ETAN Working Paper

Strategic Dimensions of Intellectual Property Rights in the context of Science and Technology Policy

Prepared by an independent ETAN Expert Working Group

for the

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FOREWORD

European Technology Assessment Network (ETAN)

The purpose of ETAN is to promote communication and debate at the European level between policy researchers and policy makers on important science and technology (S&T) policy topics. ETAN convenes expert working groups which review, consolidate and synthesise results of socio-economic and other research to identify issues and options for S&T policy. The task of each working group is to prepare a report in a form appropriate for discussion with policy makers and other stakeholders. ETAN's ultimate objective is to promote a shared understanding of the issues in order to facilitate the development of more consistent, concerted and complementary European and national S&T policies.

The Expert Working Group

The ETAN Working Group **'Strategic dimensions of intellectual property rights (IPRs) in the context of science and technology policy'** met four times in 1998-99 to develop a broad strategic view of various IPR issues from a S&T policy perspective: what are the issues, their importance, and the best approach in addressing them. The group then made its own recommendations concerning the objectives, scope and content of appropriate RTD policies. The meetings were attended by Commission officers, who contributed information on EU policies and programmes.

The contents of this report are the sole responsibility of the working group, whose views do not necessarily reflect those of the Commission.

Purpose of the report

The purpose of the report is to develop a broad strategic view of various IPR issues from a S&T policy perspective.

Key issues covered include:

- Changing S&T environment, new IPR regimes, and flaws in policy approaches;
- The correct use of IPR instruments to enhance research and innovation policy;
- IPR policy in public funding and collaborative ventures;
- IPR cost reduction and IPRs as fund-raising policy instruments;
- Options to adapt the European and international IPR systems to new needs.

EXECUTIVE SUMMARY

I. The question addressed and general thesis

1. **Are intellectual property rights assisting or impeding science and technology policy in Europe?** To answer this question we must first understand the present basis of both policy and IPRs.
   - There is a widespread belief among European policy makers that S&T is a dynamo driving such important growth sectors as pharmaceuticals, electronics, aviation, and telecommunications, and probably to some extent all modern industry (an unquestioning belief in 'the knowledge society').
   - This belief has been supported by an over simple view of developments in S&T over the course of this century. Its consequence has been that policy makers have sought to foster creativity in S&T, and hence invention and innovation in ways which are not optimal.

2. **We believe two fundamental flaws underpin the prevailing approach.**
   - One lies in an outdated concept of the process whereby an idea turns into an innovation (i.e. a marketable product). This is the idea that there is a linear progression from basic research leading to invention to innovations in the market place. Although this *'linear model*' is widely integrated into policy structures, it is largely outmoded. It is now generally accepted by experts that the innovation process is best promoted by interaction between all participants in the knowledge production and innovation process, very often at an international level *(Chapter 1.5).*
   - The other lies in the IPR system, which is not well adapted to accommodate many of today's S&T developments, such as those in the growing knowledge-intensive business sectors, and high technology small and medium size enterprises ('SMEs') *(Chapter 3.1.1).*

3. **European HEIs and PROs are excellent at generating ideas, but these are often exploited elsewhere.**
   - A common belief is that this is because Europe has a *'patenting deficit*', a belief partly encouraged by the strengthening of the patent system in the USA, leading to what is called the *'pro-patent era' (Chapter 2.2).*

4. There are dangers, however, in overemphasis on patents

- It may lead to the neglect of other elements which are essential to the development of an effective innovation strategy *(Chapter 2.4.1, 2.5)*.
- The range of protection mechanisms available includes maintaining information as a trade secret, copyright, design rights, registered designs, as well as patents (and where available utility models) *(Chapter 2.5)*.
- In developing an effective innovation strategy it is also important to distinguish between knowledge that is appropriable through IPRs and knowledge which is not but is banked within the minds of researchers, and to realise that *both* kinds of knowledge are important in the innovation process *(Chapters 1.4-1.6, 1.9, 5.1*).

5. Accordingly, *if approached in the right way* IPRs can assist S&T policy, approached in the wrong way, they can impede it. It is the purpose of this report to try to identify the right approach.

II. General implications of thesis for industry

1. Awareness of the importance of IPRs needs, in general, to be raised.

- IPR principles should become part of the training of management (including senior management), scientists and engineers *(Chapter 4.3)*.
- IPR strategies must become an integral part of business plans *(Chapter 4.2)*.
- Appropriate incentives should be offered to researchers to innovate *(Chapter 4.2)*.
- As a key element in competitive strategy, IPRs should not be treated in isolation *(Chapter 2.3, 2.4, 4.1, 4.2, 5.5)*.
- Similarly, IPRs are key elements in international collaborations *(Chapter 4.2)*.

III. Application of the thesis to HEIs and PROs

1. It can be counter-productive to put pressure on Higher Educational Institutes ('HEIs') and Public Research Organisations ('PROs') to secure IPRs

- Although licensing (a precondition of which is ownership by the public sector organisation of appropriate IPRs) is an important exploitation mechanism, it is not the only one. The transfer of human capital into industry is at least as important *(Chapter 5.2, 5.5, 5.6)*

- A flexible approach in relation to IPRs is necessary in relation to research contracts with HEIs and PROs whether placed by industry or government *(Chapter 5.3)*.
- It follows that negotiations need to be conducted on a case-by-case basis with appropriate support and counselling being made available for participants with limited resources *(Chapter 4, 5.3)*.
- Effective collaborative ventures are important for knowledge transfer *(Chapter 5.3)*.
- Accordingly policy makers should encourage:
- transfers and secondments of staff between industry and academia and other public sector institutions;
- the development of collaborative projects with industry;-the formation of spin-off companies *(Chapter 5.6)*.
- It follows that risk taking needs to be encouraged, and barriers to taking risks lowered, if innovation is to be promoted (the benefits of this would extend beyond promoting innovation in the public sector) *(Chapter 6)*. Possible ways of achieving this (which would also benefit industry generally) include:
- improving tax regimes *(Chapter 6.2)*;
- making it easier to use IPRs to raise capital *(Chapter 6.3)*;
- improving insolvency regimes *(Chapter 6.4)*.

IV. Implications of the thesis for the IPR system

1. The cost of acquiring European-wide patent rights is too great (Chapter 3.2).

- Changes to tax regimes could help to lower the effective costs of acquisition of rights (Chapter 6.2).
- Means of reducing the direct costs of patenting need to be sought, and we strongly support initiatives in this direction (especially in relation to the Community Patent) *(Chapter 3.2)*.
- Internationalisation points to the need for further harmonisation of IPR systems. *(Chapter 1.6, 2.3)*.
- The possibility of reduced fees for SMEs (as in the USA) should be considered *(Chapter 3.2)*.

2. **The present IPR system is not well adapted to some new technologies.**

   - The question as to whether current exclusions from patentability such as in relation to certain biotechnological inventions and computer software still serve a useful purpose needs to be addressed, though it is important to bear in mind that overstrong IPRs can discourage innovation as well as weak IPRs *(Chapter 3.1)*.
   - The possibility of introducing *new* forms of IPRs needs to be approached in the same spirit *(Chapter 3.1)*.
   - The IPR system should have increased capacity in future to distinguish between individual fields of technology so far as the duration of rights is concerned: subject to TRIPs and other international agreements, both longer *and* shorter terms of protection should be considered on the principle that the object of protection is to provide a reasonable period of protection for investment to be recouped and a return made *(Chapter 3.1.5)*.

3. **The inventor's disclosure of an invention is a bar to obtaining a patent, which can present problems.**

   - One solution to this would be the introduction of a general 'grace period' into the EPC, but there are problems associated with this solution *(Chapter 3.1.2)*.
   - Another solution would be to introduce provisional filings, as in the USA *(Chapter 3.1.3)*.

4. **Mutual recognition of prior users' rights should be introduced into the European patent system**

   - At present, a prior user of an undisclosed invention in one member state of the European Patent Convention has no rights in other member states *vis-à-vis* an applicant for a patent in other member states. This situation is unfair, and should be remedied by mutual recognition of prior users' rights in other member states *(Chapter 3.1.4)*.

5. **The cost of IPR litigation, especially of patents, is too high and discourages use of the system other than by large undertakings**

   - Efforts should be made to create a European patent court *(Chapter 3.2.1)*.
   - An option worth considering would be compulsory expert arbitration with the possibility of legal aid for the respondent party in the event of an appeal *(Chapter 3.2.3)*.
   - The previous proposal might help to make patent litigation a more insurable risk *(Chapter 3.2.2)*.

KEY POLICY OPTIONS AND RECOMMENDATIONS

In an ideal world, we would like all of our policy recommendations to be implemented as soon as possible, i.e. they would all be *short term* recommendations. This is not feasible, however, because

- structural difficulties in national legal and other systems may make implementation unrealistic in the short term;
- the international conventions which govern IPRs may need amendment, and this is usually a slow process, as are other developments requiring international initiatives.

Accordingly, we have grouped our options and recommendations into three appropriate categories:

I. Short term options and recommendations

1. Current initiatives to reduce the costs of patenting should be supported. (Chapter 3.2)

2. When the results of basic or applied research have commercial potential, to whom should the benefits go? Previous systems of pre-imposed allocation of rights have not been very effective in promoting innovation. A better solution is to **leave the ownership of, and the responsibility for, exploitation of PROs/HEIs research results with the organisations concerned, but make them subject to some basic obligations.** *(Chapter 5.2)*

3. Following from the above, in collaborative ventures the principle should be that it is up to the funded parties to negotiate appropriate and fair terms regarding the ownership and exploitation of results. The advantages of this are: flexibility; better motivation for the exploitation of the results; encouragement of more valuable input and wider participation. *(Chapters 5.2 - 5.5)*

4. A condition for the success of this strategy is extensive training and support systems. Some ways of achieving this are as follows:

- An IPR culture needs to be created, starting at the level of higher education. Student-centred interactive teaching materials are being developed and tested to help achieve this, which can form parts of the student's coursework. *(Chapter 4.3)*
- Also important in the generation of an IP culture is the education of the broader business community. National patent offices have a role to play in creating this culture, and should be developed into IPR Centres covering the whole field. *(Chapter 4.5)*

5. There is a need for PROs and HEIs to develop their own IPR policy, either by themselves, *via* support systems, or in collaboration with others. Such a policy requires the following issues to be addressed: publication versus patenting; development of an IPR strategy by reference to defined fields; establishment of a licensing policy; a distribution plan for licensing income. *(Chapters 5.4, 5.5)*

6. A necessary complement to an IPR policy, if not an objective in itself, is to enhance the mobility of researchers and industry personnel. It is not only academic-to-industry transfers which are necessary; flows of knowledge (of all types) in the opposite direction are also essential for effective innovation. *(Chapter 5.6)*

II. Options and recommendations where structural difficulties may make short term implementation unrealistic

It follows from the previous point that a closer and more flexible relationship should be developed between PROs/HEIs and industry, which includes facilitating the movement of personnel. *(Chapter 5.6)* The following are some ways which might be considered to achieve this goal:

1. Spin-off companies and other forms of SME can be a very effective way of nurturing innovation by involving *both* PRO/HEI personnel *and* entrepreneurs. Present structures that discourage risk-taking need to be dismantled, and replaced with a positive and encouraging framework. *(Chapter 6)*

2. Rules imposed by most public research funding bodies for the allocation of IPRs are overly complex. Policy should concentrate on the role of IPRs in promoting the effectiveness of the innovation system. The rules should place the onus of exploitation upon the participants. More general policies are needed to change the cultural and legislative climate in favour of risk-taking. *(Chapters 5.2 - 5.4)*

    - Raising finance is a major problem for spin-off companies. One particular and important difficulty is finding finance to develop laboratory bench models to the point at which finance can be raised to develop them into innovations. This gap may have to be filled by national governments, since there seems to be a market failure in this area.. IPRs are an important mechanism for securing loans, but if this is to be promoted, simpler and more effective ways of creating security interests in IPRs need to be established at an EU level. *(Chapter 6.3)*

    - Member states should be encouraged to introduce tax structures which encourage risk-taking and R&D. *(Chapter 6.2)*

III. Options and recommendations requiring changes in international conventions and other international initiatives

The intellectual property system exists within a framework of international conventions, and changing these is not easy. Nevertheless, there is room for improvement in the long term. The following are some preliminary suggestions:

1. Harmonisation and mutual recognition of prior-users rights in the patent laws of the member countries of the European Union should be considered. *(Chapter 3.1.4)*

2. The problem of the satisfactory enforcement of *all* forms of IPR needs to be addressed. Consideration should be given to reforming the European rules on jurisdiction under the Brussels and Lugano Conventions. *(Chapter 3.2.1)*

3. Publishing patent applications at an earlier date could obviate some unnecessary duplication of research. There are obvious problems associated with this, but since it appears a desirable goal solutions should be sought. *(Chapter 4.4)*

4. The possibility of filing provisional patent applications should be considered. This would help resolve the tension between the need to publish, and the need in appropriate cases to obtain patents in PROs/HEIs. *(Chapter 3.1.3)*

5. Alternatively, support could be given to current initiatives to reconsider at an international level the desirability of an appropriate 'grace period' to permit patenting notwithstanding prior disclosure within a specified (short) period prior to application. *(Chapter 3.1.2)*

6. The IPR system should have increased capacity in the future to distinguish between individual fields of technology. The introduction of Supplementary Protection Certificates (which give the possibility of a longer term of protection in the case of pharmaceuticals and agro-chemicals) has been a move in this direction, but the introduction of *shorter* terms may be desirable in certain fields. The simplicity of the present system should not be thrown away lightly, as it gives predictability, however, a standardised system (one size fits all) is not *necessarily* desirable, especially where new rights are concerned.*(Chapter 3.1.5*)

7. By far the greatest deterrent to the use of IPRs, in particular patents, by SMEs as well as PROs and HEIs, is the fear of heavy costs to enforce them, and in particular patents. Serious consideration should be given to current initiatives to create a specialised tribunal or tribunals at a European level to resolve patent disputes. *(Chapter 3.2.1*)

8. The implications of compulsory arbitration with legal aid for the responding party in the event of appeal to the Courts from an arbitration, deserve to be investigated. *(Chapter 3.2.2)* The effectiveness of insurance schemes to cover patent litigation costs could be linked to compulsory arbitration of disputes. The cost of defending an appeal to the courts from a successful arbitration decision might become a more easily insurable risk. *(Chapter 3.2.3)*

(Note: the proposal contained in Box 3.1 substitutes money for time as a measure of intellectual property grants would not require a change to any international convention.)

AVANT-PROPOS

Réseau d'évaluation technologique européen (ETAN)

L'ETAN a pour but de promouvoir la communication et le débat au niveau européen entre les chercheurs et les décideurs dans le domaine des politiques sur des questions importantes pour la politique en matière scientifique et technologique (S&T). L'ETAN réunit des groupes d'experts, qui examinent, consolident et synthétisent les résultats de la recherche socio-économique et dans d'autres domaines pour mettre en évidence les questions et les options pour la politique en matière de S&T. Chaque groupe de travail doit élaborer un rapport sous une forme permettant une discussion avec les décideurs et les autres parties intéressées. L'objectif final de l'ETAN est de promouvoir une compréhension partagée des questions pour faciliter l'élaboration de politiques en matière de S&T européenne et nationale plus cohérentes, plus complémentaires et mieux concertées.

Le groupe de travail d'experts

Le groupe de travail ETAN **'Les dimensions stratégiques des droits de propriété intellectuelle (DPI) dans le contexte de la politique en matière scientifique et technologique'** s'est réuni quatre fois en 1998-1999 pour élaborer une vision stratégique large des différentes questions relatives aux DPI sous l'angle de la politique en matière de S&T: les questions, leur importance et le meilleur moyen de les traiter. Le groupe a alors présenté ses propres recommandations en ce qui concerne les objectifs, la portée et le contenu de politiques de RDT appropriées. Des fonctionnaires de la Commission, qui ont apporté des informations sur les politiques et les programmes communautaires, assistaient à ces réunions.

Le contenu du présent rapport relève de la seule responsabilité du groupe de travail, dont les avis ne reflètent pas nécessairement ceux de la Commission.

