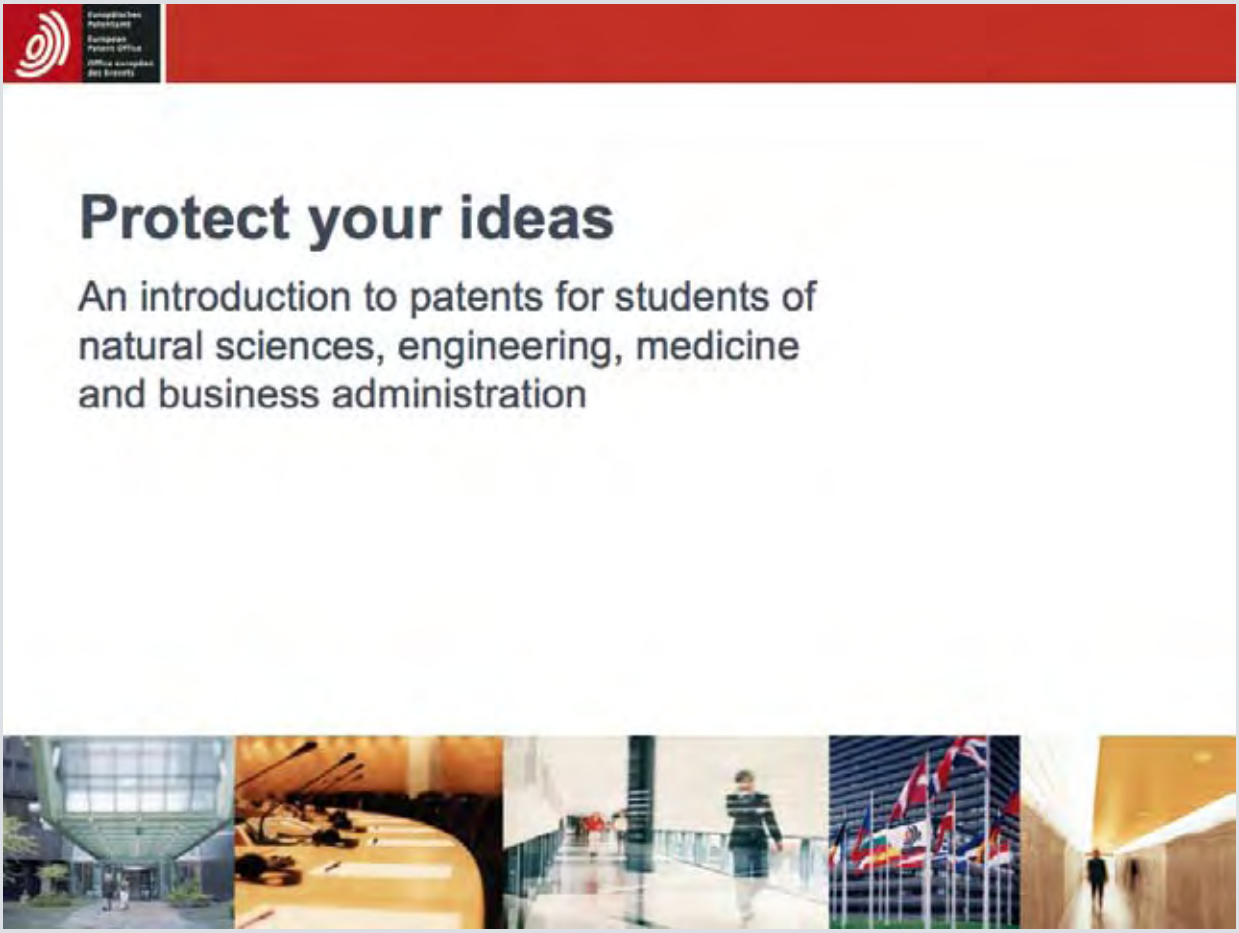
Core Module 1
Protect your ideas

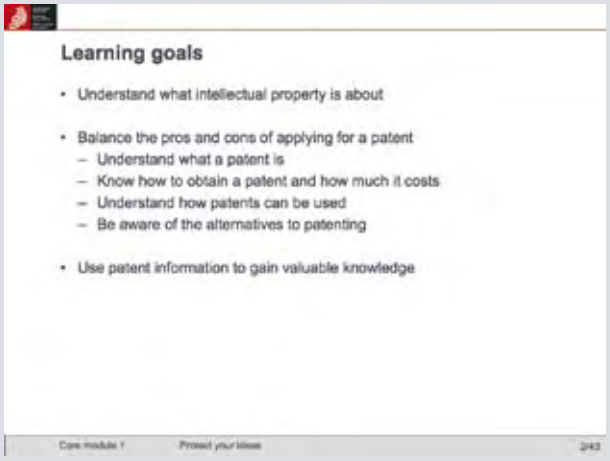
An introduction to patents
for students of natural sciences,
engineering, medicine
and business administration

Overview


Protect your ideas
An introduction to patents for students of natural sciences, engineering, medicine and business administration

Slide 2:
Contents of the lecture

The slide shows students what they can expect from the presentation.


