Forfás

From Research to the Marketplace

Patent Registration and Technology Transfer in Ireland

THE NATIONAL POLICY AND ADVISORY BOARD FOR ENTERPRISE, TRADE, SCIENCE, TECHNOLOGY AND INNOVATION

Forfás

From Research to the Marketplace

Patent Registration and Technology Transfer in Ireland

THE NATIONAL POLICY AND ADVISORY BOARD FOR ENTERPRISE, TRADE, SCIENCE, TECHNOLOGY AND INNOVATION

From Research to the Marketplace: Patent Registration and Technology Transfer in Ireland

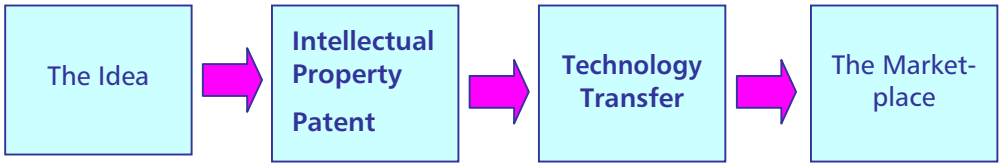
Published by:

Forfás, Wilton Park House
Wilton Place
Dublin 2
Ireland

Tel: +353 (0)1 607 3000
www.forfas.ie

Edited and designed by Rédacteurs Ltd
www.redact.ie

PREFACE



In the excitement of discovering and creating new ideas it can be difficult to understand just how hard it can be to get that great new idea into the marketplace and to get the credit and financial reward that the idea deserves. As a first stage, the creators of the innovative product, process or service need to seek formal recognition of their idea in a secure and legally binding form – in other words, to convert their innovation into **intellectual property**. The most secure way of protecting the intellectual property in a product, process or service is to file for a **patent**.

On its own, however, intellectual property is not very useful to the wider world, and the next stage is to exploit the commercial possibilities of innovative products or processes, and this requires **technology transfer**.

The purpose of this document is to examine the processes by which knowledge is commercialised in Ireland, and to identify ways in which these processes could be enhanced.

The Circa Group Europe Reports

In 2003, Forfás commissioned Circa Group Europe to carry out a research project in the areas of intellectual property, patents and technology transfer. Circa carried out extensive desk research, field work and data analysis, and delivered two reports to Forfás. The current report is based on the data and analysis gathered in the Circa Group Europe reports, and Forfás would like to acknowledge the valuable work carried out by Circa Group Europe.

CONTENTS

1 Introduction 6
What Is Intellectual Property? 6
Patents 7
Other Forms of Intellectual Property 7
Patent Registration and Technical Innovation 8
Why Is Intellectual Property Important? 8
What Is Technology Transfer? 9
Why Is Technology Transfer Important? 9
What Is Ireland's Track Record in Intellectual Property? 10
2 Knowledge Commercialisation in Ireland 11
Overview of Knowledge Commercialisation 11
The Knowledge Generators 11
Universities, Institutes of Technology and Other Research Institutions 12
State Agencies and Government Departments 12
Industry 12
Individual Inventors 12
Knowledge Intermediaries 13
Patent Agents 13
Technical and Licensing Consultants 13
Lawyers 13
Technology Transfer (TT) Brokers 14
Financiers 14
Government Agencies 14
The Irish Patents Office / Oifig na bPaitinní 15
Knowledge Users 15
Universities and ITs 16
State Agencies and Research Institutes 16
Industry 16
Individuals 17
Policies and Supports for Intellectual Property 17
Irish Council for Science, Technology and Innovation 17
Enterprise Ireland 18
Tax Incentives 18
R&D: Tax Disadvantages 19
3 Patent Registration in Ireland 20
Patent Applications 20
Trends in Irish Patent Activity 21
Patent Activity by Sector 23
Irish-owned and Foreign-owned Companies Compared 24
Analysis of Irish patent activity 25
Enhancing Irish Patent Performance 26
Developing Awareness of IP among Researchers 26
Developing Patent Expertise within the Public Research System 26
Developing Funding Mechanisms for Patenting Activity 27
Expanding the Role of the Irish Patents Office 27
4 Technology Transfer in Ireland 29
Research Institutions and Industry: Making Connections 30
Dealing with Culture Clash 30

National Code of Practice 31
Technology Transfer Activity in Ireland 31
Knowledge Intermediaries and Technology Transfer 32
Dealing with Increased Regulation 32
Current Technology Transfer Management in Ireland 33
Current Staffing Levels in Technology Transfer 34
Alternative Approaches 34
Importance of Assessment 35
Enhancing Irish Technology Transfer Performance 35
Promotion of Research Discovery and IP Licensing 35
Developing Technology Transfer Expertise 37
Performance Measurement System 38
Appendix A: Suggested Performance Measures 40

1 INTRODUCTION

The creation and use of technological knowledge are key drivers of a modern, globally-competitive economy. New technologies can stimulate innovation and competitiveness by improving the quality of products, or by incorporating them in entirely new products, which in turn open up new business opportunities and new markets. They may also contribute to improving processes, and act as a factor in increasing productivity. Sales of high-technology products have become an important and dynamic component of many countries' export performance, while the high-tech industries that manufacture these products are associated with high value-added and well paid jobs.

Under the National Development Plan (2000-2006), the government has committed €2.48 billion for Research, Technological Development and Innovation. This investment is intended to underpin Ireland's objective of becoming a knowledge-based economy. Maintaining a strong science base and sustained investment in research and technological development, although they are important components of a modern competitive economy, are not ends in themselves. The knowledge that is created also needs to be exploited for the benefit of society – to enhance the competitiveness of industry, to promote growth, employment and higher living standards, and to improve the quality of life in terms of health and environment. Consequently, there is a clear need for policy to address any issues which might inhibit the exploitation of new technology and limit its contribution to overall national development.

It is far from easy to evaluate how well countries perform in developing and commercialising technology. The national systems of innovation that underlie and help to explain these performances involve complex phenomena that are difficult to measure and analyse. The most commonly used measure of technological output is patenting activity.

This chapter looks at both the development of knowledge as *intellectual property* and at how it is commercialised via *technology transfer.* It attempts to answer the questions *Why is intellectual property important?* and *Why is technology transfer important?,* and it also looks at Ireland's track record in this area.

What Is Intellectual Property?

Intellectual property consists of the creative outputs of the human intellect deemed to be unique and original and to have marketplace value. It includes industrial property such as inventions, trademarks and designs; and copyrighted material such as films, books, databases, computer programs and works of art.

Patents

A **patent** is a legal protection granted to the owner of an invention or process. To be eligible for a patent, an invention or process must incorporate technical or functional novelty. Patents are concerned with how things work, what they do, how they do it, what they are made of or how they are made. The vast majority of patents are for incremental improvements in known technology. Innovation tends to be *evolutionary* rather than *revolutionary*.

Other Forms of Intellectual Property

The following table summarises other ways in which the owners of intellectual property assert their ownership and protect their legal rights.

Registered Trade Marks	A **trademark** is any sign which can be used to distinguish the goods and services of one trader from those of another, and be represented graphically. A sign includes words, devices (logos), three-dimensional shapes and sometimes sounds and smells. A trademark is therefore a 'badge' of trade origin, and is generally used as a marketing tool so that customers can recognise the product of a particular trader.
Registered Designs	A **registered design** grants its owner a monopoly right for the outward appearance of an article or a set of articles of manufacture. It can last for a maximum of 25 years and is a property that, like any other business commodity, may be bought, sold, hired or licensed. A registered design is additional to any design right or copyright protection that may exist automatically in the design.
Copyright Ownership	The authors of copyrightable material enjoy automatic **copyright ownership** of their creations. There is no official registration system for copyright – no forms to fill in and no fees to pay. Works that may be covered by copyright include the following: ■ Original literary works, including novels, poems, newspaper and journal articles ■ Original dramatic works, including works of dance or mime ■ Technical documents such as instruction manuals and training guides ■ Original musical works ■ Original artistic works – including paintings, engravings, photographs, sculptures, collages, works of architecture, technical drawings, diagrams, maps, and logos ■ Films, including videos ■ Published *editions* of literary works ■ Sound recordings in any medium.

Copyright subsists as soon as a work is recorded in any material form. Copyright may protect a work that expresses an idea but not the idea behind it.

Patent Registration and Technical Innovation

Patents represent an outcome of technologically oriented inventive activity and are generally intended to cover products or processes that possess or demonstrate innovation in functional or technical aspects. Moreover, since firms invest considerable amounts of time and money to obtain patent protection, the existence of a patent usually indicates an expectation that it will bring a return on this investment.