Objectif du rapport

Le rapport vise à élaborer une vision stratégique large des différentes questions concernant les DPI sous l'angle de la politique en matière de S&T.

Il couvre les questions-clés suivantes:

- les changements que connaît la S&T, les nouveaux régimes de DPI, les lacunes des approches;
- l'utilisation correcte d'instruments axés sur les DPI pour améliorer la politique en matière de recherche et d'innovation;
- la politique en matière de DPI en ce qui concerne les entreprises financées par l'État et les entreprises réalisées en collaboration;
- les réductions des coûts en matière de DPI, et les DPI en tant qu'instruments pour obtenir un financement;
- les options en matière d'adaptation des systèmes de DPI européens et internationaux aux nouveaux besoins.

RÉSUMÉ

I. La question traitée et les conclusions générales

1. **Les droits de propriété intellectuelle (DPI) sont-ils un élément qui favorise ou au contraire gêne une politique de la science et de la technologie?** Pour répondre à cette question, il importe tout d'abord d'examiner la situation actuelle en matière de DPI et de définition des politiques.

   - Les décideurs européens estiment généralement que la science et la technologie jouent un rôle de locomotive pour d'importants secteurs en croissance tels que les produits pharmaceutiques, l'électronique, l'aéronautique et les télécommunications et, probablement, dans une certaine mesure également pour la totalité de l'industrie moderne (foi aveugle en la "société de l'information").

   - Cette "foi" a été nourrie par une vue plutôt simpliste des développements de la S & T au cours du XXe siècle. En conséquence, les responsables des politiques ont cherché à promouvoir la créativité dans le domaine S & T, et, partant, l'invention et l'innovation, selon des modalités qui ne sont pas optimales.

2. **Nous estimons que l'approche en vigueur actuellement souffre de deux limites fondamentales.**

   - La première est une conception dépassée du processus par lequel une idée devient une innovation (c'est-à-dire un produit commercialisable). Cette conception est fondée sur le principe qu'existe une progression linéaire qui part de la recherche fondamentale pour mener à une invention, puis à des innovations sur le marché. Bien que ce "modèle linéaire" soit largement intégré dans les structures décisionnelles, il est totalement dépassé. De manière générale, les experts s'accordent désormais pour penser que c'est les interactions entre tous les acteurs et très souvent à un niveau international (paragraphe 1.5) qui promeuvent le mieux le processus d'innovation.

   - La seconde réside dans le système des DPI, qui n'est guère adapté à l'évolution actuelle du domaine S & T, marquée par la croissance des secteurs où les connaissances jouent un rôle essentiel, et des petites et moyennes entreprises (PME) de haute technologie (chapitre 3.1).

3. **Les établissements d'enseignement supérieur et les organismes de recherche publics européens produisent beaucoup d'idées, qui sont souvent exploitées ailleurs.**

- On pense généralement que cela est dû au fait que les Européens ont un déficit en termes de brevets de l'Europe. Cette opinion est étayée en partie par le renforcement du système de brevets aux États-Unis, qui a fait naître l'idée d'une attitude de plus en plus favorable vis-à-vis des brevets ('pro-patent era') (paragraphe 2.2).

4. **Il y a néanmoins quelques dangers à mettre trop l'accent sur les brevets.**

- Cela peut inciter à négliger d'autres éléments importants, essentiels pour la définition d'une stratégie efficace en matière d'innovation (paragraphes 2.4.1, 2.5).

- Parmi les mécanismes de protection existants, on peut citer le maintien du secret industriel en ce qui concerne l'information, les droits d'auteur, les dessins et modèles, les brevets (et, là où ils existent, les modèles d'utilité) (paragraphe 2.5).

- Dans l'élaboration d'une stratégie d'innovation efficace, il importe également d'opérer une distinction entre les connaissances qui peuvent être appropriables via les DPI et celles pour lesquelles c'est impossible, les connaissances tacites incorporées dans le capital humain, et de se rendre compte que les deux types de connaissances sont importants pour l'innovation (paragraphes 1.4 à 1.6, 1.9 et 5.1).

5. **En conséquence, compte tenu de l'approche adoptée, les DPI peuvent renforcer une politique en matière de S & T. Dans le cas contraire, ils peuvent constituer une entrave. Le présent rapport vise en définitive à définir la bonne approche.**

II. Les conséquences de nos conclusions pour l'industrie…

1. **Il est, d'une manière générale, nécessaire de sensibiliser à l'importance des DPI.**

- Les principes régissant les DPI devraient faire partie de la formation des dirigeants (y compris ceux de niveau élevé), des scientifiques et des ingénieurs (paragraphe 4.3).

- Les stratégies en matière de DPI doivent devenir partie intégrante des plans stratégiques d'entreprise (paragraphe 4.2).

- Il faut, par des moyens appropriés, inciter les chercheurs à innover

(paragraphe 4.2).

- En tant qu'éléments clés d'une stratégie concurrentielle, les DPI ne doivent pas être traités isolément (paragraphes 2.3, 2.4, 4.1, 4.2 et 5.5)

- De même, les DPI sont des éléments clés pour les pratiques de collaboration au niveau international (paragraphe 4.2).

III. … Et pour les établissements d'enseignement supérieur et aux organismes de recherche publics

1. Il peut être contre-productif d'imposer aux établissements d'enseignement supérieur et aux organismes de recherche publics d'acquérir des DPI.

- La concession de licences (pour laquelle la détention des DPI correspondants par l'organisme public concerné est un préalable) est un important mécanisme d'exploitation, mais ce n'est pas le seul. Le transfert de capital humain dans l'industrie est au moins aussi important (paragraphes 5.2, 5.5 et 5.6).

- S'agissant des contrats de recherche avec des établissements d'enseignement supérieur et des organismes de recherche publics, une certaine flexibilité est nécessaire pour traiter la question des DPI, que les contrats soient conclus avec l'industrie ou avec l'Etat (paragraphe 5.3).

- Il s'ensuit que les négociations doivent donc être menées cas par cas en facilitant, pour les participants dont les ressources sont limitées, l'accès à un soutien et à des conseils appropriés (paragraphes 4 et 5.3).

- Des projets conduits en collaboration étroite avec l'industrie sont importants pour le transfert de connaissances (paragraphe 5.3)

- En conséquence, les décideurs politiques devraient encourager:
  - les transferts et les détachements de personnel entre l'industrie, les universités et les autres organismes du secteur public;
  - le développement de projets en collaboration avec l'industrie; la création d'entreprises autonomes ('spin-off ') (paragraphe 5.6).

- Il importe donc d'encourager la prise de risques et de supprimer les entraves à cet égard, si l'on veut promouvoir l'innovation (les retombées favorables s'étendraient au-delà de la promotion de l'innovation dans le secteur public) (paragraphe 6). Pour y arriver, on peut envisager (ce qui bénéficierait à l'industrie dans son ensemble) :

- d'améliorer les régimes fiscaux (paragraphe 6.2);
- de faciliter l'utilisation des DPI pour lever des capitaux (paragraphe 6.3);
- d'améliorer les régimes légaux concernant la faillite personnelle (paragraphe 6.4).

IV. Conclusions pour le système des DPI

1. Le coût d'acquisition de droits de brevet à l'échelle européenne est trop élevé (paragraphe 3.2)

- Des modifications des régimes fiscaux pourraient contribuer à réduire les coûts réels de l'acquisition de droits (paragraphe 6.2).
- Il faut chercher des moyens de réduire les coûts directs de l'acquisition de brevets, et nous soutenons fortement les initiatives en ce sens (particulièrement en ce qui concerne le brevet communautaire) (paragraphe 3.2).
- L'internationalisation souligne le besoin de poursuivre l'harmonisation des systèmes de DPI (paragraphes 1.6 et 2.3).
- Il faudrait envisager la possibilité de réduire les redevances pour les PME (comme aux États-Unis) (paragraphe 3.2).

2. Le système de DPI actuel est inadapté à certaines technologies nouvelles.

- Il faut examiner si les exclusions actuelles de la brevetabilité, comme celles qui concernent certaines inventions biotechnologiques et les logiciels, sont toujours justifiées, mais il est important de garder à l'esprit qu'un système de DPI trop forts peut décourager l'innovation tout antant qu'un système de DPI faibles (paragraphe 3.1).
- La possibilité de créer de nouvelles formes de DPI doit être envisagée dans le même esprit (paragraphe 3.1).
- À l'avenir, le système des DPI devrait être davantage capable de faire des distinctions entre les différents domaines technologiques pour ce qui concerne la durée des droits : tout en tenant compte de l'accord ADPIC (TRIPs) et d'autres accords internationaux, il faudrait envisager aussi bien des durées de protection plus longues que des durées plus courtes, sur la base du principe que la protection a pour objet de ménager une durée raisonnable qui permette d'amortir les investissements et de dégager un profit (paragraphe 3.1.4).

3. **La divulgation d'une invention par son inventeur l'empêche d'obtenir un brevet, ce qui peut poser des problèmes.**

   - Une solution serait d'introduire un "délai de grâce" général dans la CBE, mais cela pose des problèmes (paragraphe 3.1.1).
   - Une autre solution pourrait être d'introduire des dépôts provisoires, comme aux États-Unis (paragraphe 3.1.2).

4. **Il faut introduire dans le système de brevet européen la reconnaissance mutuelle des droits de possession antérieure.**

   - À l'heure actuelle, celui qui, dans un Etat signataire de la convention sur le brevet européen, utilise une invention non divulguée, ne jouit dans d'autres Etats membres d'aucun droit vis-à-vis de quelqu'un qui déposerait une demande de brevet pour la même invention dans ces Etats membres. Cette situation est injuste, et il faudrait y remédier par une reconnaissance mutuelle des droits de possession antérieure dans les autres Etats membres (paragraphe 3.1.3).

5. **Le coût des litiges en matière de DPI, particulièrement en ce qui concerne les brevets, est trop élevé : il décourage l'utilisation du système par d'autres que les grandes entreprises.**
   - Il faut s'efforcer de créer une Cour européenne des brevets (paragraphe 3.2.1).
   - Une option qui vaut la peine d'être examinée serait l'arbitrage obligatoire par des experts, avec la possibilité d'une aide juridique pour le défendeur en cas d'appel (paragraphe 3.2.3).
   - La proposition précédente pourrait contribuer à rendre les risques associés aux litiges portant sur les brevets plus faciles à assurer (paragraphe 3.2.2)

VORWORT

Europäisches Technologiebewertungsnetz (ETAN)

Das ETAN soll die Kommunikation und Diskussion auf europäischer Ebene zwischen Wissenschaftlern und Entscheidungsträgern über wichtige Themen der Wissenschafts- und Technologiepolitik fördern. Es setzt sich aus Sachverständigen-Arbeitsgruppen zusammen, welche die Ergebnisse sozioökonomischer und sonstiger Forschung überprüfen, zusammenfassen und eine Synthese herstellen. Jede Gruppe hat die Aufgabe, einen Bericht anzufertigen, der mit den Entscheidungsträgern und sonstigen Interessengruppen diskutiert werden kann. Letztlich ist es das Ziel des ETAN, ein breites Einvernehmen über die Themen zu fördern, um die Entwicklung kohärenter, abgestimmter und sich ergänzender Maßnahmen im Bereich von Wissenschaft und Technologie auf europäischer und nationaler Ebene zu erleichtern.

Sachverständigen-Arbeitsgruppe

Die ETAN-Arbeitsgruppe **"Strategic dimensions of intellectual property rights in the context of science and technology policy"** (Strategische Aspekte der Rechte am geistigen Eigentum im Zusammenhang mit der Wissenschafts- und Technologiepolitik) tagte 1998/99 viermal mit dem Ziel, sich einen breiten, strategischen Überblick über verschiedene Fragen der Rechte am geistigen Eigentum (RGE) unter dem Gesichtspunkt der Wissenschafts- und Technologiepolitik zu verschaffen und herauszufinden, um welche Probleme es dabei geht, welche Bedeutung sie haben und wie sie am besten gelöst werden. Anschließend gab die Arbeitsgruppe Empfehlungen bezüglich der Ziele, des Umfangs und Inhalts von Forschungs- und technologischen Entwicklungsmaßnahmen. An den Sitzungen nahmen auch Beamte der Kommission teil, die Informationen über die Politik und die Programme der EU beisteuerten.

Für den Inhalt dieses Berichts ist allein die Arbeitsgruppe verantwortlich, deren Ansichten nicht unbedingt mit jenen der Kommission übereinstimmen.

Zweck des Berichts

Dieser Bericht soll eine breite, strategische Übersicht über verschiedene RGE-Themen unter dem Gesichtspunkt der Wissenschafts- und Technologiepolitik vermitteln.
Hauptthemen sind u.a.:

- Veränderung des Wissenschafts- und Technologieumfeldes, neue RGE-Regelungen und Mängel der politischen Konzepte
- Richtiger Gebrauch der RGE-Instrumente zur Verbesserung der Forschungs- und Innovationspolitik
- RGE-Politik in der staatlichen Finanzierung und bei Gemeinschaftsunternehmen
- Senkung der RGE-Kosten und Nutzung der RGE zur Kapitalbeschaffung
- Optionen für eine Anpassung der europäischen und internationalen RGE-Systeme an neue Bedürfnisse.

ZUSAMMENFASSUNG

I. Fragen und allgemeine Thesen

1. ***Unterstützen* oder *behindern* Rechte des geistigen Eigentums (IPR "Intellectual Property Rights") die Wissenschafts- und Technologiepolitik in Europa?** Die Beantwortung dieser Frage erfordert ein Verständnis der derzeitigen Grundsätze sowohl der Politik als auch der Rechte am geistigen Eigentum.

   - Unter europäischen Entscheidungsträgern herrscht vielfach die Auffassung, daß Wissenschaft und Technologie Motoren sind, die wichtige Wachstumsbranchen antreiben, z.B. die Arzneimittelindustrie, die Elektronikbranche, den Luftfahrt- und den Telekommunikationssektor sowie in gewissem Umfang vermutlich die gesamte moderne Industrie.
   - Dieser "blinde Glaube" an die Wissensgesellschaft beruht auf einer allzu einfachen Sicht der wissenschaftlichen und technischen Entwicklungen in diesem Jahrhundert. Deshalb ist die Förderung der wissenschaftlichen und technischen Kreativität, d.h. Erfindungen und Innovationen, durch die Entscheidungsträger nicht optimal.

2. **Unserer Meinung nach hat das derzeitige Konzept zwei grundlegende Mängel.**

   - Ein Mangel ist die veraltete Vorstellung davon, wie aus einer Idee eine Innovation (d.h. ein vermarktungsfähiges Produkt) wird. Nach dieser Vorstellung führt ein gerader Weg von der Grundlagenforschung zur Erfindung und dann zu Innovationen auf dem Markt. Obgleich dieses "lineare Modell" in die Entscheidungsgremien weitgehend Eingang gefunden hat, erscheint es doch weitgehend überholt. Heute sind sich Experten allgemein darin einig, daß der Innovationsprozeß, der sich häufig in einem internationalen Rahmen abspielt, durch eine gegenseitige Befruchtung aller daran Beteiligten am besten gefördert wird, (Kapitel 1.5).
   - Der andere Mangel besteht darin, daß das Schutzrechtssystem vielen gegenwärtigen Entwicklungen in Wissenschaft und Technik, beispielsweise wissensintensiven Wachstumszweigen oder den kleinen oder mittleren Unternehmen (KMUs) der Spitzentechnologie nicht mehr gerecht wird (Kapitel 3.1).

3. **Hochschuleinrichtungen und öffentliche Forschungsanstalten in Europa sind ausgezeichnet im Hervorbringen von Ideen; verwertet werden diese jedoch häufig anderswo.**

   - Nach allgemeiner Auffassung liegt der Grund hierfür in dem "Patentdefizit" Europas - eine Ansicht, die zum Teil durch die Stärkung des Patentwesens in den USA Nahrung erhält, welche zur sogenannten Pro-Patent-Ära geführt hat (Kapitel 2.2).

