization can accommodate a loan-to-value ratio of as much as 75 %.
- Capital is obtained immediately, rather than waiting for royalties to trickle in over time.

- Securitization sets up a fixed interest for the duration of the deal.
- Securitization is non-recourse to the originator and the irrevocability of the bond sale becomes a *de facto* insurance policy for the value of future royalties.
- Taxes do not have to be paid on the amount raised by the securitization.
- The owner retains ownership of the IP (as opposed to monetization by outright sale of IP). IP securitization can be structured so that the seller holds on to an equity component of the royalty stream, while the buyer participates mostly in the debt-side.
- The credit rating on the securitization can be higher than the originator's rating because of the quality of the assets, credit enhancement, and the isolation of the assets in a bankruptcy-remote entity.

The trend to securitization only serves to underscore the importance of an intellectual property valuation. Valuation is fundamental to the securitization of intellectual property assets.[139] Valuation is therefore an important step in determining if securitization is feasible. The sale price of the IP-backed bond is the discounted future earnings, but these must be accurately projected and stressed by consideration of any number of contingencies which will affect the income stream of the IP. Where intellectual assets are not credibly valued by their owners, they will remain undervalued by capital markets because of insufficient information. It has been demonstrated that more disclosure in IPO prospectuses for pharmaceutical and biotechnology companies correlates with lower stock volatility. It is clear that once investors have information they will take action; that information improves accuracy in the valuation of a company and its assets.

Securitization of IP has grown less rapidly than one might expect given the advantages outlined above. On the one hand, the reluctance may be due to the risk and the expense: given the risks and complexities, due diligence concerning the IP in question prior to securitization is more expensive than with traditionally securitized assets. On the other hand, cultural factors may play a significant role in the lack of take-up. In the past, accounting divisions of corporations have rarely interacted with R&D departments, where catalogues of IP are maintained.

Box 20. Policy support for IP auditing, accounting and valuation

The Scottish Intellectual Asset Management Centre is a public sector body supported by the Scottish Executive that provides advice and tools to innovative companies. The German Federal Ministry of Economics and Technology, in cooperation with the Fraunhofer Institute for Production Systems and Design Technology, is offering to SMEs a software tool assisting them in managing their intellectual assets. They have created a research group that promotes "the scientific development and broad application of Intellectual Capital Statements as a strategic management tool." Relatedly, the Fraunhofer Academy offers professional training programs leading to a certified qualification in intangible asset management.[140]

[139] Michael K. Fung, 2006, "R&D, Knowledge Spillovers and Stock Volatility", Accounting & Finance 46 (1), 107–124: arguing that asymmetric information caused by R&D activities with uncertain future output increases stock volatility, even though dividends and consumptions remain unchanged.

[140] Available at http://www.akwissensbilanz.org/index-en.htm.

E. Conclusions and recommendations

Intellectual property valuation, auditing and accounting, while growing in acceptance, remains a developing area, so it is not possible to make hard and fast recommendations as to policy or as to any particular method of valuation. As a general rule, however, PROs and SMEs need to have in place a robust system to measure and track all aspects of the performance of intangibles/intellectual capital. This is true all the more so since the value of IP at the operative time tends to be more vulnerable than tangible property to extraneous factors, such as litigation, confidential information or reputational factors related to socio-economic and environmental issues.

As IP assets valuation is a complex and highly specialized area and not a straightforward exercise, experts should be engaged to carry out the design and crucial stages of the task.[141]

This requires government funding for the training of staff. It is essential that those managing intellectual property have at least a working knowledge of the concepts and the various methodologies for evaluating IP. Government subsidies may assist the implementation of best practice concerning intellectual property valuation and securitization of intellectual assets. In so far as we have identified litigation as one of the prime risks, the offer of subsidies for defensive litigation insurance may protect PROs and SMEs against the potential risk of liability.

In summary, IP auditing, accounting and valuation are of increasing importance for innovative businesses, public research organizations, venture capitalists and other providers of financing for innovative enterprises. They are the basis for successful IP management, ready access by innovative firms to external finance on affordable terms, and well functioning markets for IP.

IP auditing is a systematic appraisal of the stock of IPRs possessed by a company or a PRO, including how strongly IPRs are protected, and how important they are to the business. IP auditing is the starting point for the development of any IP management strategy.

Putting a value on IP assets becomes indispensable when considering the sale, purchase or licensing of IP assets, mergers and acquisitions of firms with significant IP assets, joint venture arrangements and strategic alliances, litigation over IPR infringement, and for the purposes of financial reporting and disclosure.

It is increasingly important that firms report on their IP in a transparent and informative way and that they communicate their IP exploitation strategies effectively. The reason is that accounting standards currently allow for only a limited recognition of intellectual assets in financial statements. Given that intellectual assets are becoming increasingly important for value creation, this means that financial statements alone are less informative today than in the past for assessing the performance and prospects of innovative companies.

[141] "Business Performance and Intellectual Assets", 2004, OECD, Paris: available at: http://www.oecd.org/dataoecd/51/58/33848005.pdf. See also Baruch Lev, Doron Nissim and Jacob Thomas, "On the informational usefulness of R&D capitalization and amortization": available at: http://pages.stern.nyu.edu/~blev/docs/On%20the%20informational%20usefulness%20of%20R&D%20capitalization%20and%20amortization%202005.04.17.pdf.

However, IP auditing, accounting and valuation are new, complex and rapidly evolving areas. Therefore, there is currently little factual basis for recommending good practices to policymakers and standard setters.

One problem is that there is no single best methodology for the valuation of IP. Whether to use static or dynamic models, whether to rely on income-based, cost-based or transaction-based methods depends crucially on the purpose for which the valuation is undertaken.

Whichever method is chosen, IP valuation will inevitably involve a large element of subjectivity due to the need to:

(a) assess the quality and strength of intellectual property rights and the capability of the company's management to protect and enforce them;
(b) assess market prospects of existing and future IP-based products (which among other things will depend on the quality of the management team of the company owning the IP);
(c) estimate future royalty streams;
(d) estimate future development costs to bring IP-based products to market;
(e) assess the risks surrounding all these estimates as well as other risk factors such as the costs of protection, execution, compliance, and enforcement, possibly including litigation; and
(f) identify comparable IP assets that were recently sold and whose prices a company can use as benchmarks in valuing its own IP.

Another conceptual problem is the difficulty of distinguishing between investments in intangible assets and current research and development (R&D) expenditures, such as the remuneration of R&D employees. These employees acquire skills and know-how in the course of the research and development process, and those skills and know-how constitute important intangible assets for the company. Similarly, the value of various IP assets depends in large measure on the IP management capabilities and business strategy of the firm, which is difficult to measure objectively. For these reasons, it has proved difficult to expand the coverage of IP in accounting standards.

There is some evidence from OECD economies that competition in financial markets encourages companies to improve their reporting and disclosure policies on IP, and that companies with strong corporate governance structures are better at managing, valuing and reporting their IP. Fostering capital market competition and good corporate governance, while important policies in their own right, may also be useful therefore to spur improvements in IP auditing, valuation and accounting.

Industry and financial sector associations are also developing voluntary codes of conducts and standards in this area. Moreover, there are firms specializing in providing IP auditing and valuation services to other firms.

Policymakers should monitor these developments with a view to disseminating and encouraging the adoption of good practice as it evolves. Further extensive sharing of experiences will be needed for the identification of good practices and setting the corresponding standards.

At present, any regulations that might be adopted should preferably be principles-based rather than prescriptive: i.e. they should set out general principles and goals to be reached without prescribing in detail what companies would have to do to comply.

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Intellectual Property Commercialization

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