It should also be understood that not all inventions or innovative activities result in a patent, and not all patents are exploited economically. Patents do not measure innovation *per se*, but rather the existence of knowledge which has the potential for innovation; these two things are very different.

The level of patent registration gives only a partial picture of the level of innovation in an economy. Other complementary indicators exist or are being developed (by OECD and EUROSTAT), but these can pose problems in terms of availability, comparability and interpretation. One such indicator is the *technological balance of payments* (TBP) which measures international trade in technical knowledge and services – for example, on sales of patents, licences for patents, know-how, models and designs, trade-marks, and technical services. Such data is extremely valuable and sheds important light on a country's ability to sell its technological know-how, or conversely its dependence on importing foreign technology. It is an important indicator of the international diffusion of technology. However, TBP data is not available for many countries, and requires further harmonization efforts. When comparing countries' patenting levels, differences in their industrial structure must be taken into account. Looking at individual technological or industrial sectors can help overcome this problem of interpreting patent data.

Certain industrial sectors, by the very nature of the knowledge they produce, generate more patents than others. For example, it is 'easier' to file patent applications in the field of mechanical engineering than in the services sector. Patentable innovation, however, is not exclusive to the technology sector, and many companies have moved to patent innovations in the areas of finance and software.

Why Is Intellectual Property Important?

In the New Economy, knowledge and information have become a significant source of wealth creation and competitive advantage. Traditional barriers-to-entry are vanishing – capital is now relatively plentiful, and the labour force is increasingly mobile and global. When all businesses are moving at Internet speed, first-mover advantage has almost

vanished. Thus, the barriers-to-entry in the New Economy are increasingly access, presence, and intellectual property rights (IPR).

Ownership of patents confers very important legal rights, such as a 20-year monopoly on exploitation of the patented product or process. And patents have become key assets of multinational companies – enabling them to establish and protect market share and in many instances to become *de facto* market controllers. Patent infringements almost certainly result in legal actions and demands for compensation. Furthermore, intellectual property rights can bring in revenue streams as patent-holders license their ideas for large fees – for example, by 2003 IBM was the top registrar of patents in the US, having tripled its revenues from licensing since 1994.

The implications of these developments for Ireland are clear. The development, commercialisation and exploitation of IP is a major development path of the future. But Ireland has a long way to go. We have only begun to develop our innovative capacity, and our level of investment in research and registration of patents is still low by international standards.

What Is Technology Transfer?

Closely related to the idea of intellectual property is the idea of *technology transfer*. This is the formal process of commercialising intellectual property (IP) generated in research institutions, primarily through selling or licensing IP to industry or the creation of new spin-out companies.[1] In other words, it is the means by which innovative ideas move from the laboratory to the marketplace.

Technology transfer represents a desirable outcome of technologically oriented inventive activity in research institutions. Successful commercialisation benefits the researcher, the research institution, funding agencies, the tax payer, and Irish industry and society generally through additional incomes, revenues and employment.

Why Is Technology Transfer Important?

Technological innovation and the acquisition of intellectual property are fast becoming recognised as offering a very sustainable business approach. The transfer of technology

---

[1] ***Spin-out companies*** are established to exploit intellectual property owned by the university, and to which the university has a right to some return in the form of an equity stake in the business or royalties etc. A spin-out may involve the employment of staff, post-graduates and students from the university, but could equally involve the assembly of a new management team drawn from outside of the University.

Start-up companies are established by University staff/students, where there is no direct IP or equity link to the university.

from research organisations to industry is central to the commercialisation of state-funded research investment. This activity was facilitated in the US by the Bayh-Dole Act in 1980 and this was central to the successful commercialisation of research by Universities in the US – Stanford and MIT Boston in particular. Universities in the UK are currently increasing their investments in technology transfer and making improved efforts to commercialise their research. In Ireland, the interest in IP management and technology transfer has been stimulated by the significant investment into R&D under the NDP 2000-2006.

Within a well-functioning national system of innovation, which inspires and supports technological advancement and increased industrial competitiveness, the commercialisation of research is achieved by promoting the transfer of knowledge, capability and capacity from universities and research institutions into industry and the marketplace. This process of technology transfer is complex in view of the different missions held by the key stakeholders, even though both research institutions and industry recognise its importance. They also recognise that technology transfer is an essential element in the commercialisation of research and the development of Ireland's technological competitiveness.

What Is Ireland's Track Record in Intellectual Property?

Ireland is, however, at a very early stage in the development, commercialisation and exploitation of IP. This is characterised by low levels of patent registration (IP protection) in Ireland compared to other EU member states. Chapter 3 of this document looks at the generation of technological knowledge as codified in patents in Ireland.

Ireland has a low level of patent registrations nationally, under the European Patent Office (EPO) and under the US Patent and Trademark Office (USPTO). This becomes particularly evident when Ireland is compared to other EU member states of similar size. If Ireland is to benefit from the recent increased investment in research and innovation, it is important that appropriate support mechanisms are in place to enable the protection of research findings and to stimulate their commercialisation where appropriate.

The Circa study on patents generation and licensing, commissioned by Forfás, has found that among researchers in the third-level sector the level of awareness of the importance of patents and of the patent process is low. The study also found that there was a lack of awareness within the third-level sector of the costs associated with registering and defending a patent. Where there was awareness, the high level of costs emerged as a deterring factor in the low level of patent activity by Irish researchers/inventors. In addition to the cost of the patent application process, the cost of defending a patent against infringement can be substantial. Additionally, there was a lack of expertise in the third-level sector in relation to evaluating the commercial potential of research findings. University research budgets generally do not provide for patent application and subsequent patent maintenance.

2 KNOWLEDGE COMMERCIALISATION IN IRELAND

Overview of Knowledge Commercialisation

The commercialisation of knowledge is a complex process that begins with the generation of research results and progresses through a number of intermediate steps to the final utilisation of the results in commercial applications. Along the way, there are several groups of actors involved in this process. Figure 1 presents a model of how these different groups of actors interact in the process of knowledge commercialisation.

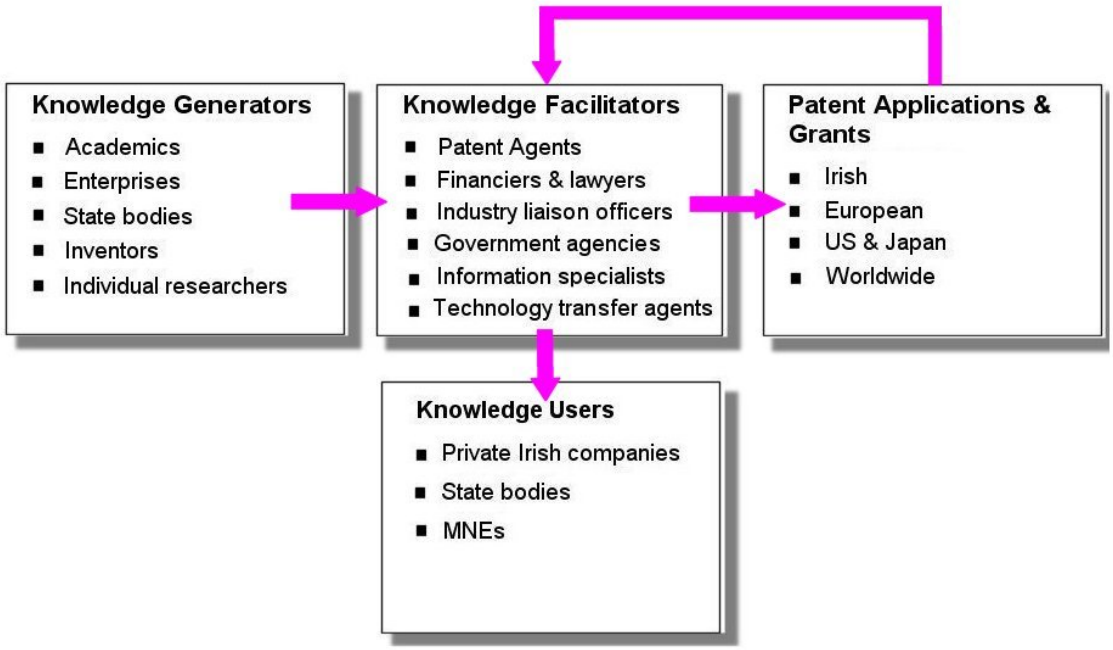


FIGURE 1: AN IP BUSINESS MODEL, SHOWING THE MAIN ACTORS

This chapter deals with each of the main groups of actors in the knowledge commercialisation process, and also deals with the policies and supports that are available for Intellectual Property rights.