4. **Patente sollten jedoch nicht überbewertet werden.**

   - Dies könnte zur Vernachlässigung anderer wesentlicher Faktoren führen, die für die Entwicklung einer wirksamen Innovationsstrategie wesentlich sind (Kapitel 2.4.1, 2.5).
   - Die verfügbaren Schutzmechanismen reichen von der Zurückhaltung von Informationen als Geschäftsgeheimnisse über Urheberrechte, Musterrechte, Geschmacksmuster (und ggf. Gebrauchsmuster) bis zu Patenten (Kapitel 2.5).
   - Zur Entwicklung einer wirksamen Innovationsstrategie muß auch zwischen Wissen, das man sich durch Rechte des geistigen Eigentums aneignen kann und Wissen unterschieden werden, bei dem dies nicht möglich ist, das aber in den Köpfen von Wissenschaftlern gespeichert ist. Darüber hinaus ist es auch wichtig zu verstehen, daß *beide* Arten von Wissen für den Innovationsprozeß wichtig sind (Kapitel 1.4-1.6, 1.9, 5.1).

5. **Daher können Rechte an geistigem Eigentum – richtig genutzt - die Wissenschafts- und Technologiepolitik unterstützen, – falsch genutzt - jedoch behindern. Dieser Bericht soll zeigen, wie sie richtig genutzt werden.**

II. Allgemeine Folgerungen aus den Thesen für die Industrie

1. **Die Einsicht in die Notwendigkeit von Rechten an geistigem Eigentum muß wachsen.**

   - Die Grundsätze des geistigen Eigentums sollten in die Schulung von Managern (einschließlich Führungskräften), Wissenschaftlern und Ingenieuren einbezogen werden (Kapitel 4.3).

- Strategien betreffend Rechte an geistigem Eigentum *müssen* Teil der Unternehmensplanung werden (Kapitel 4.2).
- Für Forscher sollten die notwendigen Innovationsanreize geschaffen werden (Kapitel 4.2).
- Als Schlüsselfaktor der Wettbewerbsstrategie sollten jedoch Rechte an geistigem Eigentum nicht isoliert behandelt werden (Kapitel 2.3, 2.4, 4.1, 4.2, 5.5)
- Desgleichen sollten RGE als Schlüsselelemente der internationalen Zusammenarbeit behandelt werden (Kapitel 4.2).

III. Anwendung der Thesen auf Hochschuleinrichtungen und öffentliche Forschungsanstalten

1. Die Ausübung von Druck auf Hochschuleinrichtungen und öffentliche Forschungsanstalten, sich Rechte an geistigem Eigentum zu sichern, kann kontraproduktiv sein.

- Auch wenn die Lizenzvergabe (die voraussetzt, daß die öffentliche Anstalt die notwendigen Schutzrechte besitzt) eine wichtige Form der Nutzung ist, ist sie doch nicht die einzige. Zumindest ebenso wichtig ist der Transfer von Hochschulangehörigen in die Wirtschaft (Kapitel 5.2, 5.5, 5.6).
- Bei Forschungsverträgen mit Hochschuleinrichtungen und öffentlichen Forschungsanstalten ist, gleich ob es sich bei dem Auftraggeber um die Industrie oder um staatliche Stellen handelt, Flexibilität gefragt, was Schutzrechte betrifft (Kapitel 5.3).
- Aus diesem Grund müssen Verhandlungen von Fall zu Fall und mit einer angemessenen Unterstützung und Beratung jener Teilnehmer geführt werden, die nur über begrenzte Mittel verfügen (Kapitel 4, 5.3).
- Für den Wissenstransfer sind effiziente Gemeinschaftsunternehmen wichtig (Kapitel 5.3).
- Dementsprechend sollten Entscheidungsträger folgendes fördern:
  - Mobilität der Mitarbeiter zwischen Industrie und akademischen sowie anderen Institutionen des öffentlichen Bereichs
  - Entwicklung gemeinsamer Projekte mit der Industrie, Gründung von sog. spin-off Unternehmen (Kapitel 5.6).
- Daher müssen die Risikobereitschaft gefördert und Hindernisse für die Risikoübernahme abgebaut werden, wenn die Innovation vorangetrieben werden soll (davon würde nicht nur die Innovationsförderung im öffentlichen Sektor profitieren) (Kapitel 6). Erreichen ließe sich dies (was der ganzen Industrie zugute käme) u.a. durch

- Verbesserung der Besteuerung (Kapitel 6.2);
- Erleichterung der Kapitalbeschaffung unter Nutzung von Rechten an geistigem Eigentum (Kapitel 6.3)
- bessere Insolvenzregelungen (Kapitel 6.4).

IV. Folgerungen aus den Thesen für das System von Rechten an geistigem Eigentum

1. Die Kosten europaweiter Patentrechte sind zu hoch (Kapitel 3.2).

- Eine Änderung des Steuerrechts könnte dazu beitragen, die *tatsächlichen* Kosten für den Erwerb dieser Rechte zu senken (Kapitel 6.2).
- Es muß nach Wegen gesucht werden, die direkten Patentierungskosten zu verringern. Entsprechende Initiativen werden von uns mit Nachdruck unterstützt (vor allem im Zusammenhang mit dem Gemeinschaftspatent) (Kapitel 3.2).

- Angesichts der Internationalisierung müssen die Rechtsschutzsysteme weiter harmonisiert werden (Kapitel 1.6, 2.3).
- Es sollte geprüft werden, ob die Gebühren für KMUs (wie in den USA) gesenkt werden können (Kapitel 3.2).

2. Das derzeitige Rechtsschutzsystem ist auf einige neue Technologien nicht zugeschnitten.

- Es stellt sich die Frage, ob die derzeitigen Bestimmungen über den Patentierungsausschluß, z.B. bestimmter biotechnologischer Erfindungen und Computersoftware, noch immer sinnvoll sind, wobei allerdings zu bedenken ist, daß allzu weitgehende Schutzrechte, ebenso wie zu schwache RGE, auf Innovation hemmend wirken können (Kapitel 3.1).
- Mit derselben Einstellung muß auch die Frage nach der Einführung *neuer* Schutzrechtsformen angegangen werden (Kapitel 3.1).
- Das Schutzrechtssystem sollte in Zukunft eine Unterscheidung zwischen einzelnen Technologiegebieten, was die Laufdauer der Rechte betrifft, erleichtern. Abhängig von TRIPs und anderen internationalen Vereinbarungen sollte bei der Festlegung sowohl längerer *als auch* kürzerer Schutzfristen der Zweck des Schutzes berücksichtigt werden, nämlich die Investitionen wieder hereinzuholen und die Rentabilität sicherzustellen (Kapitel 3.1.4).

3. **Die vorzeitige Offenbarung einer Erfindung durch den Erfinder versperrt den Weg zu einem Patent, was zu Problemen führen kann.**

- Eine Lösung dieses Problems bestünde in der Einführung einer allgemeinen "Neuheitsschonfrist" in das EPÜ, was allerdings mit Schwierigkeiten verbunden wäre (Kapitel 3.1.1).
- Eine andere Lösung bestünde in der Einführung von vorläufigen Anmeldungen wie in den USA (Kapitel 3.1.2).

4. **Die gegenseitige Anerkennung der Rechte von Vorbenutzern sollte in das europäische Patentsystem aufgenommen werden.**

- Zur Zeit hat der Vorbenutzer einer (nicht offenbarten) Erfindung in einem Mitgliedstaat des Europäischen Patentübereinkommens keinerlei Rechte *gegenüber* einem Patentamelder in anderen Mitgliedstaaten. Dieser Zustand sollte durch die gegenseitige Anerkennung der Rechte von Vorbenutzern in den anderen Mitgliedstaaten behoben werden (Kapitel 3.1.3).

5. **Die Kosten eines Schutzrechtsstreits, insbesondere bei Patenten, sind zu hoch und schrecken alle außer Großunternehmen von der Inanspruchnahme des Systems ab.**

- Anstrengungen sollten unternommen werden, um einen europäischen Patentgerichtshof zu schaffen (Kapitel 3.2.1).
- Eine überlegenswerte Alternative wäre die obligatorische Schlichtung durch Sachverständige mit der Möglichkeit, daß die beklagte Partei im Falle einer Berufung der klagenden Partei Prozeßkostenbeihilfe erhält (Kapitel 3.2.3).
- Der vorstehende Vorschlag könnte dazu beitragen, daß Patentstreitigkeiten ein leichter zu versicherndes Risiko würden (Kapitel 3.2.2).

Chapter 1. Intellectual Property in the Science, Technology and Innovation System

1.1 Introduction

The last decades of the twentieth century have seen dramatic developments in the fields of science and technology. The same period has also seen a rapid increase in the perception of the importance of IPRs, a term including patents for inventions, protection for industrial designs, and copyright. These changes have important implications for those charged with responsibility for formulating science and technology policy. It is the purpose of this Report to examine what those implications are and to propose policy options.

In this Chapter, we will develop further the thesis set out above. Chapter 2 analyses the role of different forms of intellectual property in company strategy. Chapter 3 examines how the IPR system can be adapted to suit the needs of the new environment, followed by an assessment in Chapter 4 of the role which could be played by the institutions concerned with it. Policy issues concerning IPRs resulting from publicly funded research are examined in Chapter 5. The thesis with which Chapter 5 concludes is developed further in Chapter 6, where some specific policy suggestions are made with a view to improving the present situation. A summary of our conclusions appears in the Executive Summary at the beginning.

1.2 Science and Technology Policy

Science and technology decisions are important aspects of public policy for several reasons. A significant part of Europe's civil research effort is funded from public sources, and this must be carried out and exploited, where appropriate, as effectively as possible. The welfare of the population may be affected by these policies, with impacts on economic well-being and on the quality of life, for example in health or safety areas. Industrial competitiveness may also be improved. In addition, public authorities are responsible for setting the regulatory framework in which research is carried out, including IPRs. However, the IPR system is determined by wider political and commercial considerations. Increasing emphasis is being given to IP in the context of international trade negotiations, and in response to the theory of the rise of the knowledge-based economy. In genetics and bio-technology, moral and ethical considerations have been prominent in debates about patenting and scientific research. Much attention has also been devoted to competition and monopoly issues and IPRs.

In general, trade, ethics and competition law[1] have not been explicitly addressed within this report, which concentrates on those aspects of IPRs which influence science and technological progress, and in particular the ways in which policies on IPRs may assist in achieving the objectives of S&T policy.

1.3 What Are Intellectual Property Rights?

IPRs are legally enforceable rights over the use of inventions or other creative works. IPRs create rights over the embodiments of intangible ideas, but not over ideas themselves. Like all property rights, they confer a right to exclude others from their use. The most common of these rights for present purposes are:

- patents (and in some countries, utility models2);
- industrial designs;
- copyright;
- trade marks.

Modern products may be protected by a complex set of IPRs. For example, a consumer purchasing a product such as a computer for personal use does not acquire rights to copy, manufacture, license, or otherwise use or exploit the owner's IPRs. Such products are protected by a combination of patents, trade marks, designs, copyright, etc.

For the purposes of science and technology policy, the most significant of these rights are patents, copyright, and trade secret protection (which protects know-how and does not require registration).

Other rights play a very important role in innovation and recovering technology investments (for example trade marks and industrial designs). Trademarks can extend the period of market domination conferred by a patent, and industrial designs may be crucial in the successful commercialisation of innovations protected by patents. But these rights are not a direct concern of S&T policy.

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[1] We recognise that competition law is an important limitation on the abuse of IPRs, but this is too extensive a topic for this report.

[2] Utility models are a type of patent with less rigorous qualifying criteria and shorter duration. As concerns the relevance of 'utility model' protection as such for S&T policy, reference can be made to the draft of the Commission for a Harmonising Directive of June 1998.

IPRs *can* provide a monopoly limited in time on a *specific* technical solution to a problem, although this does not prevent competitors from inventing around the patent and developing an alternative solution. A pharmaceutical company with the best treatment for a disease may have the market to itself for a while, but a competitor is quite free to bring out a different product which does the job better. Patents may encourage research and development which is aimed at overcoming existing IPRs owned by competitors.

Inventions, and their associated IPRs, are not valuable in themselves, or to society, until they are used. This is one reason for the important distinction between 'invention' of new techniques, and **'innovation'**, the first time an invention is employed commercially.

The purpose of IPRs, over the several centuries of their existence, has been to encourage the endeavours of inventors or authors to create socially and economically beneficial works, by giving them a temporary power of exclusion over the expression of their ideas in marketed products (books, mechanical artefacts, software, etc.). IPRs enable the investments of time, money and other resources devoted to research and development (R&D) to be recouped by protecting commercial sales of products and services embodying IPRs, thus encouraging inventive and innovative efforts by individuals and companies. They are intended to prevent 'free riders' from benefiting from the expensive and risky process of R&D at little or no cost or risk to themselves, thus reducing the incentives for investment in R&D.

In addition, patents have the purpose of revealing to society the details of inventions, to increase the fund of knowledge which will assist others in their innovative activities.

In essence, IPRs are a trade-off between the interests of inventors and those of society, intended to achieve a socially advantageous rate of innovation and progress.

Many of the most visible high technology industries, such as pharmaceuticals, chemicals, bio-technology and computer software, depend upon IPRs to recoup their large investments in R&D. IPRs are vital to a number of important sectors of advanced modern economies.

The development of new technologies, in particular in computers and biotechnology, has presented the IPR system with new challenges.

IPRs are institutionalised in a complex set of national and international frameworks, which have evolved over more than a century. A degree of harmonisation has been achieved, but there are still considerable differences between some systems. For example, the most significant is that between the United States' patent system and that used by the rest of the world. The US relies on proof of the 'first to invent' for ownership, and incorporates a general 'grace period' which allows inventors up to 12 months after the publication of details of their invention to register their claim. The rest of the world uses a 'first to file' system, mostly with no grace period. This difference inhibits the trend towards harmonisation and mutual recognition of IPRs.

Some essential features of the global IPR system are the result of international negotiations and compromises over many years, and, for the purposes of this Report, must be assumed fixed in the short to medium term. However, there remains some flexibility and room for change. For example, this Report considers features such as the costs of obtaining protection, the methods and costs of enforcing rights, and the function of patent offices for information diffusion, among others. **This Report discusses various options for policy makers which could improve the operation of the science and technology system**. These are outlined in the Executive Summary.

1.4 The Knowledge-Based Economy

In recent decades it has become clear that knowledge is increasingly the main driver of future economic growth and social welfare. OECD economies have experienced a trend towards growth in high technology investments, high technology industries, more skilled labour and associated productivity gains. It has been estimated that more than 50% of the GDP in the major economies is now knowledge-based.[3] Thus, IPRs have become the focus of much attention. Box 1.1 gives one example of the significance of trade in IP.

However, this report maintains that formal intellectual property rights (listed in Chapter 1.3) must be seen in a broader context: they are only one part of the innovation system which generates and uses knowledge. Table 1.1 shows one way of categorising knowledge, using distinctions between *codified* and *tacit* knowledge, and between *public* and *proprietary* knowledge. Intellectual property rights (especially patents) represent codified knowledge *par excellence*, but all forms of knowledge are important for the effective functioning of the innovation system.