The Knowledge Generators

The generation of knowledge through organised research arises from a number of sources, the principal of which are:

- Universities, Institutes of Technology, and other research institutions (including the PATs (Programmes in Advanced Technologies)
- State Agencies
- Industry
- Individual inventors.

Universities, Institutes of Technology and Other Research Institutions

The seven universities and the fourteen Institutes of Technology have active research programmes across all science and technology disciplines. In addition to their primary objective of generating knowledge, these research programmes also have a role in the training and development of students and research personnel.

Significant research funds are invested under a variety of programmes. Programmes range from those concerned with basic research to those that are highly focused and take an applied, problem-solving approach.

State Agencies and Government Departments

There are twelve state agencies (non commercial and commercial) and Government Departments which actively engage in, or sponsor scientific research. Examples include the Environmental Protection Agency (EPA), COFORD, Bord na Móna, and the Department of Communications, Marine and Natural Resources.

While much of the research conducted by stage agencies and Government Departments consists of data gathering or similar survey type research, some of it is applied research with the potential to develop into intellectual property by means of patent or licence.

Industry

The majority of research conducted by industry is highly focused, and is essentially aimed at improving existing products or processes, or in generating entirely new ones. Applied research may be conducted in both Small to Medium Sized Enterprises (SMEs) and large Multi National Enterprises (MNEs). Within the MNEs a degree of fundamental research is also conducted, usually strongly allied to the core science discipline within which the firm operates. Such fundamental research is conducted with a view to achieving revolutionary 'breakthrough' technologies for future and often as yet unknown products and processes.

Industry research may be carried out entirely within the resources of the company or in partnership or subcontracting arrangements with researchers located in other organisations, primarily the universities and institutes of technology.

Individual Inventors

Historically there have always been individual researchers who operate alone and are essentially self-resourced. While the public perception may be that such 'inventors' are a significant source of knowledge and new products and processes, the reality is that, with a few notable exceptions, individuals lack the substantial research and financial resources that are usually necessary.

Knowledge Intermediaries

A number of intermediaries are involved in turning an idea, an invention or research findings into a commercial success. These include the following:

- Patent agents
- Technical and licensing consultants
- Lawyers
- Technology transfer brokers
- Financiers
- Government agencies

Patent Agents

There are thirty-seven individuals registered to practise as patent agents by the Irish Patents Office. There are five significant practices, the largest of which employs 70 people, including support staff. Patent agents have a primary technical degree and go on to train in a practice and take the Patent Office examinations. Many of them also go on to become members of the Chartered Institute of Patent Agents (UK) and/or become European patent attorneys. Those who operate in practices also work with registered trademark agents.

The services provided by patent agents generally include advice on all aspects of IP, filing of applications and obtaining protection in Ireland and abroad through a network of associates. They also provide services in licensing and research. In general, the level of service provided in Ireland is comparable to, or better than, that in many other countries but patent agents have difficulty in recruiting good staff in what has become an increasingly complex area.

Technical and Licensing Consultants

There are no full-time licensing consultants in Ireland although there are many in larger countries. The Licensing Executives Society has 6,000 members worldwide, many of whom are full-time involved in licensing. The reason why licensing consultants do not operate full-time in Ireland is because of the low level of activity in licensing and the fact that a lot of the work is done by patent agents or lawyers. Technical consultants also facilitate the commercial exploitation of inventions mainly by assisting with aspects of R&D management including evaluation of projects and advising on patenting and licensing.

Lawyers

Only the major law firms have IP lawyers who provide services in relation to patent litigation or licensing, but many international companies offer services throughout Europe. As patenting activity develops, it is expected that patent litigation and the need for legal services will increase.

Technology Transfer (TT) Brokers

There are no full-time independent technology brokers in Ireland. Technology brokerage on a *no-foal no-fee* basis has yet to become a viable business in Ireland and most consultants work on a fee basis or on a mixture of fees and commission or royalty. Usually they are commissioned by a potential licensee to search for technology and no fee is paid by the licensor. There are many successful firms in the US due to the higher level of technology transfer activity there, both inside the US and internationally. Technology brokerage is also carried on in the Far East where consultants can be found.

Financiers

It now costs about €100,000 to obtain a patent for an invention in the developed countries of the world. This is outside the range of private individuals, third-level colleges and small firms. Most inventors therefore attempt to license their technology before the major funding needs arise in the patent process. The licensor would then take over patent filing and defence costs.

Companies wishing to use the patent themselves must obtain some form of financing to allow them to do so. Financing is obtained by a number of routes. These can include private borrowing, raising capital by selling shares in a patent holding company giving a tax-free return, raising venture capital for a manufacturing company to exploit the invention, or obtaining assistance from the Intellectual Property Unit in Enterprise Ireland. Most patent holders do not provide for the possibility of fighting a legal action although legal expenses insurance is available.

Government Agencies

A key support is provided to industry by government agencies such as Enterprise Ireland which has intellectual property expertise in its Intellectual Property Unit and Technology Transfer Service. It also provides services in patent and technical information.

Under the Industrial Research and Standards Act 1961, the Institute for Industrial Research and Standards (IIRS) was empowered to 'assist in the development of inventions where it is in the public interest'. This role has been passed down through Eolas and Forbairt to the present IP Unit in Enterprise Ireland. This unit administers a budget of €400,000 which devotes about 50% to inventions submitted to the unit from outside and 50% to projects coming from the Programmes in Advanced Technology.

The unit accepts submissions for inventions and gives advice on initial protection and commercial exploitation. Where a satisfactory plan for commercial exploitation is received the unit provides initial funding of 100% to a limit of €19,000, usually to pay for a Patent Cooperation Treaty (PCT) application. At the end of the PCT period and following a review,

further funds up to €30,000 can be provided at 50% funding rate with a royalty repayment schedule on a cost recovery basis.

Historically the universities have not used these funds, possibly because in the early days assignment of the patent was required, similar to the UK approach. This was dropped many years ago but there may still be a perception that there are strings attached to obtaining funds from Enterprise Ireland.

In addition, plans are being made to provide IP assistance in conjunction with the Advanced Technology Research Programme and the Research Innovation Fund.

The Irish Patents Office / Oifig na bPaitinní

The Irish Patents Office is the body responsible for the granting of patents and the registration of trade marks and industrial designs in Ireland. Applicants for patents are required to submit evidence of novelty in the form of a search report carried out by a larger patent office elsewhere.

The Irish Patents Office remains a significant earner of revenue for the exchequer, bringing in approximately €4.0m per annum. A number of efforts have been made in recent years to develop the Irish Patents Office as an information service to encourage innovation. A Patent Office Users Council was set up in 1997 and has continued to meet and make recommendations. The Irish Patents Office has engaged in a number of initiatives to promote information on its services and on the patents system but these have been low-key.

Table 1 summarises key statistics relating to the Irish Patents Office.

TABLE 1: IRISH PATENT OFFICE KEY STATISTICS 1998-2001[2]

	1998	1999	2000	2001
Patent Fees Received (€m)	3.64	4.04	4.82	3.91
Surplus of Income/Expenditure (€m)	3.10	3.75	4.01	3.75
Number of Patent Examiners	9	4	4	4
Number of Patents Applied for		162	212	257
Number of Patents Granted		45	39	53

Knowledge Users

Commercialisation can be defined as the process by which research outputs are converted to commercial usage or ownership. Only a very small proportion of the knowledge

[2] Source: Irish Patents Office Annual Reports, 1998-2001

generated through research ever reaches a point where it provides a commercial return to the various players in the progression of an invention through to commercialisation.

Universities and ITs

Within the institutions the impetus for commercialisation of research findings comes from the researcher and/or the ILO. Support can take a variety of forms ranging from the provision of the ILO skills and technology transfer Programmes to more direct financial arrangements. The commercialisation may be in the form of a licence to an existing company, or creation of a new company.

Also of note in regard to commercialisation support are the Enterprise Ireland Programmes in Advanced Technologies (PATs). Several of these PATs (particularly BioResearch Ireland and AMT Ireland) provide assistance to college researchers in technology commercialisation.

Where Campus Companies are not involved, the universities and ITs may promote those research findings that are considered to have commercial potential to outside companies.

Commercialisation via this route is often impaired by lack of specific market knowledge or of a sufficient capability to evaluate the commercial viability and potential of the research findings.

State Agencies and Research Institutes

As a number of State Agencies, such as Teagasc, the Marine Institute and the EPA now have an increasingly commercial brief it can be expected that they will become more active in commercialisation of their research findings in the future. Often these bodies believe that they have little IP to license, but even data can be exploited. For example, geographical knowledge such as that generated by the Ordnance Survey Office is commercially exploited through mechanisms such as licensing or copyright.

Other proven routes are the creation of spin-off companies such as has occurred in Bord na Móna where the development of environmental protection equipment (wastewater treatment systems) arose from research sponsored or originating in the parent organisation.

Industry

Within industry the path to commercialisation is more straightforward, as the initial research is likely to have been tightly focused on meeting a specific commercial need. In such instances the commercialisation fits readily within the company's existing structures for patent protection, prototype development, testing, final modification and market entry.

In other instances industry may have a requirement for a product or process (or some sub element of same) the research or development of which has not been undertaken or sponsored in-house. In such cases various routes to adoption of research findings may be taken. Many companies actively trawl the knowledge generators operating in the relevant field for outputs that meet their needs; larger companies may also sponsor promising research with appropriate experts, with an agreement on rights to the output.

Individuals

In parallel with this industry-based commercialisation route, individual 'marketeers' or 'miners' can play a part in acting as locators of commercial research output and finding and matching this with an appropriate commercial enterprise's need. Similarly individual 'inventors' with a strong entrepreneurial capability have succeeded in commercialising their own research. However, as noted, the diversity of skills and knowledge resources necessary severely limits the potential for commercial success by such individuals.

Policies and Supports for Intellectual Property

Interest in IP is increasing as businesses and state agencies become more aware of its value as a potential driver of economic advantage and seek to get the message out to the wider business community – the current document is part of that dissemination effort. Forfás, the Irish Council for Science, Technology and Innovation and Enterprise Ireland have been to the forefront in this area. Tax incentives also provide a valuable support for the commercialisation of intellectual property.

Irish Council for Science, Technology and Innovation

The Irish Council for Science, Technology and Innovation (ICSTI) was established in 1997 to advise policy makers on science, technology and innovation-related issues. Over the years it has been proactive in urging that greater attention to be given to the area of intellectual property. It is of the opinion that 'increased efforts to utilise intellectual property generated from publicly funded research in Ireland can be a driver of significant socio-economic benefits'.

In January 2004, ICSTI published a *National Code of Practice for Managing Intellectual Property from Publicly Funded Research*. The code incorporates:

- Principles for the management of intellectual property
- Code of practice for the management of intellectual property from publicly funded research
- Guidelines for the implementation of the code of practice.

The *National Code* has been widely endorsed by stakeholders in industry and all the major funding organisations, the Irish Business and Employers Confederation (IBEC), the Irish

Venture Capital Association (IVCA) and the Conference of Heads of Irish Universities (CHIU).

Enterprise Ireland

Enterprise Ireland has funded a significant programme of R&D Management training courses under its Innovation Initiative which have included modules on IP.

Enterprise Ireland provides assistance under an Intellectual Property Assistance Scheme aimed at protecting, developing and commercialising inventions. Available figures indicate that the private sector accounts for some 90% of the applications for support with the universities accounting for as little as 9% and the Institutes of Technology 1%. The universities and Institutes of Technology are not the primary focus of this support and it is not currently a meaningful source of funding for them.

Through its Research Innovation Fund, Enterprise Ireland provides support for research commercialisation:

- Proof of concept: €50-70,000
- Technology Development: €300–400,000
- Commercialisation of R&D: €215–300,000

In addition, Enterprise Ireland has a range of other supports that could be helpful to assisting R&D and patent commercialisation:

- Seed Fund
- Equity Fund
- Incubator Centre Initiative
- Technology Transfer Initiative – Atlantic University Alliance (UCC, NUI Galway and the University of Limerick)
- CORD and Mentor programmes.

Additionally, a group comprising Forfás, Enterprise Ireland, ICSTI, CHIU, SFI, HRB and HEA has been established to progress the national dialogue on the commercialisation of research.

Tax Incentives

Under the Finance Act of 1973, tax exemption for patent royalty income was first initiated. The relief was targeted at those companies pursuing ongoing research and development programmes or exploiting significant innovations protected by patents. The patent must be granted before the exemption can be claimed but relief may then be backdated to the filing of the complete specification. This incentive mechanism has been modified in recent years in order to eliminate or reduce the possibility of its abuse as a tax evasion mechanism.

The unique tax incentive position that applies in relation to patents in Ireland is considered, at least on anecdotal evidence, to be a valuable but under utilised stimulant and support for the development of returns through patents. In the current R&D climate the exemption should be particularly attractive to:

- Inventor entrepreneurs
- Third-level researchers
- Existing manufacturing companies
- Investors.

Furthermore the tax incentive can provide attractive backing to the specific support initiatives promoted by Enterprise Ireland including

- High Potential Start-Ups (HPSUs)
- Commercialisation of Third-level Research
- Existing SMEs.

R&D: Tax Disadvantages

The unique tax incentive position that applies to patents in Ireland is regarded as a valuable but under-utilised stimulant. However, Ireland does not have as favourable a tax regime in respect of R&D expenditure as other OECD countries, particularly since the abolition of the quadruple R&D allowance in the late 1990s – out of 24 OECD countries, Ireland ranks 14th for large firms and 16th for small firms in its level of tax incentives for R&D.

In order to redress the declining growth and intensity of business R&D expenditure in Ireland in recent years, Forfás in conjunction with the industrial development agencies has proposed the introduction of a 20 per cent tax credit payable on incremental R&D expenditure.

3 PATENT REGISTRATION IN IRELAND

The level of patent registration gives us one measure of the scale of knowledge creation and commercialisation in Ireland. It is, of course, only a partial picture: not all patents will be successfully commercialised, while others can have a very significant impact on the industrial products and processes industrial processes whether patented or not.

In this chapter we look at the patent system in Ireland:

- How patent applications are dealt with
- The level of patent applications in Ireland and emerging trends
- Ways in which patent performance in Ireland might be improved.

Patent Applications

A patent application must relate to a single invention only or to a group of inventions so linked as to form a single general inventive concept. If an application cannot uphold the requirements of unity of invention, then a divisional application may be filed. Divisional applications can be filed only in respect of subject matter which does not extend beyond the content of the earlier application. These divisional applications then have the same date of filing and, where applicable, priority date of the earlier application.

A patent application is published as soon as practicable after the expiry of a period of eighteen months from the filing date (or the priority date if there is one), unless it has been finally refused or withdrawn before the termination of technical preparation for publication. It may however be published earlier upon request by the applicant. The publication of an application is advertised in the *Patents Office Journal*. Copies of published applications are made available to anyone who wishes to inspect or purchase them.[3]

A patent application consists of:

- A request for the grant of a patent – the prescribed filing fee must accompany the application;
- A specification – a description (and drawings) of the invention, and claims defining the matter laid out according to the Patent Rules 1992 and the Patents Act 1992;[4]
- An abstract containing a summary of the matter contained in the specification; and
- The name and address of the inventor(s) – if the applicant is not the inventor, the derivation of his/her right must also be given.

---

[3] Irish Patent Office PO website: www.patentsoffice.ie.

[4] *Copies from Government Publications Sales Office*.

The Patents Office accepts applications for both long-term and short-term patents:

Long-term Patents	Long-term (or full-term) patents allow the inventor/applicant protection for 20 years. The requirements for filing an application are as above, but for a long term patent to be granted, the applicant must prove evidence of the invention's novelty. This can be done by issuing the Irish Patent Office with a request for a search report to be conducted, or by supplying 'evidence of novelty'. The Irish Patent Office (IPO) is a legal and promotion office and does not examine patent applications – as a rule, searches are contracted out to the UK Patent Office.
Short-term Patents	Short-term patents offer a less complex and quicker alternative to long-term patents. Usually they can be granted within twelve months of the filing date, as long as the applicant complies with all the requirements promptly. The period of protection offered by a short-term patent is five years. If applications are made for both a short-term patent and a long-term patent in respect of the same invention, the short-term patent becomes void once the long-term patent is granted. The provisions for short-term patents are the same as for long-term patents with a few exceptions: for short-term applications, procedures are simpler and fees are 50% of those that apply to long-term patents.