[3] OECD, The Knowledge-Based Economy, OCDE/GD(96)102, Paris 1996

Box 1.1 International Trade in Knowledge: US Licensing

Fees from licensing patents have grown to be significant items in international trade, as shown in Table A:

Table A: US Foreign Licence and Royalty Fees by Country: 1996 ($ millions)

Country	**Payments to the US**	**Payments by the US**
Japan	5 484	1 398
UK	2 665	1 875
Germany	2 653	719
France	2 257	351
Netherlands	2 102	408
Canada	1 416	192
Singapore	1 408	13
Italy	1 095	129
Korea	989	43
Spain	672	12
Other countries	12 082	2 714
TOTAL	**32 823**	**7 854**

(The figures in the table include the results of considerable licensing activities between subsidiaries, so transfer pricing issues are important in their interpretation.)
The EU is the US's main technology trading partner. The EU collectively pays about $15 billion in royalties and licence fees annually, while the US pays $4 billion to the EU.
The royalties accruing to US firms from abroad for various types of IP are shown in Table B:

Table B: US Corporate Royalties and Licence Fees from Foreign Unaffiliated Entities: 1996 ($ millions)

Type of Intellectual Property	**Exports (receipts)**	**Imports (payments)**
Industrial Processes & Products	3979	1126
Computer Software Royalties	2129	162
Trademarks & Brand Names	997	128
Franchise Fees	425	-
Broadcast & Recording Rights	153	524
Books, Records & Tapes	324	135
Other Intellectual Property Rights	336	108
	8343	**2183**

Source: S. Degnan, *'The Licensing Payoff from US R&D'*, Research-Technology Management, March-April 1999

Table 1.1: Categories of Knowledge in the Knowledge-Based Economy. [4]

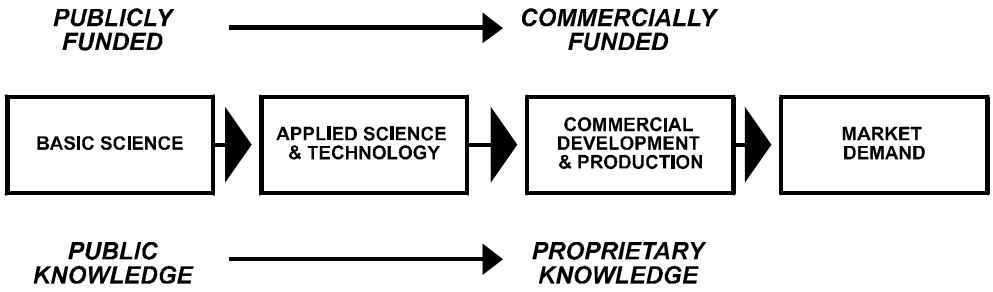
	CODIFIED KNOWLEDGE	TACIT KNOWLEDGE
PUBLIC KNOWLEDGE	**e.g. academic journals, publications, expired patents, etc**	**Generic skills**
PROPRIETARY KNOWLEDGE	**e.g. current patents, copyrights, etc.**	**Firm-specific skills: know-how**

1.5 Knowledge-Production and Intellectual Property Rights

Since 1945 the dominant framework of policy makers for understanding the process of the production and use of knowledge, and consequently for policy making, has become known as the *linear model*. The intuitive appeal of this model, and the resulting 'common sense' approach to policy making, makes it important to discuss its shortcomings in the context of this report.

Basic, or pure, research (in the linear view) is conducted by universities and public research institutions with little or no commercial objective, while that conducted for a commercial purpose is '*applied*'. Further refinement of specific products and processes, and their testing is '*development*' and was expected to be undertaken by companies, resulting in commercial exploitation. Knowledge outputs from each stage were transferred to the next, involving constant refinement from general theories to specific applications (Figure 1.1). The model is chronologically sequential. IPRs were mainly the concern of downstream participants in the process.

Figure 1.1: The Linear Model of Knowledge Production and Innovation.



The public research sector is necessary because the results of basic research are

[4] From L. G. Georghiou, J. S. Metcalfe, Public science, intellectual property rights and research administration, Chapter 4 in Science, Technology and Free Trade, eds. J. de la Mothe, L. M. Ducharme, Pinter, 1990

'public goods': once produced they are most useful to society if they are widely diffused.[5] In addition, the (long-term) benefits are difficult or impossible to appropriate to the exclusion of others who can thus benefit without contributing to the costs of research. Leaving such work to the market would result in an under-investment in research from the perspective of social costs and benefits. Thus public intervention in R&D and innovation is justified as a means of redressing this imbalance. The resulting knowledge should be freely available, without the protection of formal IPRs.

Downstream work is motivated by the prospect of commercial advantage, and is carried out in private research laboratories. Public science and technology policy was therefore aimed at increasing the pool of scientific knowledge by increasing funding and improving the effectiveness of its use (e.g. by improving dissemination of knowledge). Commercial institutions could draw freely from this common pool of knowledge: IPRs were therefore not the concern of S&T policy makers.[6] In many European countries the main concern has been with the apparent failure to exploit the scientific excellence of their public sector institutions and their outputs: the 'European Paradox'.[7] Policies addressed this as a *'technology transfer'* problem.

This model has been widely criticised because of its limited applicability. There is now a recognition that there are complex feedbacks in the process of knowledge production in many fields. Often basic research agendas are shaped by commercial fields: 'demand-pull' in contrast with the 'technology-push' view given above. Bio-technology research has been undertaken in part due to the prospect of commercial development.

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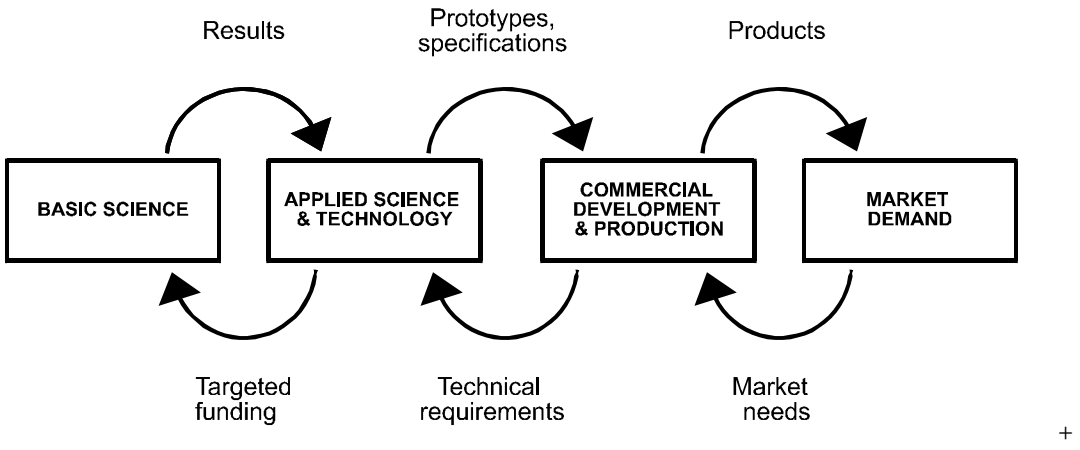
[5] Public support is particularly appropriate for the production of scientific knowledge which is necessarily non-exclusive in use. If the production of public goods, such as national defence or lighthouses, is left to the market, then the level of provision will be sub-optimal.

[6] See, for example, a concise view of the linear model in W. E. Steinmuller, *Basic Research and Industrial Innovation*, Chapter 5 in M. Dodgson & R. Rothwell; *The Handbook of Industrial Innovation*, Edward Elgar, 1994.

[7] *"There is a growing perception that Europe's science and technology system is in a paradoxical situation. Although Europe's educational and scientific research base is acknowledged to be of high quality, it seems to be failing to convert this advantage into strong technological and economic performance."*, from the *Second European Report on S&T Indicators*, Chapter 4: *Beyond the European Paradox*, p 175, European Commission, 17639, December 1997

Figure 1.2 summarises an alternative 'interactive' model, which stresses the role of feedbacks of knowledge at each stage of the innovation process.[8]

Figure 1.2: Interactive Model of Knowledge and Innovation Systems



S&T policy measures to encourage these transfers of knowledge (especially tacit knowledge) have concentrated on *collaboration* between the participants. National and EU programmes have all stressed the need for public institutions and companies to work together to reduce barriers and to improve economic competitiveness. IPRs have more importance in this model, but they are still mainly the concern of commercial decision makers.

1.6 The Changing Science and Technology Environment

The S&T system is changing fundamentally as a result of several long term trends, in particular:

- The inclusion of the whole S&T system as a crucial element of economic competitiveness, specifically as part of innovation systems, by both companies and governments.[9]

[8] For a detailed explanation, see: S. J. Kline, N. Rosenberg, *'An Overview of Innovation'*, in R. Landau, N. Rosenberg (eds.) : *'The Positive Sum Strategy: Harnessing Technology for Economic Growth'*, Washington DC, National Academy Press, 1986.

[9] For example the Green Paper on Innovation, European Commission DGXIII/D, 20 December 1995.

- 'Internationalisation' of the S&T system.[10] While scientists always considered science to be an international enterprise, commercial research and technology development are now also conducted by major corporations using international strategies: world class research facilities and personnel are available in many countries.
- Intellectual property rights, previously mainly considered to be a national concern, are now clearly an international issue. Harmonisation and reciprocal recognition if IPRs are seen to be crucial by corporations and many policy makers as a necessary condition for international trade.
- There has been a growing emphasis on the importance of IPRs within the USA, especially by large and politically influential corporations, as a tool of economic strategy and competitiveness. This has influenced both the internal US regulatory process and also the international process, tending to make IPRs much stronger and more restrictive on competitors.
- The growth in communications (especially cheap air travel and electronic networks) has, together with internationalisation of markets and high costs and risks of much research, resulted in a significant[11] part of commercial and public R&D being conducted collaboratively, by different types of institutions and between different countries. This has been encouraged in the European Union by the requirement for projects funded by the RTD Framework programmes to include members from different countries within the EU.
- There is increasing pressure on public research institutions to reduce dependence upon direct public funding, in favour of commercial support.
- Technological complexity is leading to increased needs for collaboration in order to bring together required skills and knowledge.

Many analysts have stressed that the focus of technology policy is now on innovation systems and networks, rather than on their component organisations.[12] Collaboration between all research organisations is now essential in many fields. **The interfaces between these organisations are defined by the nature of knowledge and IPR flows among them**. For example, project collaboration agreements regulate the appropriation of academic results for exploitation by commercial participants, and protect the use of results by PROs in further research or teaching**. IP regulations and agreements determine the roles and**

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[10] 'Internationalisation' has been used here rather that 'globalisation' to emphasise that there remains a huge diversity in economic, scientific and technological stages of development over the 'globe'. See: *'Internationalisation of Research and Technology'*, European Commission, ETAN Working Paper, EUR 18762, July 1998.

[11] For example, the results of the 1993 CIS for eight EU countries indicate that 27% of innovative manufacturing firms were involved in one or more co-operative R&D projects between 1990 and 1992 (Source Eurostat, Community Innovation Survey, 1993).

[12] e.g. M. Callon (ed.), La science et ses réseaux: genèse et circulation des faits scientifiques, Paris, La Découverte, 1989. Also See Chapter 3, *Competition, Collaboration and Integration*, in J. Peterson, M. Sharp, *'Technology Policy in the European Union'*, Macmillan, 1998.

activities of participants in projects, and even which organisations take part. PROs are anxious to promote the transfer of their knowledge in order to generate funds, but this also implies competition with commercial organisations. Patents are one means of exploiting knowledge generated in these public institutions, but other means are becoming significant, such as science parks and spin-off companies, from which are derived indirect as well as financial benefits from licensing and donations.

We may characterise the emerging innovation system as one in which networks of collaborating participants, with temporary project collaborations, perform problem-oriented research, then disperse to form new collaborations, but retain the knowledge and network contacts produced during the process. Their economic and professional success depends specifically upon the knowledge flows between them, which will be in both codified and tacit forms.

One influential view considers that we have moved from a 'Mode 1' system to 'Mode 2' in which the activities of participants are converging.[13] While public research organisations ('PROs') have been entering areas of research ('problem-oriented' or contract research) which were previously the preserve of commercial bodies, it is also the case that companies make substantial contributions to public knowledge. Industrial researchers have now become a major source of journal publications, contributing to the overall process of scientific advance (Figure 1.3).

Although this growing method of conducting R&D is, and will remain, small in relation to the total undertaken within individual organisations[14], it has become a major concern of public science and technology policy-makers who see it as a means of overcoming the barriers to the exploitation of S&T capabilities and knowledge, especially within Europe, and also as a means of encouraging structural change and job creation within the European economy.[15]

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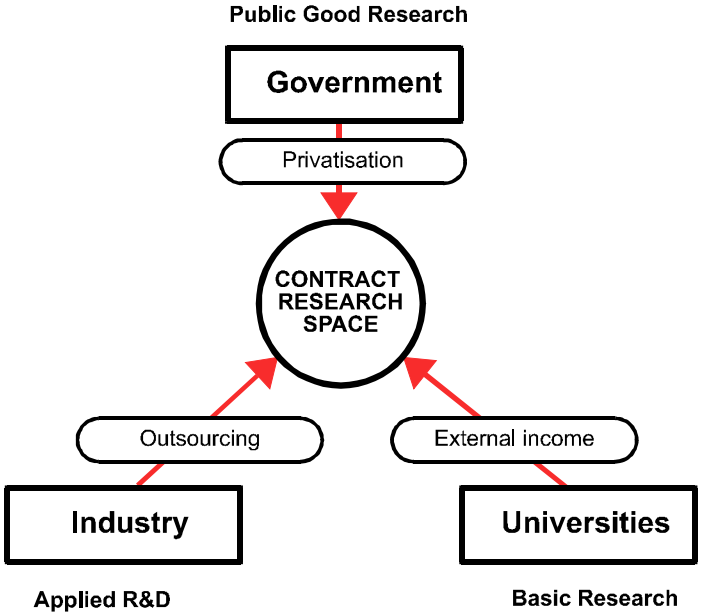
[13] M. Gibbons, et al, The New Production of Knowledge, 1994

[14] For example, 8% of European R&D staff are involved in projects funded by the RTD Framework programmes. From *'Society, The endless frontier'*, P. Caracostas, U Muldur, European Commission DGXII, EUR 17655, 1998.

[15] See Chapter 1, J. Peterson, M. Sharp, *'Technology Policy in the European Union'*, Macmillan, 1998,

Figure 1.3: A Convergence Model of the Mode 2 Innovation System.[16]



1.7 Patents as Targets for S&T Policy

Attempts to measure the various forms of S&T activity have had a significant effect on policy makers. For example, there has been a gradual movement towards the view that much research in PROs should be treated as an investment, analogous to more straightforward commercial investments. Studies at a micro-level (individual projects, programmes or technologies), and at a macro-level (aggregated economic data) have been carried out with varying degrees of success, but have generally pointed to a very high rate of social return in comparison with private investments.[17] But the greatest influence has been on the general framework in which spending decisions are made. No longer are peer review opinions taken as decisive: economic consequences are now important. Though most of the policy community agrees on the need for curiosity driven research, arguments now focus on the relative sizes of this sector of research in comparison with objective-oriented work. Therefore measurements of the results of research must be made, however controversial are the methods used. Due to the time-lags and attribution problems involved in determining economic returns to investment in research, proxy measures have gained in importance; in particular bibliometrics (analysing publications statistics) is used in evaluating

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[16] L. Georghiou, *Science, technology and innovation policy for the 21st century*, Science and Public Policy, vol. 25 No. 2, April 1998, pp 135 - 139

[17] A survey of research on the divergence between private and social rates of return to R&D is contained in: B. Hall, *'The Private and Social Returns to Research and Development'*, Chapter 6 in: B. L. R. Smith, C. E. Barfield (eds.); *'Technology, R&D, and the Economy'*, Brookings Institution/American Enterprise Institute for Public Policy Research, 1996.

academic performance, and patents are used for industrial research. **The result of this has been to emphasise the importance of knowledge flows between parts of the system, primarily as economic transactions, but also as tools of the new public sector management policies which have brought business methods to the field**.

In the same way that Japanese companies aim to increase their patents 'counts', S&T evaluators now use patent counts as indicators of the health and effectiveness of the innovation system. The implications of this are significant: if patents are targeted, then a criterion of success is that the numbers of patents must increase (for PROs, companies and countries**). However, if we take a view (see later in this report) that patents are just one 'intellectual property strategy' for organisations, and further, that social benefits are not *necessarily* increased by more patenting, this measure can be misleading. For example, we may reduce the barriers to the award of patents, thus increasing the numbers of patents, but this does not in itself increase the numbers of inventions, level of innovative activity, or economic success.** This would depend upon the response of S&T performers to the change and could in fact inhibit them (see Chapter 3.1).

1.8 New IP Tensions in the S&T System

While publicly funded institutions were seen only as producers of public knowledge, freely available to all, there was little prominence given to the concept of financial rewards for transferring knowledge to exploiting organisations. The rise of commercially funded research within public institutions has given rise to concerns that it may restrict the availability of knowledge to the community as a whole (for example in forbidding or delaying open publication of results for secrecy or patenting reasons). What was previously considered public knowledge may often now be considered proprietary.

Other IP issues have also arisen, such as the division of benefits between the participants (researchers, students, departments, institutions, and sponsors), and also detailed problems such as the responsibility or liability of public research organisations (PROs) for any faults which appear in the resulting technologies (warranties). New areas of professional expertise have grown to cope with these problems: university-industry liaison officers to stimulate (financial) links and technology licensing officers, to bring some expertise in negotiating and contracts to PROs.

1.9 Conclusion

The main problem, as seen by all the actors in the field, is to break down the barriers and enable effective technology transfer, that is between academics and industry. This has produced a series of useful policy conclusions, including a much broader appreciation of the forms of IP which may result from research. Results of research may in some cases be 'codified', but these formal types of intellectual property grossly understate other useful outputs, which will include tacit, uncodified knowledge, skills, know-how, methods of working, algorithms, etc, etc. This new view tends to reduce the importance of the traditional IP outputs (patents) and stresses that knowledge is embedded mainly in the *people* who carry out the work. IP management and strategy should therefore have a broader view than that given by concentration entirely on patents and licensing issues. There are many forms of output knowledge, and ways of exploiting these. It would be a mistake to concentrate entirely on patents only because they are the most highly developed and systematic form of codified IP, and because analysts find them the best (only?) comprehensive and highly quantified sets of data on IP. The policy implications of this are dealt with in Chapter 5.

This chapter has argued that the emerging system of innovation has increased the importance of *knowledge flows* between participants, partly due to increases in scale, but mainly due to changes in the structure of knowledge exchanges and recognition of their diverse nature. These flows of knowledge consist not only of codified results, but also of tacit, human-embodied skills and know-how. Management of knowledge involves both formal IPRs and other forms of knowledge. The effectiveness of the system depends crucially upon the frameworks which deal with this IP.

Chapter 2. Old Uses and New Uses of IPR

2.1 The Role of Intellectual Property Rights

In order for the capitalist system to operate efficiently, it is crucial that markets for productive materials and services function. But markets for ideas, knowledge, information and intellectual products in general have difficulties in operating. It is difficult to sell an idea without disclosing it in a way that others can use without payment. This is the 'non-excludability' problem. From society's point of view, this may result in an underinvestment in creative work and knowledge production, since creators and innovators do not get sufficiently rewarded by profits from selling their creations on the market: the 'non-appropriability' problem. To compensate for this deficient functioning, the IP system has evolved as a method of appropriation and, additionally, has encouraged a market for ideas. In particular, patents have developed a market for technological knowledge. Inventive activity is encouraged, and the resulting information disclosed, improving social welfare.

2.2 The Rise of The Pro-Patent Era

Though the intellectual property rights system has existed for longer than capitalism itself, it has not generally been considered to be an important element of the economic system as a whole, with the exception of in modern times chemicals and pharmaceuticals. However, in the 1980s, the 'pro-patent' era emerged for a number of reasons. The general recognition of the transition towards a knowledge economy and technological competition had focused attention on IP issues, and the competitive success of Japanese companies in particular had drawn attention to patents and the difficulties which US companies had experienced in protecting their R&D investments. The patent system and exploitation became significantly strengthened in the USA. In 1982 a new Federal Court of Appeals for patent cases was created in the USA. At about the same time, but for differing reasons, US anti-trust policies changed in favour of strengthening the enforcement of patent rights. In parallel, US industry and US politicians started to campaign for a strengthening of the IP system world-wide.

2.3 IP Assets

Increasingly, there has been a recognition that, along with physical assets of companies, intellectual assets should be included in a company's worth: that is why attempts are now made to value these. Though not yet universally accepted, these exercises have shown convincingly that many trademarks and patents have astonishing values, and are therefore of great importance to companies. Along

with the increased probability of winning court cases and the damage claims for infringement, the result has been to increase both the use and the abuse of the patent system, prompting the eruption in the mid-to-late 1980s of what has been referred to as 'patent wars' between the USA and Japan. Resources devoted to protection of IP have increased and have become a major part of competitive strategy. Several US and many Japanese companies have become particularly active in building up patent portfolios and have become skilful in their use of the IP system, including using patent information for technology and competitive intelligence.

As the values associated with the market exploitation of intellectual property increase, the need to foster and manage the development of these creations as well as their rights on an international front grows proportionately. A very general conclusion for policy making, at least in the short and medium term, is to seek ways of using the present system more effectively, and to work to improve it in order to secure investment in R&D, innovation and diffusion of new products, processes and services. Ultimately, the internationalisation of S&T and business points to the need for international IPRs, so that we could, for example, speak of 'world patent rights'; however this could be merely simplifying which is already a complicated but global patent system. For the foreseeable future, however, we will have the present system of national rights, with some 'regional' systems.

2.4 Appropriation Strategies

2.4.1 Patenting and Secrecy

The main function of intellectual property rights from the company viewpoint is to help to generate returns from investment in intangible assets. For example, especially in the chemical and pharmaceutical industries, patents can assist in this during the exploitation of new technology, by capturing the benefits from R&D and innovation, and by protecting the competitive advantage of new or improved products or processes. However, there are other ways to achieve this, such as secrecy, efficient production or efficient marketing, many of which are complementary to patenting or alternatives. Several surveys have tried to determine the effectiveness of patents and the relative importance of different methods of achieving competitive advantage, such as secrecy, market lead times,

production cost reductions or superior marketing.[18] Significantly, Japanese companies regard patenting as their most important strategy, while marketing ranks highest in the USA. Sectoral differences are marked: chemicals and electronic companies rank patenting highest, with secrecy close to bottom, while mechanical engineering companies give greatest emphasis to production cost reductions and production process secrecy.

Patenting may, from the applicant's view, suffer the disadvantage of disclosing knowledge or projects, whereas secrecy, which theoretically may last longer, would allow a company to keep an edge on competitors. Patenting can also be considered of little use if the essential competitive edge lies mainly in being first in the market (e.g. in the semiconductor industry). On the contrary, patenting is likely to be appropriate where R&D investment is long-term and costly or where the firm plans to enter collaboration or licensing agreements.

As a general rule, firms prefer to patent products rather than processes. In relation to processes, industries trust secrecy more, because they are afraid of disclosing a process which would be easy to replicate without the possibility of infringement being detected. However, in practical use, protection by secrecy alone carries risks. Secrecy cannot secure freedom of exploitation in the long term. Reverse engineering (the process of determining manufacturing procedure by analysing the finished product) has made much progress, making the choice of secrecy less attractive, but also enabling patentees to detect infringement through their own reverse engineering. Against this, however, is the increasing complexity of some products and processes: for these technologies, complexity raises imitation costs and increases copying time-lags, thus reducing the incentives to patent.

Large chemical and pharmaceutical firms consider as obsolete the classic oppositions 'patenting versus secrecy'. For products, formulations, compositions or applied uses, secrecy may make sense up to the start of the commercialisation process. Even for processes, it may be difficult to maintain secrecy over a sufficient period. Some analyses will detect traces of a catalyst and thereby give away information about the process. In any case, the information divulged by the patent is not sufficient for building a plant. **In truth, patenting and secrecy**

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[18] Levin, R.C., Klevorick, A.K., Nelson, R.R., Winter, S.G., 1987, *Appropriating the returns from industrial research and development*. Brookings Papers on Economic Activity 3, 242-279.

Harabi, N., 1995, *Appropriability of technical innovations: An empirical analysis*. Research Policy 24, 981-992.

Arundel A., van de Paal G., Soete L. *Innovation Strategies of Europe's Largest Industrial Firms: Results of the PACE Survey for Information Sources, Public Research, Protection of Innovations and Government Programmes*, EIMS Publication 23, Directorate General XIII, European Commission, 1995.

Cohen, W.M., Nelson, R.R., Walsh, J., 1999. *Appropriability conditions and why firms patent and why they do not in the American manufacturing sector*. NBER Working Paper, NBER, Cambridge.

should be considered as complementary rather than exclusive alternatives. If the manufacturing of the product or the working of the process requires special know-how and expertise not transferable to others, this element of secrecy allows the possibility of patenting without the risk of imitation. However, for a particular enabling technology (one which allows associated products to be manufactured), the same firm may choose to allow other firms to adopt its process freely; the original company can then profit from related products and support services.

2.4.2 Patenting and Firm Size

There has been much debate about the relative importance of patenting for SMEs compared with large firms. A study has even concluded that they are of no value at all.[19] There are reasons, however, why patents may be important for small firms. They may be unable to exploit research internally and have to rely on protected transfer of technologies to recoup investments, or they may use patents as a breathing space to allow a build up of manufacturing capacity. It seems that patents are also an important element in attracting investment. Conversely, there are reasons why patents pose problems for SMEs. SMEs may find it exceedingly difficult to defend their patents from infringement by a determined and economically strong opponent.

2.4.3 Where to Patent

The applicant must, at an early stage of the procedure, designate the countries for which protection is requested, knowing that costs may impose the need to be selective. Going through the Patent Co-operation Treaty (PCT) route allows the applicant to defer those choices, but not to avoid them.

If the invention can be exploited only in some restricted geographical areas, the number of designated countries can be very limited. A firm specialising in oil services would extend its patents in Europe only to the UK and Norway.

The applicant generally makes his selection according to the following priorities: the countries where he produces, his main markets, the countries where his competitors have industrial facilities. If potential competitors are present in many countries, it will probably be necessary to make numerous designations, especially if the investment costs related to the invention are low.

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[19] S. Macdonald, B. Lefang; *'Patents and Policy in the Innovation of SMEs: Building on Rothwell'*, in R. Oakey & W. During (eds.), New Technology-Based Firms in the 1990s, Vol. V, pp. 185-208, Paul Chapman, London 1998.

These considerations lead to consequences which may be very different according to sectors:

- Some Japanese electronic firms often limit themselves in Europe to the three main markets (Germany, UK and France) and the Netherlands (because their competitor Philips has facilities there): this is sufficient because the share of the European market which the patentee's competitors could access is not attractive enough to justify investment.
- The pharmaceutical industry generally designates *all* European countries, and very many others world-wide, because in many cases manufacturing by a competitor for only one national market could be technically as well as economically profitable.
- Firms which make software-related or biotechnological inventions are primarily concerned with obtaining the US patent, because the USA represents for them a huge share of the world market: designation of other countries is then of secondary importance.

2.4.4 Licensing or Not

For some firms which have research as their core business, licensing is an activity in itself, and its purpose is to generate income. However, for industrial firms, licensing is also an option well adapted to particular situations, for example:

- where the innovating firm does not possess the resources to industrialise or commercialise its technology in all countries, in particular because the required investments would be too heavy (e.g. Pilkington in the 1960s for float-glass, or Saint-Gobain for fibreglass insulation) or where the local legal formalities are too complex (pharmaceuticals);
- where the company operates in a sector where *de facto* (effective) or *de jure* (legal) standards are imposed and where keeping the technology exclusive does not make sense (main concerned sectors: consumer electronics, telecommunications, computer industries);
- where the competition is pursuing R&D that could improve the technology and extend its use; for example, in the chemical industry, the inventor of a molecule may license it to his competitors in the hope that they will invent new uses capable of broadening the market;
- where patents can be a bargaining asset in exchange for other patents: cross-licensing is a current practice in consumer electronics (where it is impossible to be totally technologically independent), as well as in pharmaceuticals and chemical industries.

2.4.5 Maintaining the Patent

- Patents are maintained only for a short time when the rate of product replacement is high (2-3 years for electric household appliances) or when technologies evolve rapidly (consumer electronics, computers). On the other hand, in the automobile industry, patents are frequently maintained for 10 to 15 years.
- Patents for incremental inventions which give a temporary commercial advantage (e.g. formulas for detergents) are often maintained for medium durations.
- Patents are more frequently maintained for a full 20-year term in sectors such as pharmaceuticals or cosmetics, where products may enjoy a long commercial life. For pharmaceuticals, the long period of testing for effectiveness and safety of a drug delays product marketing and distribution so that the patent only secures a return on investment towards the end of its life. Cosmetics are very dependent upon fashion and yet the marketing department can sometimes arrest the commercial decline of a product.
- Patents can usefully be renewed for their full term if the products are part of a long-lasting investment (e.g. equipment for oil drilling) or of an installed system with a low rate of component renewal.

2.5 Total Intellectual Property Strategies

Companies create and own intellectual assets of various types, and there are a number of ways of protecting each. Most companies find it necessary to employ several such means of protection within an overall appropriation strategy; even a single-sector company may use several tools in relation to a single product. A pharmaceutical company will patent a drug, will have trademark protection, may have design rights to the shape and colour of the capsule or its packaging, a patent on the means of delivery, and copyright on the technical literature, etc. It will also maintain R&D programmes to produce successor drugs, and to disadvantage competitors' product developments. It may license other companies to produce the drug, or to reduce the cost of production. Yet more companies may be licensed to sell the drug in some geographical areas. It may maintain secrecy about its activities, or may publish results to damage competitors' patenting possibilities.

However, when discussions about IP take place, patenting dominates. The 'patent industry' consists of inventors, patent lawyers, company patent departments, and patent offices. The entire structure of the system, with its long-term stability, information databases and professionalisation, makes it easy to place too much emphasis on this single aspect of IP. Copyright, database right, trade secrets, trademarks and designs may be more appropriate, or even the only possibility, for example in some areas of information technology, or more

generally, of product refinement. In addition, the interrelationships among these should not be neglected. Even within the domain of patenting, there are almost infinite variations of patent strategy: what to protect and when, where to file, how to improve competitive position, etc.

A company IPR enforcement and litigation policy is a necessary concomitant of securing property rights. Some US companies have pursued active enforcement strategies over a long period. IBM, for example, has achieved a reputation for frequent and energetic litigation to the extent of pursuing even those cases in which it has little chance of success. Competitors are therefore very wary of infringement. IBM has also practised a parallel policy of extensive licensing (though partly for anti-trust reasons), which also helps persuade other companies to recognise its property rights.

Japanese companies, on the other hand, have traditionally been reluctant to resort to litigation and court settlements. However, this seems to be changing, at least in cases where Japanese companies are accused of infringement. When Motorola accused Hitachi of infringement of several patents in 1989, Hitachi countersued Motorola for infringing Hitachi's patents. The court stopped sales of both companies' products, which affected Motorola more than Hitachi.

2.6 Conclusion

The past two decades have witnessed changes in the economic, regulatory, and commercial value ascribed to patents. This has affected the way in which they are used by companies to protect intellectual property.

However, the emphasis on patents may overshadow other essential elements of successful intellectual property and exploitation strategies. These may include the whole range of formal legal rights and commercial practices, used where appropriate to the technology's maturity and intrinsic characteristics, as well as the industrial sector addressed. Enforcement and litigation policies are also a necessary part of an overall IP strategy. It follows that it would be a mistake for companies, public funding bodies, and others responsible for specifying IPR strategies, to overstress at the outset the need to file patents. The whole range of appropriation and protection mechanisms available needs to be explored for what will be best in the particular case, including maintaining information as a trade secret, copyright (which protects some aspects of software for example), design rights, and registration of designs, in addition to patents. The choice of appropriate strategy will depend upon the characteristics of particular cases, and it will often be not possible to arrive at the most suitable strategy for appropriation until quite late in the research programme.

Chapter 3. Adapting the Present IPR System to the Needs of the New Environment

3.1 The IPR System and Recent Technological Developments: Bringing the Present System Up to Date

The changing character of technologies creates mismatches with the legal frameworks designed to foster them. The present IP system is well adapted to the needs of the chemical and pharmaceutical industries, for which it is recognised to be a critical factor in justifying large investments in R&D. However, new technologies create a demand for their own protection. The problem is that the existing European protection systems are established within a framework of International Conventions, and changing these is extremely difficult because it requires unanimity amongst the adherent states.

Notwithstanding the problems, however, there is considerable pressure at present to change the existing system. Thus, developments in bio-technology, computer software and medical procedures have led to pressure to remove exclusions from patentability and for harmonising national rules. We would welcome in particular a speedy conclusion of the ongoing revision of the EPC, dealing especially with whether or not such exclusions from the patent system *should* be removed. Removal of some of the exclusions is highly controversial, as is seen in the current debate over bio-technology.