Trends in Irish Patent Activity

Ireland's level of patenting activity is particularly low – a fact that has been consistently highlighted. One contributory factor is Ireland's dual industry structure and a foreign-owned sector that, with few exceptions, does not carry out high value-added activities in Ireland. An earlier Forfás study (1999) gave Ireland's ranking as 18th out of 28 OECD countries in terms of European Patent Office (applications) and 18th out of 23 countries for US Patent Office (USPTO) patents granted.

In its review of Irish patent registrations for Forfás, Circa undertook literature searches of the Irish, European and US Patent Offices to obtain statistical information on patent activity by applicant, by sector and by science and technology field, in different countries. Information was also sought in Eurostat and OECD publications and from the European Innovation Scoreboard. In addition, recent studies and statements on IP in Ireland and elsewhere were reviewed.

Circa held structured interviews and focus group discussions with key stakeholder groups, including research performers, technology transfer staff, state R&D funding agencies, private sector service providers and patent intermediaries.

Circa used 2000 as the base year for the collection of Irish Patent Office data, but in doing so acknowledged that Irish research funding has changed dramatically in subsequent years and that the lead time for publication of a patent, before exploitation, can be several years. Choosing a base data year is inevitably problematic: before 2000 R&D funding was low and comparisons with current patent rates might not be like-for-like comparisons. On the other hand, patent application details are not published until approximately 18 months after the date of their submission, so 2001 or 2002 were not feasible as base data years.

Applications for patents can be made in Ireland and by Irish interests in Europe and the US. Table 2 shows the number of long and short-term patents granted by the Irish Patents Office during the period 2000-2002.

TABLE 2: IRISH GRANTED LONG- AND SHORT-TERM PATENTS[5]

	2000	2001	2002
Full–term patents	298	249	381
Short-term patents	158	302	236
Total granted	**456**	**551**	**617**

Table 3 shows the number of Irish patent applications and patents granted through the European Patent Office (EPO) compared with Finnish figures.

TABLE 3: NUMBER AND PERCENTAGE OF EUROPEAN PATENT OFFICE APPLICATIONS AND GRANTED TO IRELAND AND FINLAND[5]

	1999		2000		2001	
	Number	%	*Number*	%	*Number*	%
Ireland						
Applications	162	0.18	212	0.21	257	0.23
Granted	45	0.13	39	0.14	53	0.15
Finland						
Applications	1017	1.14	1223	1.21	1571	1.43
Granted	352	1.00	264	0.96	340	0.98

[5] Source: *Irish Patent Office Annual Reports*, 2000-2002.

Countries that file a larger number of patent applications also tend to have a higher conversion rate from applications to granted patents. Ireland's conversion rate is noticeably below that of countries with a similar level of applications. The lack of funding to see the patent programme through to grant level may be one possible reason.

Ireland is increasing its share of the European patents granted and also its share of US granted patents, although the overall level is still low (Table 4).

TABLE 4: AVERAGE ANNUAL GROWTH IN PATENT SHARE OF FASTEST GROWING COUNTRIES IN THE EU (1992 – 1999)[6]

Rank	European Patents		US Patents	
	Country	*Share %*	*Country*	*Share %*
1	Finland	7.8	Denmark	6.8
2	Ireland	7.6	Belgium	3.9
3	Sweden	6.1	Spain	2.9
4	Greece	6.0	Finland	2.7
5	Spain	5.6	Ireland	2.5

Ireland heads the table of annual growth in patent filing at the EPO with a growth rate of 26.0% from 1995 to 2000, with Luxembourg second at 23.8%. In terms of patents filed per million of population at the EPO, Ireland is well down the list at 70 patents, behind the UK at 113 but ahead of Italy at 67, Spain at 21, Greece at 6 and Portugal at 4.

Patent Activity by Sector

The level of patent activity varies with the area of technology. Table 5 shows the main technology classifications of EPO-granted patents originating in Ireland during the period 1999-2001.

[6] Source: *Third European Report on Science & Technology Indicators,* 2003.

TABLE 5 - MAIN TECHNOLOGY CLASSIFICATIONS OF EPO-GRANTED PATENTS ORIGINATING IN IRELAND[7]

Technology Classification	1999	2000	2001
	Number of EPO-granted Patents		
Health (incl. medical devices)	15	19	43
Electronics	7	16	36
Medicines and Toiletries	15	14	33
Controlling and Computing	14	35	32
Instruments	9	13	15
Organic Chemistry	3	11	10
Electrical Devices	8	12	9
Construction	8	16	8
Fermentation	7	7	7

The recent growth in Ireland in medical devices, pharmaceuticals, computers, software and electronics is clearly evident, but not in agriculture and food.

Irish-owned and Foreign-owned Companies Compared

Analysis of the profile of Irish-based companies engaged in patenting shows that none of the top 50 exporters are among the top ten foreign-owned patenting companies, and leading computer manufacturers are entirely absent. Only one of the top 15 pharmaceutical exporters (Abbot) appears on the list. Analysis of top indigenous patenters shows that they are mainly SMEs operating in traditional sectors. However, the omissions tell us more about the state of indigenous industry than those that are included. The Irish food sector contributes two-thirds of all indigenous industry exports but no major food company or co-operative appears on the list (Table 6).

[7] Source: *European Patent Office Annual Reports*, 1999-2001

TABLE 6: MAJOR PATENTERS OF IRISH-BASED INVENTIONS, 1990–1999[8]

Irish-owned Companies		Foreign-owned Companies	
Elan	43	Analogue	78
Tillotson	7	Loctite	36
Oglesby & Butler PLC	8	DEC	26
Westonbridge International	8	Molex	26
Caroll Products & Designs	6	Hitachi	20
Abatis Medical Technologies	4	Square D	14
Arthur Guinness Son & Co	4	Abbot	8
Bard Connaught	4	IBM	8
Burlington Consolidated	4	Logitech	6
Ryan Plastics (Ireland)	3	Donnelly Mirrors	5

Analysis of Irish patent activity

The Circa study found that the overall levels of patent filing and patent granting in Ireland and by Ireland in Europe and the US are low in comparison to similar sized EU economies.

Denmark, Austria and Finland are the European countries that are nearest to Ireland in terms of population size and industrial structure. When patenting activity in the technology sectors of Ireland and these four countries is compared, Denmark and Finland come out ahead of Austria and Ireland. Ireland's performance, however, is improving steadily in all sectors except agriculture, food, health and environment. This highlights the fact that research performed in these sectors is generally not focused on commercial exploitation. Ireland's growth is most noticeable in computing and electronics. Ireland's performance in organic chemistry is disappointing although some of the performance in this sector may be showing up under other categories – for example, under medicines.

The number of patent applications from public (government) research bodies in Ireland is very small – as few as 2-3 per year. Much of the government-funded research is directed at public good purposes, and as such is disseminated widely and freely to encourage the maximum adoption throughout society. But the historically low level of patenting activity also reflects the low level of publicly-funded research and a lack of awareness of the possibilities of commercial exploitation.

[8] Source: Gogan & McDevitt

The Circa study also attributed the low level of patenting by public research organisations to the following:

- Low levels of awareness of IP among institutional researchers, particularly in the institutes of technology
- Shortfall in the availability of staff with expertise in IP management (this is more crucial for the universities, as they produce most of the patents)
- Low levels of commitment from the universities and institutes of technology to producing patents
- Low levels of funding for patents and associated activities.

Enhancing Irish Patent Performance

This section outlines some of the ways in which the issues currently facing the performance of patenting activity in Ireland can be addressed.

Developing Awareness of IP among Researchers

The value of intellectual property and patents as an important building block in the development of a knowledge-based economy is not adequately recognised within public research organisations and the third-level system. In particular, the rewards system for researchers within the university sector needs to take cognisance of patent outputs – where currently the emphasis is almost exclusively on research publications as the route to career advancement.

Researchers and inventors also generally fail to recognise that securing a patent grant is only the first stage in a process that requires the subsequent inputs and expertise of a number of intermediaries such as patent lawyers, technical and market assessors, technology transfer agents, licensing consultants, business negotiators, financiers and so on. These participants are essential players in the successful commercialisation of patents. Without their contribution, patents in their own right would be worthless. In addition, the successful prosecution of a patent requires continuing inputs by the inventors in defending and/or rewriting claims and answering queries. In this regard, patent agents report that continued cooperation with the researchers is not always possible.

Many researchers do not have a sufficient appreciation of what is required to pursue a patent application – in terms of costs and commitment – and that they can sometimes have unrealistic expectations of the value of patents.

Developing Patent Expertise within the Public Research System

Identifying what research findings have the potential to be patented, finding suitable companies or people to exploit the research commercially, and negotiating the commercialisation are skills that are currently generally lacking among researchers at third-

level, and in the public agencies as well as among college Industry Liaison Officers. There may be a role for dedicated 'miners' to seek out IP with the potential to meet known commercial needs and to establish the linkages with relevant researchers. BioResearch Ireland has engaged two specialists to assist in IP generation, protection and licensing.

Commercial awareness is a skill that needs to be actively fostered. University College Dublin (UCD) is currently holding seminars on research commercialisation. Such courses need to be more formally established and more widely available. To be effective, the courses need to provide an overview of a wide range of related areas such as appropriate research protocols and logging/recording of research findings, the patent process, patent protection, patent law, IP issues, commercialisation costs, the commercial realities that operate within the marketplace for research findings, and so on. Such courses, if accredited and formally recognised for career progression, could be made more attractive to researchers.

A pilot action is being undertaken by Enterprise Ireland with UCD whereby the staffing capability and capacity for the technology transfer function in the college is being augmented to cover ICT and Biotechnology. These specialists will be Enterprise Ireland employees, placed in UCD's Industrial Liaison Office and reporting on a day-to-day basis to the ILO. It is expected that these individuals will act as a flexible and dynamic link between the research community and the resources and networks available in Enterprise Ireland.

Developing Funding Mechanisms for Patenting Activity

The Circa study found that patenting activity is not inadequately supported by the state development agencies. And if the level of patenting activity is to be increased, additional resources will be required to meet the significant financial burden associated with carrying a research finding through to a fully protected and commecialised patent. One way of doing this is to establish a dedicated patent fund that would be available to the university or institute of technology generating the knowledge to be protected. Alternatively, or additionally, patenting costs could be an allowable cost for research grant purposes.

In proceeding down this route the potentially very significant costs to the state in funding such an approach must be carefully balanced with the potential for commercial success and financial return. In this regard it must be recognised that patents in their own right are not reliable indicators of likely future success and should be correctly regarded as high risk, speculative ventures.

Expanding the Role of the Irish Patents Office

In recent years patent offices across Europe have modernised and extended their facilities and services to better facilitate patenting activity, to promote IP protection (patents) to enterprise, and to encourage technological progress. By contrast with offices in other

countries, the Irish Patents Office has a more limited role, and the number of examiners has been reduced from nine to four in recent years. With so few examiners, the Irish Patents Office does not currently have the capacity to develop the expertise that could attract international business in specialist areas. A patent office with both searching and examining capabilities is considered to be of vital importance – currently the Irish Patents Office has no searching capacity.

The Finnish Patents Office (FPO) offers a model that the Irish Patents Office could emulate. The FPO annually processes the highest number of hi-tech patent applications in the world. In conjunction with the Finish Foundation of Innovation, the FPO sponsors 18 innovation managers who are placed in Industry Development Centres and in universities. These collaborations are seen as a crucial part of the strategic aim to reach all possible clients.

The FPO considers dissemination of patent information, which also covers the promotion of the patent system, as a key strategic process. The aim of active dissemination of patent information is to support industry in directing its inputs into product development in an effective way, to further the adoption of new technology, and to reduce overlapping of product development and research. The FPO has a dedicated budget for promotion activities amounting to €1.7 million per year. Each year, a detailed promotion plan is determined for activities such as participation in trade fairs and training courses for customers and cooperation partners. This is accompanied by a performance monitoring mechanism which includes objectives, means and performance indicators.

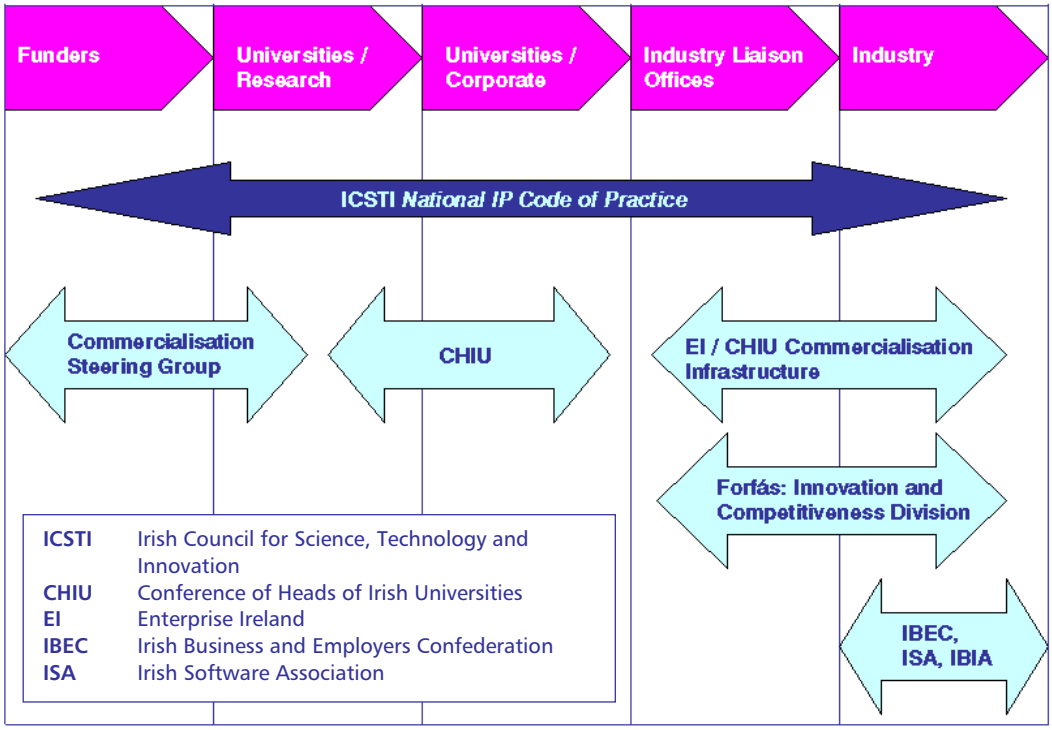
4 TECHNOLOGY TRANSFER IN IRELAND

The creation, protection, development, commercialisation and exploitation of IP represent a major development path for the future in Ireland. Considering the potential outputs from the €2.48 billion investment in research, technological development and innovation under the NDP, 2000-2006, policy must optimise the commercialisation potential arising and promote the exploitation of new technology and its contribution to overall national development.

State policy on IPR is developing slowly. The Department of Enterprise Trade and Employment, Forfás, Enterprise Ireland (EI), Science Foundation Ireland (SFI), the Higher Education Authority (HEA) and the Irish Council for Science, Technology and Innovation (ICSTI) have all explored IPR issues over the past few years, and private bodies such as the Irish Exporters Association have a deep interest in IPR and knowledge-based exports.

The principal stakeholders in the knowledge commercialisation chain have all acknowledged the need for improved technology transfer and have taken initiatives to that end. Figure 2 is a representation (derived from ICSTI) of the activities of the various stakeholders in the area.

FIGURE 2: OVERVIEW OF STAKEHOLDER INITIATIVES ON IP COMMERCIALISATION[9]



[9] Source: ICSTI, *ICSTI NCP Taskforce Workshop,* October 2003

In this chapter we look at technology transfer in Ireland:

- How research institutions and universities interact with industry; and how the perceived culture clash between the two can be addressed
- The levels of technology transfer and R&D activity in Ireland
- The role of knowledge intermediaries in technology transfer activity, in particular in the light of increased EU regulation
- The management of technology transfer in Ireland – in particular, the levels of staffing in research institutions and universities, alternative approaches that can be taken to technology transfer, and the importance of assessing research outcomes
- Ways in which technology transfer in Ireland might be enhanced.

Research Institutions and Industry: Making Connections

The average time lag between discovery and realisation of income is four to nine years – perhaps longer for biomedical technologies. It is often very difficult to assess the immediate and long-term value of the IP. Sometimes the research institution, the intermediaries or the knowledge user may have unrealistic expectations that are difficult to manage. In a typical start-up situation, universities will require, as a return on their investment, a 15 per cent of the equity in any company set up on foot of a research proposal. Subsequently when the company seeks venture capital, the universities or research institutions will seek to retain that 15 per cent equity undiluted, even where the issued share capital of the company is now considerably increased. Usually, the universities or research institutions will also require the reversion of any licences in the event of company failure. Such requirements on behalf of the universities can form a major impediment in licensing negotiations and many venture capitalists regard them as prohibitive.