In this context WIPO has recently tended to adopt the strategy of 'add-ons', such as the Patent Law Treaty, and in a somewhat similar vein the European Commission has promulgated the Biotechnology Directive. This Directive, and the Database Directive, were responses to pressure for change, and were proposed and adopted after intense consultation with *all* interested parties on all sides. We think it is important that consultations should bear in mind the interests of all the parties concerned, including the public interest, before *any* extension of the IPR system is embarked on. In the USA, due to the absence of express statutory exclusionary provisions, the system is more flexible and under control of a single court. However, a body of opinion[20] holds that the effective acceptance of patentability of computer software through case law has been to the prejudice of smaller undertakings and the benefit of larger ones.

[20] see Allen Wagner, 'Patenting computer science: are computer instruction writings patentable?', paper given to The Chartered Institute of Patent Agents, London, 16th September 1998.

In addition, it has to be borne in mind that any software patent which might be granted would have to fulfil the other patentability requirements of the patent system, such as novelty, inventive step and industrial applicability.

3.1.1 The IP Assembly (or 'patent-blocking') Problem

Advances in various fields of science and technology typically interact with each other. Occasionally new advances falsify some older knowledge, but on the whole advances build upon one another. Thus as a matter of S&T history, accumulation dominates over substitution.

When S&T advances are implemented in commercial products (including services), two phenomena are important, perhaps increasingly so:

- the emergence of generic (or general purpose or multi-product) technologies;
- the emergence of multi-technology products, being based on a wide range of technologies, which need to be assembled.

Thus there is an interlocking and interdependence of new products and new technologies. R&D performing agents also become interdependent and need to trade technologies, facilitated by the IP system (in particular the patent system). However, the number, scope, duration and enforceability of exclusive rights to technological inputs tend to create transactions costs, monopolistic behaviour and deadweight losses as well as dynamic efficiency losses. At some point the fragmentation of IPR among agents starts to impede further progress, due to the failings of technology markets adequately to deal with the problem of assembling necessary IPRs. *This IP assembly problem* is further aggravated by the recent trend in some fields, notably bio-technology, to grant patent and other IPR protection (e.g. database protection) to research tools, i.e. inputs to the R&D process rather than the production process.[21]

There are a number of possible remedies to the IP assembly problem:

- more effective filtering of insignificant patents by raising the standards of non-obviousness and usefulness, steepening the renewal fee schedule, and implementing more efficient patent examination procedures

[21] No systematic empirical research beyond accumulating anecdotal evidence of the significance if the IP assembly problem exists up to date. However, theoretical work, notably by S. Scotchmer, points to the possible slow down of subsequent innovations due to overly strong protection of initial innovations. (see for example, S. Scotchmer, '*Standing on the shoulders of giants: cumulative research and the patent law*', Journal of Economic Perspectives 5, 29-41, 1991)

- using a two-tier structure with patents and utility models
- improving mechanisms for technology markets and transfer, including more liberal attitudes towards patent pooling and technology sharing; schemes for collecting rights and clearing-house procedures; cross-licensing and block-licensing incentives
- control of monopolistic abuse by reducing the scope and length of protection and/or more consistent use of compulsory licensing
- reduction of legal uncertainty by faster and cheaper validation of rights and dispute resolution

3.1.2 A General Grace Period

Other possible improvements to the present IPR system being actively discussed at present include the introduction of a general 'grace period' so that the disclosure of an invention, for example in an academic paper, would not be a bar to obtaining a patent, provided application was made within a certain period of months.

One of the arguments in favour of introducing a general grace period is that conditions have changed greatly for the scientific community. Scientific and cultural changes are putting increasing pressure on university staff to publish at the earliest possible stage, in particular on the Internet, in order to attract sufficient investment for the further development of their scientific projects (a hazardous strategy where the rules for patentability are imperfectly understood). Another factor is the increasing collaboration between universities and industry. However, one should be aware that a general grace period may increase legal uncertainty and give rise to opportunities of misuse.

The EU should take up this issue with the US and Japan in order to find an effective international solution. (There is little doubt that the United States would be willing to co-operate multilaterally, for instance in the framework of the TRIPs Agreement).

3.1.3 Provisional Applications

From the S&T perspective, one of the potentially most useful reforms of the present European patent system which might be made (in particular in the course of the Revision of the EPC) is introducing the possibility of filing provisional applications, which has shown itself to be very effective in the USA.

Thus, it should be possible to deposit a scientific paper containing an invention which would be susceptible of industrial application, without the necessity of wording claims, etc., to deal with cases in which publication or disclosure of any kind is likely to destroy novelty. This would meet *most* of the arguments of those who wish to see the introduction of a general grace period. It should be noted however that the paper filed must contain an enabling disclosure.

3.1.4 Mutual Recognition of Prior Users' Rights

At present, the recognition of the rights of a prior user, i.e. someone who has at least commenced serious preparation leading to the invention before the application date of an applicant for a patent on the same invention, are confined to the country where the prior user is operating. Thus, when the patent is granted, the prior user will be debarred from using the invention in the other member states in which the applicant has acquired rights.

This seems unfair, and we think there should be a harmonisation and mutual recognition of prior users' rights in the patent laws of the member countries of the European Union. What is envisaged is similar to the approach taken in the community trade mark system, where use within one country of the Union or even for export purposes, satisfies the use requirements within the entire Union.

3.1.5 Variations in IPR duration

The IPR system should also have increased capacity in the future to distinguish between individual fields of technology as far as duration of rights is concerned. Thus exceptions have so far been made for pharmaceuticals and agro-chemicals by the introduction of the Supplemental Protection Certificate (SPC). The justification for this is that the effective patent term is shortened by the need to obtain a regulatory approval. The additional term gives a reasonable period in which to recoup R & D investment.

The logic which led to the introduction of the SPC might argue for the introduction of this system for other technological fields in which the patented subject matter must obtain some form of official approval before being put on the market, thereby shortening substantially the ordinary patent term. An illustration is aviation: patent protection on some components of the CONCORDE aircraft had completely expired before the aircraft went into service. Given that the object of protection is to allow a reasonable period of

protection in order that investment may be recouped and a return made, it might also be desirable to consider *shorter* terms of protection where new forms of IPR are created (there is a precedent for this in the database directive.). Subject to TRIPS, any extension of existing protection to new subject matter, e.g. software, should be made with due consideration to the appropriateness of the term of protection.

3.1.6 Problems with the Internet

World-wide novelty is a requirement of the EPC, and because of this the Internet is beginning to cause serious problems. Material is often undatable, so that it is impossible to tell if it was posted before or after the priority date, and it is often transient, so that it may not show up in a search, but could well have been printed out by some one while it was posted, and so become available unexpectedly to destroy the patent. **This difficult problem needs urgently to be addressed.**

3.2 IPRs and the cost issue

From the viewpoint of the applicant, the decision to patent an invention must be based upon an expectation of returns exceeding costs. For significant inventions these costs are proportionally small and so cannot constitute a deterrent to patenting. On the other hand studies have shown that only a small proportion of patents justify the investment in them. As an example, in Germany less than one-fifth of patents are renewed for the full term, and so evidently do not even justify paying the final renewal fees. Naturally, the reason for this is not only lack of returns, but also a premature ageing of patented subject matter.

In its proposal to make the patent system more attractive to SMEs, the European Parliament has proposed measures to reduce patent fees for such applicants, and the Commission wishes these reductions to be extended to universities and non-profit-making research institutes. As regards SMEs, the question arises as to whether the present definition of up to 500 employees is appropriate for European conditions, or whether this number should not rather be set at 100, for example, in order to extend any cost benefits to the companies that really need them. We note that many so-called SMEs in Europe are daughter companies of larger, even multinational concerns, and criteria must be established for distinguishing these from independent SMEs.

3.2.1 Dispute resolution

In our view, by far the greatest deterrent to the use of IPRs, in particular patents, by SMEs as well as universities and similar institutions, is the fear of heavy costs to enforce them.

We therefore consider that efforts should be made to create specialised courts (at least of first instance) dealing with such disputes and availing themselves of experts on the panel (such as patent expert lay judges, e.g. as is done in Austria). One suggestion is that a (pan-European) court of appeals might be based on the Boards of Appeals in the EPO strengthened with patent judges from the member states. As a general and indispensable principle, however, we consider that a body dealing with appeals should be independent of the institution which grants the patent.

The foregoing considerations are of even greater importance with the expected proposal of the EU concerning the Community Patent Convention. One of the key issues to be addressed if this comes into force will be the problem of establishing a pan-European patent court system. Consideration of this *of itself* is desirable at the present time, however, because of the very unsatisfactory working of the Brussels and Lugano Conventions in this field.

3.2.2 Arbitration

We have been convinced by empirical evidence presented to us that the main element in the excessive cost of resolving IP disputes is the use of the *ordinary courts* to deal with what are essentially technical matters. Part of the problem is that even judges with a science or engineering background usually need to be educated in the technology concerned, which requires time and money. The US 1992 Commission on Patent Law reform concluded that *'litigation has become an increasingly inefficient, ineffective and undesirable means of resolving patent related disputes.'*

Disputes can of course be referred to arbitration, such as the Arbitration and Mediation schemes operated by WIPO and by Chambers of Commerce. The problem with this, as with all alternative dispute resolution mechanisms (ADRs) is that the use of ADRs is voluntary, and the economically stronger party is unlikely to throw away its inherent advantage in resources for financing litigation.

One option worth considering[22] would be *compulsory* arbitration of disputes with legal aid for the respondent party in the event of appeal to the courts from an arbitration. Empirical evidence suggests that the cost of these reforms would not be great. A large-scale working model is the 'Interference' procedure in the USA, which generates only a tiny percentage of successful appeals. Careful thought would need to be given in setting up such a tribunal to avoid high costs. Such a scheme, funded out of patent renewal fees, would go a considerable way towards redressing the grievances expressed by SMEs about the current patent system. Compulsory arbitration might also benefit the public interest by reducing the ability of firms to use the threat of litigation as an anti-competitive strategy.

3.2.3 Litigation insurance

We note that the Commission intends to organise a European conference to consider the possibility of an insurance scheme to cover patent litigation costs. We call attention to the link between this and compulsory arbitration of disputes referred to above. The empirical evidence from the working model of the US 'Interference' system is that successful appeals from such arbitrations are likely to be very few indeed. **Consequently, the cost of defending an appeal to the courts from a successful arbitration decision might then become an insurable risk.**

3.3 Employees' inventions

We have also considered possible harmonising activities concerning problems created by disputes about employee's inventions in the context of S&T policy in the Community. However, in view of the new commitment of the Commission on this issue in the follow-up to the Green Paper on the Community Patent and the Patent System in Europe we consider that special attention should be given to employee incentives in PROs and HEIs. We also consider that there should be at least the harmonisation of basic concepts and notions, because this would enhance intra-European collaboration in research and development.

[22] See Kingston, W. (1995): *'Reducing the Cost of Resolving Intellectual Property Disputes,'* European Journal of Law and Economics 2 pp. 85-92.

3.4 Money instead of time as the measure of intellectual property grants

Finally, a 'blue sky' proposal on the possible shape of IPRs in the future:- [23]

BOX 3.1 Money instead of time as the measure of intellectual property grants

Invention and radical innovation can never be other than a cost from the point of view of industry accounting procedures. In to-day's complex technologies, money is only made by those firms that can develop them into commercial products through subsequent incremental changes. There is now persuasive evidence that progress in any field of technology is made most rapidly when several firms are competing to capture a share of a new market, and to widen the scope of application of an invention, through making such incremental improvements along different and competitive 'trajectories.'

The recognised comparative failure of European firms to commercialise inventive and RTD efforts is partly explained by this. No firm can exploit more than a single trajectory of incremental change properly. Proprietary rights can prevent firms which could exploit other trajectories from doing so, thus also depriving the originator of competitive pressure to move along the learning curve as fast as possible. Eventually, products from foreign firms which incorporate more incremental improvements, gain an advantage in the market.

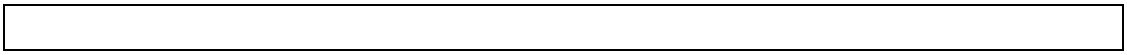
A useful contribution towards solving this problem would be the compulsory licensing of intellectual property, consistent with Articles 7, 8(1), and 8(2) (though Article 31 should also be noted) of the Agreement on Trade related Aspects of Intellectual Property Rights (TRIPS), subject to the condition of maintaining, and if possible improving incentives to invent and innovate.

It has been proposed with support from empirical research that this could be achieved by changing from time to money as the measure of any grant of intellectual property. The proper measure of any economic privilege, in fact, can only be money. No doubt at the time when intellectual property originated, any measure other than time was out of the question, since accounting techniques were undeveloped.

But to persist with such a poor measure as time to-day is simply to ignore all the achievements of accountancy since, which are now capable of providing the measurement required. Many of the problems of intellectual property rights, especially in new fields such as biotechnology and information processing, are actually caused by having to use time as the very crude measure of a patent, copyright or other grant.

The empirical research underlying this proposal shows how incentives to invent could be maintained or even enhanced by the use of capital payments for licences, instead of royalties. We think that if both objectives of this proposal could be achieved, there would be considerable benefits in terms of S&T policy. We therefore consider that although this is clearly a long-term project, it is worth investigating further.

[23] Kingston, W. (1994): *'Compulsory Licensing with Capital Payments as an Alternative to Monopoly Grants for Intellectual Property,'* Research Policy 23 pp. 1275-89.



Chapter 4. Adapting Existing Institutions to the Needs of the New Environment

4.1 Creating an IPR Culture

Previous chapters have emphasised that with the coming of the knowledge-based economy, intellectual property rights will assume an ever increasing importance in most growing economic sectors, in particular the high technology and science dependent ones. But it is also clear that in Europe, with the notable exceptions of pharmaceuticals, chemicals, electronics, machinery and software, IPRs have generally been considered to be of less importance amongst the elements which make up corporate strategy, at least until recently. Previously they were often considered a tedious and expensive administrative or legal burden, best avoided if possible by strategic managers, and left to the professionally qualified experts. This can be contrasted with the greater corporate culture observed in large Japanese companies, and in US companies, where IP considerations are thought to be very important, and where many branches of company operations and management are involved in IPR activities. To Japanese and US firms more than to European ones, IPRs play strategic roles in bargaining, standard setting, licensing, marketing and personnel management in addition to the traditional role of protecting corporate intellectual capital and confronting competitors. In formal relationships between commercial and public entities, they play a crucial part in attracting finance, in technology trade, outsourcing, acquisitions, mergers, and alliances. We are approaching an era in which knowledge management will be a decisive element in competitive strategy, and European companies may lag behind their Japanese and US counterparts.[24]

This Chapter addresses the problems of creating an IP culture in the EU and suggests ways in which awareness of IP issues can be raised. The term *IP culture* is used, to emphasise that there must be a general appreciation of IP inculcated in all parts of the innovation system; managers and industrial researchers, public sector scientists, and also in managers and administrators of the institutions making up the system: government, public research organisations, educational establishments, and the various patent offices.

[24] The PACE/CMU results show that European firms are lagging in their patent propensity rates (Arundel, A., Kabla, I., 1998. *What percentage of innovations are patented? Empirical estimates for European firms.* Research Policy 27:127-141.), which provides indirect evidence that European firms give less importance to the strategic use of IPRs.

4.2 Commercial Awareness

The remarkable propensity of Japanese companies to patent was in the past associated with the low quality of Japanese patents.[25] This is now a feature of the distant past, as with the reputation for low quality of Japanese products. Historical factors 'catching up' seem to have given way to strategic management and response to US patenting as determining behaviour. In contrast, European low patenting propensity has been attributed to factors such as: emphasis on other strategies for technological exploitation, lack of competition, engineering attitudes (emphasis on technical rather than economic value), high costs of patenting, and especially to lack of expertise and knowledge of IP.

Changes in attitudes are occurring, however, due to:

- increasingly competitive global markets, often with competitors with aggressive patent strategies;
- the emergence of collaboration and alliances which depend upon IP as 'entry qualifications';
- acquisition of companies with more advanced patent cultures;
- the increasing value of IP, especially patents, being recognised by the accountancy profession and financial markets;
- copyright protection being crucial in many high profile industries, such as entertainment, publishing and computer software;
- involvement in litigation and damages claims, etc.