Dealing with Culture Clash

In general, industry views the process of IP licensing from universities and research institutions negatively. Some companies have tried to license from institutions but have given up in frustration. Too often business and institutional cultures clash because institutions are not attuned to the needs of business. In addition to the need to reduce complexity and bureaucracy, industry considers that:

- Technologies are often too early or underdeveloped
- The terms of licensing are often unreasonable and unrelated to the commercial value of the technology
- The cost of further R&D and the requirement for 15 per cent equity participation in start-up companies are unreasonable.

Similar views are held by entrepreneurs who have previously held research or academic posts within colleges, and have dealt with the colleges as part of the creation of start-up companies.

National Code of Practice

There is agreement amongst research funders, researchers and industry that uncertainty about IP ownership is one of the main barriers to effective technology transfer and research collaboration. In the US, clarity was provided through the introduction of legislation under the Bayh-Dole Act 1980. In Ireland, the implementation of ICSTI's *National Code of Practice* (published in April 2004) will assist in addressing this issue by clarifying issues such as:

- Ownership of the IP
- The duty to report discoveries
- The share of income and assignment of IP
- The state's right to retain an interest in IP
- The share of the income that goes to the research body to support research
- The elimination or management of conflicts.

The *National Code of Practice* addresses only IP generated from 100% publicly funded research. IP generated from collaborative, public–private funding requires equal attention. At the request of the Tánaiste, ICSTI is currently developing a National Code of Practice for the management and commercialisation of Intellectual Property from collaborative research.[10] The need for guidelines to commercialise IP from collaborative research has also been acknowledged by the Commercialisation Steering Committee who are working towards a common contract for funding agencies.[11]

Technology Transfer Activity in Ireland

Almost two-thirds of Irish business R&D is performed in foreign-owned industry, mainly in pharmaceuticals and electronics and engineering. Since their establishment in Ireland, many multinational companies have set up either formal or informal R&D activities. In the main, these are related to manufacturing process improvements and in many instances are insignificant relative to gross output. All of these companies were originally set up using the technical expertise of the parent company, often assisted by international plant and equipment suppliers, in this way accounting for the largest inflow of technology transfer into Ireland. Much of their new technology still originates in their parent companies.

[10] ICSTI Task Force on developing a National Code of Practice for Managing Intellectual Property from Collaborative Research.

[11] Chaired by Enterprise Ireland.

During 1998 – 2000, of a selected 2,000 SMEs and indigenous manufacturing companies based in Ireland, 36% of companies with more than 10 employees had a continuous involvement with R&D whilst 29% had an occasional involvement[12]. In this group of companies, 64% were dependent on sources outside their company for most technology improvements, while 49% introduced technologically changed products and 40% developed new processes.

Table 7 provides an overview of where companies source their technology information and their technical needs.

TABLE 7: COMPANY SOURCES FOR TECHNOLOGY INPUTS[13]

Sources of Information	Percentage
Clients	Over 50%
Sources within the company (staff and expertise)	40 – 50%
Suppliers of equipment, materials, components or software Competitors or other enterprises Other enterprises within the group Fairs, exhibitions	20 - 30%
Professional conferences, meetings, journals Universities or other higher education institutes Government or private non-profit institutes	Under 10%

Knowledge Intermediaries and Technology Transfer

The process of technology transfer is facilitated by **Knowledge Intermediaries**, including patent agents, technical and licensing consultants, lawyers, technology transfer brokers, financiers and government agencies. Currently in Ireland, there are 37 licensed patent agents, with only the major law firms having IP specialist lawyers providing services in relation to patent litigation or licensing. There are no full time licensing consultants or independent technology brokers in Ireland.

While the current intermediary services in Ireland are adequate to meet current demand, they are not adequate to meet the expected rise in the registration of new research output that is expected to arise from recent increases in state investment in R&D.

Dealing with Increased Regulation

The requirement for qualified specialist intermediaries is compounded by the introduction in 2004 of further EU regulation on technology transfer, adding further to the complex process of licensing and spin-outs. The European Commission is keen to promote the

[12] CIS3 – Community Innovation Survey 3 (European Union).

[13] Source: CIRCA based on CIS3, August 2003.

dissemination of technology and know-how in such a manner that competition and economic efficiency are improved. Technology transfer is regulated under EC Regulation 240/96 which is currently under revision. The revision will focus on the transfer of technology where the primary objective of the agreement is the manufacture of goods or the provision of services, using licensed technology. The European Commission perceives that there is a greater risk of collusion, market-sharing and cartel behaviour between competitors than in agreements between non-competitors.

In the revised version of EU Regulation 240/96,[14] several new obligations will be imposed on the technology transfer partners:

- Market analysis will become a prerequisite to drafting technology transfer agreements
- The parties will need to establish the extent of their competitor / potential competitor position in the technology transfer agreement, avoiding a possibility of anti-competitive behaviour in the marketplace
- The parties will need to define the 'conditional' terms of the agreement so as to prevent anti-competitiveness and ensure the robustness of any technology transfer agreement.

The revised version of EC Regulation 240/96 will come into force on April 2004, but a transition period applies until October 2005 before full compliance is mandatory.

Current Technology Transfer Management in Ireland

Within the third-level sector, there is a very wide range of approaches to the commercialisation of research. Those institutions, which undertake very high levels of R&D, have more comprehensive technology management activities, mostly coordinated through a dedicated Industry Liaison or Technology Transfer office (ILO or TTO). In many of the institutes of technology (ITs), IP is not generated in any substantial quantities, and the technology transfer is given a correspondingly low priority.

All third-level institutions currently act independently in managing their technology transfer. The key types of technology transfer supports provided by these institutions are for:

- The protection and licensing of IP
- Provision of incubator centres on campus
- Setting up spin-out firms supported by the research institution
- Research for industry either directly on contract or indirectly through collaborative research programmes co-funded by the State

[14] Commission Regulation (EC) No 240/96 of 31 January 1996 on the application of Article 81 (3) of the Treaty to certain categories of technology transfer agreements, OJ L 31, 9.2.1996, p. 2.

- Provision of advice, information, consultancy and training programmes
- The supply of graduates, post-graduates and doctorate-level researchers.

The third-level sector and other research bodies regard the currently available resources and expertise for technology transfer as inadequate for ensuring reasonable success. The role of Technology Transfer Offices (TTOs) includes liaising with scientists, researchers and industry, and with licensing and patenting attorneys. In most OECD countries TTOs are small operations, with fewer than five full-time employees and their work programmes often extend beyond their strict role in technology transfer.

Current Staffing Levels in Technology Transfer

Not all Irish research institutions have clearly identified the role and function of IP management and have created specific positions to manage it. In these institutions approximately 62 people, (22 full-time equivalents (FTE)), are regarded as being involved in commercialisation activities – providing an average of 0.96 FTE staff per research institution. This compares with a median of 2.2 FTE licensing staff and 1.8 FTE other staff at the TTO offices at 168 universities surveyed in the US. The current levels of staff and resources at TTO offices at the research institutions in Ireland are deemed inadequate to ensure successful commercialisation of research.

An examination of the cost of TT Management in the US suggests that institutions with an annual R&D expenditure of less than €40 million cannot recoup their TT commercialisation expenditure. In the UK, the *National Health Service (NHS) Guide* states that the cost of running a technology transfer unit employing two full-time staff plus clerical support could amount to €250,000 per annum including overheads, plus an additional €100,000 in patenting costs (including patent attorneys' fees), giving a total of €350,000. Based on a return of 2.5 per cent[15] such an overhead requires an annual research investment of at least €14-20m.

Alternative Approaches

Research institutions in Ireland have considered three basic ways of managing and commercialising IP:

- As part of the existing Industrial liaison function (most of the Irish universities use this approach)
- As a centralised service nationally, or

[15] The estimated yield of 2.5 % of R&D expenditure is more plausible where large-scale R&D expenditures are involved rather than cases where small portfolios apply. At a large-scale level of R&D expenditure there is a greater chance of a few high return projects.

- As a separate TT company, usually owned by the institution – for example, St Angela's College Food Centre, Sligo and the University of Ulster.

Smaller universities, with fewer inventions, may benefit more either by aligning themselves with the TT offices of larger universities or by forming collective technology transfer offices (TTO) among themselves in order to capture economies of scale. The idea of some level of shared costs and regional alliances would seem to be sensible. In Ireland, several inter-institutional alliances are already in place, such as the Atlantic University Alliance, the Technology Transfer Initiative and TecNet. These alliances have evolved around collaboration in research and educational programmes. In the UK and the US, however, the experience of a single central or regional approach has not been successful.