However faster changes are needed. Several means of carrying this out are possible:

- Senior management must be involved with IP. Visiting laboratories, and involvement in IP analysis as a component of competitive strategy, should be normal activities for all senior managers.
- Managers up to the top level chief executive officers (CEOs) must be involved with IP issues and decisions. Though European corporations have fewer technologists at this level, it is not difficult for CEOs to be introduced to the field.

[25] The 'low quality' of Japanese patents to a large extent was due to former Japanese patent law, comprising rigid stipulations regarding unity of invention, which resulted in the requirement of separate filings for each and every trifle, and narrow interpretation of the 'claims' which define the exclusive rights. On the other hand, Japanese patent law has been amended 18 times since World War II, in the endeavour to constantly adapt it to the needs of the Japanese industry.

- Patent law, and other relevant branches of IP law, should be regarded as an essential part of scientists and engineers expertise (see Chapter 4.3).
- IPRs should be regarded as an integral part of business plans.
- Clear patent objectives should be set, for example Hitachi had the objective of increasing the number of strategic patents by 25 per year. Of course there are many justified objections to this, concerning the quality of patents produced, but the behavioural change induced by having objectives could be worthwhile.
- Fostering behavioural attitudes and norms. Attitudes to IPRs can be changed, not only towards protection of IP, but also as accepted ways of thinking. (One of the important aspect of patenting is the preparatory work in a company, the drafting of a specification etc., because this requires concentration on essential matters and discipline, i.e. revaluation of existing products and processes).
- Incentives should be given for R&D personnel to innovate. This also entails that organisational changes should be made: patent departments should become intellectual property management departments, and should not remain isolated units. Rather, they should be involved closely in other parts of organisations, involved in relevant decisions in marketing, licensing, project selection, etc.

BOX 4.1:

Keizo Yamaji, former CEO, Canon Group[26]

"I encourage our researchers to read patent specifications rather than academic theses and to write patent applications rather than technical reports. I also tell them to make virtual experiments ('Gedanken experiments') in order to have them apply for more and more patents, so that we can be prepared for the era to come when only some companies, strong in patents, will co-operate with each other and survive."

[26] O. Granstrand, '*Economics and Management of Intellectual Property, Towards Intellectual Capitalism*', Edward Elgar, July 1999.

Overall it must be stressed that creation of this IP culture is simply the recognition that IP is something which affects all corporate activities, for example in the way that financial management or information technology is recognised today. It is pervasive and should not be isolated in a remote department.

Formulating particular public policies to address the objective of changing corporate behaviour is more difficult than designing policies to produce particular research results, and has the problem of trying to produce what would be seen as acceptable indicators of success (notwithstanding the comments on patenting objectives made above). **EU science and technology policies are generally couched in terms of specific technological objectives with the attendant milestones and deliverables: additionality is assessed using quantifiable indicators as far as possible. Yet the broader objectives of these policies must be to change behaviour in the pursuit of S&T objectives: to increase the quantity of spending, to improve the effectiveness of research, to generate competitiveness and to promote collaboration between parts of the innovation system in order to promote social and economic objectives.**

4.3 Education and IP

HEIs have a dual role in the innovation system, producing knowledge and training scientists and technologists. Though they have been very active in attempting to exploit the results of research, there has been little activity addressing awareness and training in intellectual property rights.

The education of scientists, technologists, and business managers in most of Europe does not usually include formal exposure to the field of intellectual property. This frequently results in a failure to appreciate the general IP environment outlined previously, and even a failure to carry out research activities in an acceptable manner (e.g. maintaining laboratory notebooks and procedures in a manner acceptable to US courts).

Measures to address this are relatively straightforward. All science, engineering and technology professional qualifications must include provision for appropriate IPR knowledge. This is already the case in some parts of Europe, for example in Austria where the representative body of IP professionals on a legal basis is asked for suggestions regarding the curriculum of universities and courses to be run in IPR matters. Such training need not be a heavy burden. The necessary minimum would only require a few hours of instruction; practical exercises would also be an advantage. One requirement, which is already made in Switzerland, is that doctoral students in technical schools must complete training in IP. This could be extended throughout Europe.

BOX 4.2:

Improving IPRs culture and competencies in HEIs: a British initiative.

With financial and other help from the UK Patent Office, Bournemouth University in England has instituted an innovative approach to IP training. Student engineers and law students concentrating on IP are given a simulation of real life in their degree programmes. With the support of the UK Patent Office and their teaching materials, the local Portsmouth patent office, and a local patent attorney, the students undertake a programme that introduces them to IPRs . The law students are required to advise the S&T students on appropriate aspects of IPRs relevant to their own inventions, having elicited the relevant information from the engineers, and then give them advice in terms understandable to the lay person.

Student centred interactive teaching materials are being developed and tested, which can form assessable parts of the student's coursework. The 'micromodule' units in patents, copyright, designs and trademarks are designed for use by a facilitator who may or may not have IPR expertise, with students on a wide range of courses, so will have a wide application. Each unit has a duration of two hours of class contact time, and includes in-class exercises, self-assessment exercises, case study materials and Web links. First results of the UK pilot trials indicate that the materials are well received, and leave students in no doubt as to the relevance of IPR in their future careers. Full results will be available later in 1999.

Also important in the generation of an IP culture is the education of the broader business community. Business and economics schools should include elements of IPRs in all appropriate courses, and these should be made available to research staff as well as students in order to up-date their knowledge. Efforts are being made in this respect by patent offices, but not yet on a sufficient scale**. We see further initiatives in this direction as an important role for national patent offices.** The Commission already supports training courses with European subject content, and further initiatives in this direction would also be welcome.

More specialised studies in IPRs are beginning to receive some attention. For examples, the ETH in Zurich offers a postgraduate diploma NDS (Nachdiplomstudium) in Intellectual Property, and quite a large number of UK universities now have IP as a regular part of their curriculum at both undergraduate and postgraduate levels. This is also increasingly true of HEIs in other member states. Many courses in IP are open to those with a non-legal background such as science graduates There will undoubtedly be an increase in the number of professionally skilled practitioners required in all areas related to IPRs, including patent offices, university administrations and commercial enterprises, as well as independent patent attorneys, and we welcome this

increase in the formal teaching of IP in HEIs.

BOX 4.3.:

Improving the IP Culture and Competencies: a French initiative.

An initiative is currently tested in France to help SMEs to improve their IPR culture by means of big firms (or smaller firms with a good IP experience) 'fostering' SMEs.

In this way SMEs would be matched with a more patent-experienced firm. Three different methods are envisaged:

The SME would consult a correspondent (typically the IP manager) for advice and general information about IP strategy.

The SME would send for a few days in the IP department of the experienced firm someone who will be placed in charge of IP, and who will be able to see, in a very practical way, how the experienced firm plans and manages its IP strategy, particularly technology watch, procedures and licensing.

The experienced firm would organise a club of firms (e.g. suppliers and clients, subcontractors of the same firm, firms from the some branch or the same geographical area) where they can exchange experiences and discuss problems of common interest (e.g. defence from counterfeiting, IP clauses in partnership agreements, technology watch).

4.4 Patents as Information Sources

One of society's main motivations in giving inventors rights over their IP is to encourage the dissemination of knowledge as widely as possible producing a base for further inventive activity, yet this part of the 'bargain' has received far less attention than it deserves. Even after allowing for their flaws, patent databases enable access to one of the most comprehensive and accessible sources of scientific and technological information, but are not exploited routinely by many scientists and companies.[27] Patent specifications themselves contain the primary information, and every year tens of thousands are published all over the world, adding to the millions already available in patent libraries. There exists an almost global standard for these documents which allows efficient searching to be carried out. With the new information and communication technologies (on-line access to information, the Internet, etc.), the specifications themselves are becoming

[27] Again, notable exceptions include the pharmaceuticals and chemicals sectors.

easily and cheaply available for routine work. A large number of patent documents are now accessible in full text.

Evidence suggests that SMEs are notably less likely to exploit this information. Though various factors have been put forward to explain this, such as costs and lack of skills[28], it seems probable that lack of awareness and inconvenience are the major factors. These problems could be expected to diminish with the new ease of access from every desktop personal computer, but of the high costs of searching one of the major costs involved is the time spent on this by engineers and technical staff.

Another factor, however, concerns the quantity and quality of the information contained in patent documentation. One survey suggests that only one third of European innovations result in a patent application due to the low propensity to patent. Increasing patenting could therefore be expected to increase the attractiveness of using patents a sources of information. The quality of information has been criticised. Patents often do not contain, in readily understandable form, information which is easily usable by non-specialists outside the patent professions. A central problem concerns the practical difficulties in implementing the disclosure requirement in granting procedures. Often, the information disclosed in the patent is of little value without the process know-how which would enable the disclosed knowledge to be commercially valuable. On the other hand, the disclosure requirements often work as a disincentive to apply for patents, so it would be difficult easily to improve this balance.

One future option would be to envisage the publication of applications at an earlier date and undertake efforts aimed at introducing such a system internationally. An accessible patent application database would enable researchers to check, before filing, whether an application from a third party has already been made for a topic. This would increase legal certainty. For researchers wishing to use the information as a guide to current work, key innovations and technology trajectories this would be a valuable reform. This may speed up research and avoid any duplication or overlap with existing work. Also, the information would be valuable to academic and commercial researchers and strategists as a current guide to where work is being conducted. It would reduce some duplication of research and discourage some inefficient patenting. Collaborations would be formed more efficiently, especially in fast moving fields where changing alliance structures are characteristic.

[28] Firms must have the capability not only to search patent databases effectively, but also to absorb and use the information thus acquired.

Nevertheless such a measure has some important drawbacks:

- Reducing the 18 month time for publishing will necessary boost secrecy strategies, in particular in industrial sectors where market-lead time is a key factor for keeping a competitive advantage.
- In a system in which the applicant already discloses his/her invention without any equity, a balance of interests must be safeguarded, and opportunity offered to the applicant to withdraw the application, if the search report is unfavourable, is essential (even after 18 months in some 25-30% no search report is available at EPO).
- In any case the measure would have to be implemented at a world-wide level.
- SME's may be especially disadvantaged because of the particular importance of secrecy to them.

An improvement we would like strongly to encourage is that the EPO should intensify its efforts to shorten the time it takes to process applications.

4.5 The Role of National Patent Offices: 'IPR Centres'

In recent years, the European Patent Office has gained an increasing number of patent applications. There has been some substitution of work from national offices. However, national offices still maintain an appreciable number of national applications (about 120,000 per year for all EU countries, and about 50,000 in the German Patent Office alone). The tendency for work transferring to the EPO could continue in the future with the entering into force of the Community patent. In that case it would be necessary to redefine the role of national offices. **This redefinition is appropriate at present, taking into account the growing feeling about the importance of national offices in promoting innovation. In this direction one of the roles which they are best able to fulfil will be as mechanisms for increasing not only the effectiveness of use of the patent system, both for applying for rights and as information resources, but also the IPR system as a whole. In other words they should become 'IPR Centres'.** They have the advantage of locality and often of language, and are able to carry out these tasks in ways appropriate to their local circumstances. Provision of services to users may be provided in three channels: EPO, local offices and Internet-based information. The best balance between these will only be found with experience. Any reallocation of tasks between the two levels of Offices would be best carried out with their close co-operation. A more coherent European approach to patents would also enable the 'IP culture' objective to be furthered, by publicity, information and education campaigns.

4.6 Conclusion

IPRs have become an essential element in the strategies of all institutions in the system of knowledge production and use. However the implications of this have not yet been appreciated in most industrial sectors. **Major improvements are needed in:**

- **the awareness of the importance of IPRs at all levels of management and in a wide range of functions within companies;**
- **the knowledge of IPRs, other appropriation strategies and associated procedures, of researchers in all institutions;**
- **incorporation of IP education and training as a mandatory element in training of scientists, technologists, researchers and managers;**
- **the use of patent information as a routine and systematic tool of research and commercial strategy;**
- **maintaining efforts to reduce the cost and increase the ease of access to extensive patent information;**
- **intensification of efforts of the EPO to shorten the average duration of the grants procedure**
- **co-ordination of the functions of national patent offices in carrying out the above tasks and developing them into IPR Centres.**

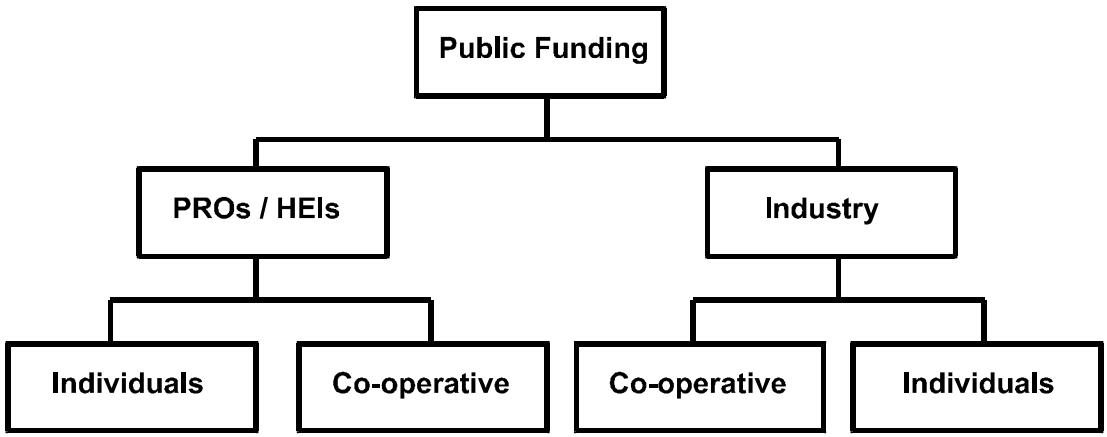
Chapter 5. Publicly Funded Research and IPRs

5.1 Why Support RTD with Public Funds?

Several justifications for the use of public funds have been put forward: basic research which is unlikely to be commercially valuable, but is considered socially desirable may be supported for cultural reasons to increase the fund of human knowledge, and to train scientists and other researchers. This applies also to traditional grants to academic researchers for curiosity-driven research. Applied science may need public funding as well where commercial outcomes are highly uncertain, or where the market would not support investment. Intellectual property issues begin to appear when either basic or applied research may be transformed into practical and useful knowledge.

Basically, public funding may go either to industry or to PROs and HEIs. In the latter case, it takes the form of either institutional funding or public funding. Projects may be carried out by industry or by PROs or HEIs either individually or in collaboration. Whereas in Chapter I, we discussed a common research space where all institutions participate, when it comes to project funding, co-operation takes more specific forms: Co-operation may be between industrial enterprises or between PROs and HEIs, but mostly the funding institution wants co-operation between industry and PROs / HEIs, to facilitate knowledge transfer.

Figure 5.1: General Structure of Public Funding Projects



5.2 To Whom Should the Benefits Go?

When the results of basic or applied research are potentially commercially useful, the question arises: to whom should the benefits go? **This question of ownership has been solved differently under various systems of public funding and has been controversial everywhere.** The criteria which determine the outcome of the conflict are the share of public funding, the objectives of the funding, and the commercial or other interests of the parties carrying out the project. Traditionally, the choices have been between ownership by the funding organisation with licences being granted to the organisation carrying out the project and possibly to third parties, or else the ownership goes to the organisation carrying out the project with obligations to allow the funding organisation to retain licences and possibly to grant them to third parties. The debate has concerned the precise terms of the imposed licensing conditions. Experience of these systems has shown that the cost of negotiating agreements is high, and little use has been made of the rights conferred. Also, the requirements may have discouraged some parties from participating in projects. **Simply put, the systems were not very effective. Therefore, a more straightforward solution is to leave the ownership of the results and the responsibility for exploitation with the organisation carrying out the project, but subject to some basic obligations. These basic obligations may include the following:**

- As a counterpart for the exclusive responsibility to autonomously exploit the result, the owner must either use the results himself or grant licences. These licences may be exclusive (and should be limited to a specific field of use) on condition that the licensee actually exploits the subject matter of the licence within a given period of time.
- The grantee may not use the exclusive rights obtained in order to obstruct other (publicly supported) R&D.
- In the case of projects having a particularly important public interest element, such as in some specific situations as public health, there may exceptionally be an obligation to grant licences to third parties on reasonable (commercial) terms.[29]

[29] Serious problems have arisen due to the material transfer agreements which are concluded in the area of biotechnology research by US private companies with research institutions. They include 'reach though' licence clauses aimed at securing industry far reaching privileges in achievements resulting from the received biological material. Apart from doubts about the legality of these agreements, they may result in serious obstacles to the international division in research and innovation efforts.