Whichever approach is taken, good and direct relationships between the TT manager and the researchers are essential for successful technology transfer and research commercialisation. And TT managers and researchers need the active support of senior administrators in their university or research institute.

Importance of Assessment

A further aspect of TT and IP management is the benefit to be derived from periodic assessment of research outcomes from research institutions. Such assessment will assist in the identification and understanding of factors that lead to success and the resources that are required to underpin them.

Ireland does not currently have activity indicators and reporting requirements in place to measure managed technology transfer and progress in the commercialisation of R&D.

Enhancing Irish Technology Transfer Performance

The licensing of technology to enterprise and company spin-outs from research institutions are two specialised activities, which operate within a managed IP and TT framework. A further study is required to address specific issues relevant to technology licensing and spin-outs and their respective required support infrastructure. This study should also address requirements such as the abolition of stamp duty on technology licensing and the imminent implementation of the new EU Technology Transfer Regulation 240/96.

This Section elaborates on other ways in which the performance of technology transfer in Ireland can be enhanced.

Promotion of Research Discovery and IP Licensing

The international technology licensing market is estimated to be worth up to $150 billion annually and growing rapidly, while the European Patent Office estimates the US market

alone is worth over $100 billion[16]. Licensing technology and finding potential buyers for a new technology or innovation can be an uncertain process. Making the right connections as a prospective seller or buyer relies heavily on personal networking, technical competence in the area, excellent market research techniques, and expert access to numerous information sources. This is even more difficult and problematic when one prospects outside one's own industry. It typically can take 12-18 months to find a buyer for each available technology. Moreover, companies rarely look beyond their own industry to market technologies. As a result, the current practice yields only a few deals per large company annually due to high transaction costs.

Technology Marketplaces

US-based companies such as yet2.com and Competitive Technologies Inc. have grown to meet the market demand for technology licensing, helping developers to identify, develop and commercialise innovative technologies. Yet2.com, for example, offers companies a global forum for buying and selling technology on the Internet, and is in effect a virtual technology marketplace.

In Europe, CORDIS, the EU Commission's Community Research and Development Information Service has created a technology marketplace where businesses and researchers can search through and display research findings from EU funded contracts which are available for licensing (Figure 3).

FIGURE 3: A PAGE FROM THE CORDIS WEBSITE SHOWING SCIENCE 'OFFERS'

In Ireland, Enterprise Ireland's Technology Transfer service has been operating since 1991 and has brokered some 400 agreements across all sectors. It provides assistance to SMEs in a number of ways:

[16] Various estimates from European Patent Office, yet2.com and Competitive Technologies Inc.

- By promoting licensing and the exploitation of intellectual property as a viable business process
- By helping SMEs to articulate their technology requirements, or technology offering
- By conducting international searches for partners
- By assisting in the negotiation process between developers and licensees.

The ExpertiseIreland.com website was set up by InterTradeIreland to provide a gateway to an all-island knowledge and competency base. It brings together innovators from both business and research backgrounds and provides information on their areas of expertise, publications and patents.

FIGURE 4: EXPERTISEIRELAND'S WEBSITE

With ExpertiseIreland's knowledge gateway now in place, there is an opportunity to complement this with a stronger promotional activity – to publicise the knowledge and inventions that have been generated and which are available for licensing or take up by industry. This activity could be accommodated within the current ExpertiseIreland gateway and could help to make licensing opportunities more visible to industry in Ireland and worldwide. Consideration should be given to making this facility available to both industry and the research community. The provisions by yet2.com and the Cordis Technology Marketplace may provide templates for such a development.

Developing Technology Transfer Expertise

Additional technology transfer expertise is required across the board in the universities, institutes of technology and state research institutions. There are two ways of addressing the expertise deficit:

- By recruiting staff with strong industry experience particularly in the areas of negotiation and deal-making (the most difficult skills to teach) for technology transfer offices
- By providing training in technology transfer to staff at universities and research institutions. Training needs to be both formal and informal, and should address the skills deficits in the following areas:
  - Appropriate research protocols
  - Logging and recording of research findings
  - The patent process, patent protection, patent law
  - The costs of commercialisation.

Training courses must have the dual purpose of promoting awareness of commercial realities and of delivering the expertise that will enable staff to identify the best opportunities and to take advantage of them commercially. The universities and institutes of technology need to be the primary drivers of such training initiatives.

Training Resources

The effective management of intellectual property arising from publicly-funded research requires that adequate financial and human resources be made available to the universities, institutes of technology and the state research institutes. As already noted, there is currently debate about how best to do this, with the universities favouring a local approach with resources available in each college. The current level of demand, however, makes a centralised or regionalised approach more viable.

Enterprise Ireland has been engaged in discussions with the universities on these issues and, as a pilot action, has supported technology transfer staff in UCD to supplement existing effort. Discussions on financial support for patent protection are also in train.

Apart from the pilot project in UCD (see page 27), Enterprise Ireland has also initiated two further training activities with the aim to increasing the levels of expertise and qualification for researchers and technology transfer personnel in the technology transfer offices of universities and institutes of technology; these involve:

- The provision of expert mentoring to universities and institutes of technology through dedicated consultation with technology transfer from Columbia University, New York and Imperial College, London
- An investigation of potential certificated IP and TT education courses for research and TT personnel at universities and institutes of technology.

Performance Measurement System

With the significant increase of public funding available for research and innovation, a mechanism to monitor performance would allow the impact of public funding to be

measured. With such a mechanism, research institutes would be obliged, through their research contracts, to report on agreed impact indicators to their relevant funding agency. In turn the funding agencies would supply this data to a central body managing the national allocation of research funds.

In their response to the EU's Lisbon Strategy for economic, social and environmental renewal, the EU Commission DG Enterprise has prepared an Action Plan to formulate a European Innovation Policy by 2004, and national governments have been asked to actively participate in this process. The development, collection and publication (on EU TrendChart) of national innovation performance Indicators form part of this policy.

The Association of University Technology Managers (AUTM) in the US and the Association for University Research Industry Links (AURIL) in the UK have both carried out national surveys which have contributed to the refocusing of R&D and its infrastructure. In Ireland no central national database is available to provide the basis for impact assessment. Information on research inputs, IP outputs, IP management and exploitation are critical to the development of technology transfer and research commercialisation impact measurement and policy formulation (Appendix 1).

The Surveys and Technical Evaluation Unit in Forfás already has a national role and responsibility in the collection and collation of national STI indicators. The unit is also the focal point for third party organisations such as the CSO, Eurostat, European Commission, EU TrendChart and the OECD. Their brief, capability and capacity should be extended to incorporate the design, development and implementation of an Innovation Performance Measurement System. Such a system should include, but not be restricted to, indicators identified in Appendix A and those used by EU European TrendChart for innovation.

Appendix A: Suggested Performance Measures

The suggested performance measures listed are based on those used by the Association of University Technology Managers (AUTM) in the US.

Research Inputs	
Value of:	■ State & State Bodies Research Expenditure ■ Research Expenditure from Industrial Sources ■ Research funds from the EU FP6 ■ Total Research Expenditures
Research Outputs Relevant to IP Management	
Number of:	■ Invention disclosures received
IP Management Resources Utilised	
Number of:	■ Licensing Full-Time-Equivalents in technology transfer offices ■ Other Full-Time-Equivalents in technology transfer office ■ Total Full-Time-Equivalents
IP Management Outputs	
Number of:	■ Securing IP ■ Total Irish/European patent applications ■ New Irish/European/US patent applications ■ Irish/European/US patents issued
Exploiting IP	
Number of:	■ Licences and options executed: exclusive ■ Licences and options executed: non-exclusive ■ Total licences and options executed ■ Licences and options executed to start-ups ■ Licences and options executed to small companies ■ Licences and options executed to large companies ■ Total licences and options executed ■ Number of start-up companies formed that were dependent upon the licensing of the institution's technology for initiation ■ Number of these that have their primary place of business in the region ■ Number of start-up companies that were dependent upon the licensing of the institution's technology for initiation and were reported in the survey this year or in earlier years that became non-operational in the fiscal year ■ Number of start-up companies that were dependent upon the licensing of the institution's technology for initiation and were reported in the survey this year or in earlier years that were operational on the last day of the fiscal year ■ Number of licensed technologies that became available for consumer (public) or commercial use in the fiscal year
Financial Performance In IP Management	
Value of:	■ Licence income received