The application of these rules will also benefit the public at large in that it increases the innovative output of public funding and thus ultimately contributes to an increase in economic activity and tax revenue.

5.3 Collaborative ventures

Following from the above, in the important case of collaborative ventures, the principle should be that it is up to the funded parties to negotiate appropriate and fair terms among themselves regarding the ownership and exploitation of results. The advantages of this approach are:

- A high flexibility allowing to take due account of the varying interests of the parties and of the particular nature of the project.
- A better motivation for the exploitation of the results for both PROs / HEIs and industry
- Encouraging better and more valuable input into the projects and wider participation

A condition for the success of this approach is that in the negotiations, due account is taken of the (commercial) interests of PROs / HEIs as well as SMEs. This condition can best be achieved not by imposed contract conditions which would violate the above principles, but rather by extensive training and support systems as discussed in Chapter 4.

In order to ensure the carrying out of the obligation to exploit the R&D results and to allow its monitoring, the grant of project funds should be subject to a condition that the applicant must submit an exploitation plan which then is updated as the project develops.

5.4 Exploitation Plans

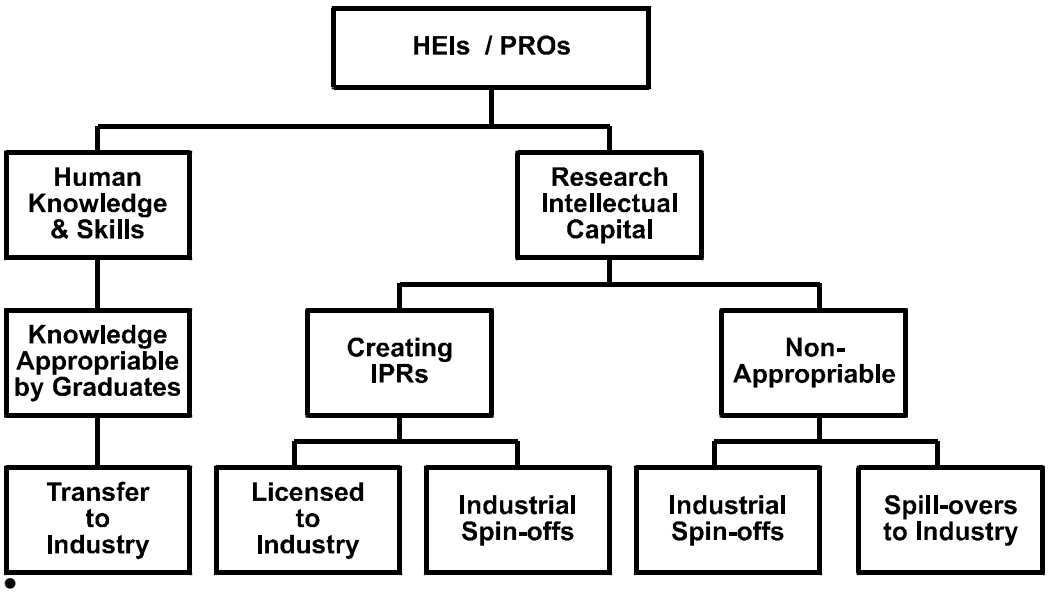
Since we recommend the application of rules which provide more incentives for innovation in order to improve the operation of the funding system, we would also recommend following the example of some programmes of EU S&T policy which require that project proposals and the subsequent projects of some action types include a commitment to a detailed exploitation plan.

Typically, these plans should be formulated at the planning stage of any project, so that the participants are chosen bearing in mind the importance of exploitation routes, and to focus the design of workplans towards eventual dissemination and use. The onus is thus on the IP producer/owner to push forward exploitation rather than passively (even reluctantly) respond to enquiries from third parties. This approach leaves all the participants with more freedom to chose the best means of exploiting their work, including financial rewards to PROs, from further research, contracts, development, consultancy, etc. Proper funding should be provided by funding agencies for these purposes.

5.5 Institutional Funding of HEIs/PROs and the Appropriation of Research Results

Figure 5.2 is a diagrammatic representation of the way in which institutionally funded research becomes appropriated by industry:

Figure 5.2: What HEIs & PROs Do



From this it follows that PROs and HEIs need to develop their own IPR policy, either by themselves, or via support systems, or in collaboration with others. Such a policy requires the following issues to be addressed as follows.

- **Publication versus IPRs**

  Academic publication versus IPRs tends to be a false issue, because proper handing and sensitivity to the IPR issue would allow protection of research results without jeopardising early publication of research results. In particular, researchers / academics should become educated to contact the appropriate IPR support system (see chapter 4). In this context we again stress the necessity of addressing the question of the Grace Period (see Chapter 3).

- **Development of an IPR strategy by reference to defined research fields**

  Protection of research results by IPRs requires more than ad-hoc patenting, rather the entire technology needs to be systematically protected through appropriate IPRs. Therefore a strategy for protection must be defined with regard to specific research fields. The strategies of industry apply *mutatis mutandis* to PROs and HEIs. (See *inter alia* WIPO 'IPR Strategies for Higher Education')

- **Establishment of a licensing policy**

  Similar considerations apply in consideration of licensing policy. In particular, exclusive licences, if specified properly with regard to their field of use and associated with an obligation to exploit, are a proper way of exploiting research results and gaining the benefits. Similarly, PROs and HEIs may commercialise their know-how by licensing.

- **A distribution plan for licensing income**

  Distribution plans are a matter for each institution, but experience shows that a fair share should go to the institution in view of its support for research and IPR matters. A fair share should go to the unit carrying out the research and to the individual researchers in order to motivate them with respect to research and its protection.

Though European and US evidence suggests that the rather optimistic hopes of generating large revenues[30] from IPR have not been borne out, we think this is in part due to the lack of a systematic approach to the matters discussed above. **We acknowledge that commercialisation of research results alone probably will never form a major part of the income of such institutions. However, we think it unacceptable to forego existing opportunities.**

[30] Even the most successful technology licensing office in the USA was contributing only about 1% to the total of its university income. In the UK, the average income generated by TLO was only £800,000. However, this is a considerable amount of money for a university.

BOX 5.3:

John L. Hennessy, Dean of Engineering, School of Engineering, Stanford University, USA [31]

"There are two kinds of technologies in the world; stuff that is patentable and broadly applicable, and the right thing to do is to give it to OTL [Office of Technology Licensing]. Then there's the stuff that is more a preliminary proof of concept. It's not patentable, and the real value is in the people and their understanding of that technology and how it can develop into a useful product. OTL's role is not to get in the way. That's when the right thing to do is to say 'Godspeed, go and do it'."

[Stanford's OTL has a rule that inventions are not patented unless a business plan forecasts a revenue of more than $100 000 over the 20 year life of a patent.]

5.6 Researcher Mobility

A necessary complement to an IPR policy, if not an objective in itself, is to enhance the mobility of researchers.

Good scientists may not be best qualified to judge the commercial potential of their work, which requires knowledge of markets and business processes, and their knowledge (broadly defined) is difficult to transfer in formal, codified ways.

This analysis points out that science and technology policy should be attempting to encourage the mobility of scientists and other researchers between industry and academia. It is not only academic-to-industry transfers which are necessary; as noted in Chapter 1, flows of knowledge (of all types) in the opposite direction are also essential for effective innovation.

One of the reasons for the lack of mobility of researchers is the risk averse culture in Europe relative to the USA. Cultural policy may be beyond the immediate remit of this report, however, as the next chapter will discuss, specific short term policy initiatives can have some effects. The social stigma of business failure and bankruptcy may take a long time to change, however the laws which increase the risks attendant upon failure can be changed. This is particularly important in the S&T context, and in the new technology industries where high risk is common. **If inventors, innovators and entrepreneurs are discouraged from attempting high risk, high return, radical innovations there will be a bias**

[31] From L. M. Fisher, *'Technology Transfer at Stanford University'*, Strategy and Business, Issue 13, Fourth Quarter 1998, pp 76 – 85.

towards conservative, *incremental* innovation.

BOX 5.4:

Nathan Myhrvold (Microsoft research director)

"Britain doesn't have the right attitude towards failure. In Silicon Valley it is very common for these young start up companies to fail. And so if a man has been CEO of three failed companies, and has burned $3 million worth of investors' money with nothing to show for it, is he going to get funded the next time? OF COURSE HE IS! He is considered an experienced guy. Sure, a couple of his companies failed, but he has seen failure in the face. He knows ways that companies screw up. And you can't expect to have a high rate of innovation, and high risk companies, without having some failures."

Interviewed on BBC Radio 4, 17th January 1999.

5.7 Conclusion

The allocation of IPRs resulting from publicly funded research is complex and no easy solutions exist which can satisfy the desires of commercial participants to protect knowledge, and to allow PROs to exploit knowledge, and ensure that the public interest is protected by disseminating knowledge as far and as fast as possible and also by promoting competition in general. Policy should concentrate on the role of IPRs in promoting the effectiveness of the innovation system as a whole rather than attempting to specify the detailed 'one-size-fits-all' rules for every project supported.

Some suggestions are made:

- **The rules should place the onus of exploitation upon the participants, for example by requiring explicit plans for exploitation to be produced from the project negotiation stage.**
- **More general policies, perhaps outside the narrowly defined 'science and technology policy' field, are needed to change the cultural and legislative climate in favour of risk-taking, and in improving the mobility of researchers between all participants in the innovation system.**

Chapter 6. Encouraging Risk-taking

6.1 Introduction

Having covered the IPR issues of publicly funded research, we think it necessary to point to some framework conditions for the successful transformation of publicly funded research into innovation.

6.2 The fiscal environment

Research can be, and is, funded by direct government funding. Because governments operate at a distance from markets, this funding is not always well directed. An alternative strategy is the use of tax incentives to undertakings to encourage them to invest in research. A number of strategies could be developed within existing tax systems to encourage the carrying out of research and development to the above end, and the risk-taking successful innovation involves. Some of the available techniques might include the following. Innovations would be stimulated by granting of tax relief on expenditure incurred by acquirers of intellectual property rights by allowing them to set their R&D expenditure against their taxable revenue. Many member states already do this, but we feel that it should be a matter of *general* policy, and would suggest a number of refinements which could usefully be adopted in relation to this:

- **The timing of relief is crucial: a deduction allowed earlier rather than later, at a specific percentage over a period of time, is more valuable to a business.**
- **Losses arising from the acquisition of IPRs and R & D, must be relieved adequately through the tax system. For example by permitting losses to be carried across, or backward or forward in time within accounts, with appropriate tax adjustments.**
- **Where scientific research allowances are granted, often at favourable rates within member states, these allowances should be available to businesses that buy-in innovative research for further development.**
- **Tax relief should be made available on the funding they provide for those businesses which fund research by PRO's.**
- **Specific schemes should be developed for the promotion of investment in PRO research. For example by encouraging people to invest in companies carrying out such research by granting them some form of tax relief on the value of their subscription for shares in the designated companies.**

- **Tax credits for expenditure incurred specifically in collaborating with PROs, or acquiring research of PROs could be granted.**
- **Administrative and cash flow barriers arising from the exploitation of PRO research (such as the requirement that tax be deducted at source from royalty payments by licensees) should be removed.**
- **Taxation of gains made from the disposal of capital, where gains are reinvested in PRO research, should be deferred.**
- **Fund holders, such as pension schemes, should be encouraged to invest in companies exploiting the outcomes of PRO research, through tax relief.**

6.3 A framework for the creation of security interests in IPRs

Raising finance is a major problem for spin-off companies. Ways in which this could be made easier should be considered. IPRs are one mechanism for securing loans.[32] If this trend is to be promoted, present legal obstacles to the creation of reliable security interests in IPRs need to be removed. One obstacle is the lack of a single register which can be searched by potential lenders. The absence of this, and the fact that each piece of national legislation on the point differs, has the result that there can be conflicts of priority between lenders. Even worse, national laws such those governing the creation of security interests in intangibles, as well as general insolvency provisions, may give a different range of answers to priority questions to the answers given by the intellectual property statutes. The complexity to which this leads is a serious obstacle both to lending within a member state, and to lending across borders. The problem is not dissimilar to that which existed in the USA before the introduction of Article 9 of the Uniform Commercial Code (discussed below). US lawyers similarly had to cope with a variety of security devices, each with its own law. To the complexities of this, there was added the conflict of laws dimension, since the rules could differ from state to state, and some interests such as chattel mortgages were registerable in state registries, others not. The situation in Europe at the present time is not dissimilar.

The problem has to a large extent been solved by Article 9 of the Uniform Commercial Code ('UCC' - promulgated by the Uniform Laws Commissioners in the USA). This is a uniform state law which introduces a single uniform security device for personal property including all forms of 'general intangible', unless excluded (§9-102(1)). 'General intangibles' means 'personal property' (with certain exceptions) including goodwill, literary rights, copyrights, trade marks and patents (§9-106 Comment). It would not be appropriate in a report of

[32] Bezant and Pond 1997

this sort to enter into the technicalities of Article 9, it suffices to say that it provides a very simple method by which lenders can register, and thereby ensure that their security interests are protected. **An EU system of this sort introduced by Regulation would be well worth considering.**

6.4 Insolvency laws

The 'mechanical' legal aspects of the protection of lenders is obviously important, but, as with fiscal considerations, so is the protection of borrowers. The insolvency laws of many member states afford little protection to the entrepreneur wishing to set up in business, other than through the creation of limited liability companies. The value of limited liability can, however, in practice be more apparent than real. If life savings and dwelling house have become collateral for the companies debts, the entrepreneur may end up losing everything. Some member states afford some protection against this. In France, for example, the home is excepted from sale on bankruptcy, and even eviction for non-payment of mortgage instalments goes through a compulsory conciliation process before reaching court (Loi Neireirmetz 1989).

In the USA, the Federal Bankruptcy Code Chapter 11, is also more favourable to the entrepreneur setting up a company to market an innovation than the law of many member states. Under Chapter 11 of that Code, the debtor is afforded a 'breathing spell' at the outset of the case (§362). Prior to the confirmation of a 'plan', payments to debtors on account of claims arising before the commencement of the case are generally prohibited. The debtor remains in possession of its property, and continues to carry on business. The 'plan' filed by the debtor must be fair and equitable to both secured and unsecured creditors. This is a highly complex area, and it will suffice to note for present purposes that one of its objectives is to enable the debtor to overcome its short-term difficulties and to prevent one secured creditor 'pulling the rug' from under both the company and the other creditors.

Glossary

Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)

Alternative Dispute Resolution Mechanisms (ADRs)

Chief Executive Officers (CEOs)

Eidgenossische Technische Hochschule Zurich (ETHZ)

European Patent Convention (EPC)

European Patent Office (EPO)

European Union (EU)

Gross Domestic Product (GDP)

Higher Educational Institutes (HEIs)

Intellectual Property (IP)

Intellectual Property Rights (IPRs)

Nachdiplomstudium (NDS), postgraduate diploma offered at the ETH-Zurich

Office of Technology Licensing (OTL)

Organisation for Economic Co-Operation and Development (OECD)

Patent Co-operation Treaty (PCT)

Public Research Organisations (PROs)

Research and Development (R&D)

Research and Technological Development (RTD)

Science and Technology (S&T)

Small and Medium Enterprises (SMEs)

Supplemental Protection Certificate (SPC)

Uniform Commercial Code (UCC)

United Kingdom (UK)

United States of America (US, USA)

World Intellectual Property Organisation (WIPO)

Errata

On p. xvi, third last line, replace "substitutes" by "to substitute"

On p. 21, footnote no. 20, replace "see" by "See"

On p. 25, last paragraph, replace "500" by "250"