Learning goals
• Understand what intellectual property is about
• Balance the pros and cons of applying for a patent
– Understand what a patent is
– Know how to obtain a patent and how much it costs
– Understand how patents can be used
– Be aware of the alternatives to patenting
• Use patent information to gain valuable knowledge

Slide 3:
Overview of different forms of intellectual property

Patents are granted for technical inventions only. They must be applied for at a patent office. Patent applications are examined in a process that may result in the refusal or grant of a patent. Patents normally last for a maximum of 20 years from the date of filing. Depending on the country, the patent belongs either to the first inventor to file an application (Europe and most other countries, "first to file") or to the first person to make the invention (in the USA, "first to invent").

In some countries a special, less powerful kind of patent called a "utility model" (or "petty patent") is also available. Utility models usually offer less effective protection for a shorter period of time. Most countries require inventions to be new in order for them to receive utility model protection. Others, for example Germany, also require them to involve an inventive step. But most countries examine neither novelty nor inventive step and will register any utility model that complies with the formalities (whether or not the utility model meets the legal requirements must then be decided later in the courts, if there is a legal dispute).

Copyright does not need to be registered. It "automatically" exists when the work is created. Any original, creative, intellectual or artistic expression is protected by copyright. Examples include novels, scientific literature, theatre plays, software, photographs and paintings, music, sculptures, television broadcasts, etc. Even the smell of a perfume may be (indirectly) protected by copyright: national courts have ruled that the blend of ingredients that goes into a perfume can represent an original work of authorship and therefore be protected by copyright.

Incidentally: the terms "all rights reserved" or "copyright by ..." are not needed in order to establish copyright. They are only used because they could improve the position of the owner of the right in an infringement lawsuit in the USA (the infringer cannot claim innocent infringement). However in Europe as well as in the USA, copyright protection exists regardless of whether you explicitly state it or not.

The duration of a copyright is roughly the life of the author plus 70 years, but this depends on the specific case and country.

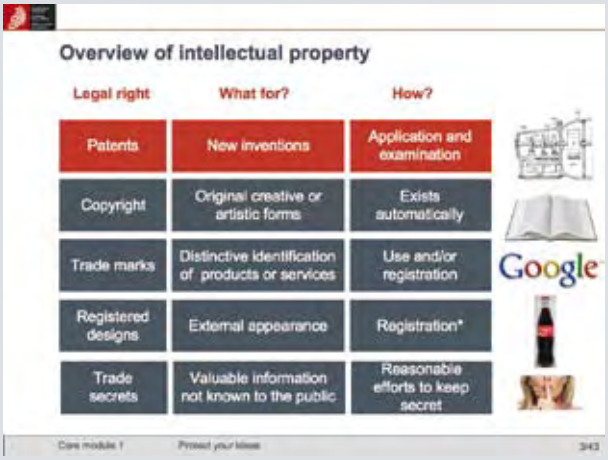
Trade marks are distinctive signs identifying and distinguishing the commercial source of goods or services. Such signs can consist of words, logos, names and colours, as well as any other means of identifying commercial origin, such as the shape of products and their packaging, and possibly even sounds or smells. For instance, most Disney characters are registered as trade marks!

Trade marks can be created simply by using them (as for example Google did) or by explicitly registering the trade mark, for example at the national patent and trade mark office, as most companies prefer. It is easier to prevent competitors from copying or damaging your trade marks if they are registered. The main requirement for the registration of trade marks in the European Union is that the trade mark must not be devoid of any distinctive character (Article 7 of Council Regulation (EC) No. 40/94): *http://oami.europa.eu/EN/mark/aspects/pdf/4094enCV.pdf*. In Europe, the trade mark must be represented graphically in order to be registered, which can be a challenge for trade marks based on smell.

Trade marks last as long as they are used and can be registered with the national trade mark offices or international bodies (e.g. EU).

Upon opposition by the proprietor of an earlier trade mark, the later trade mark for which an application is filed will not be registered if it is identical or similar to the earlier trade mark and the goods or services to which the trade mark applies are identical or similar to the goods or services for which the earlier trade mark is registered. Registration will be refused if a likelihood of confusion exists on the part of the public in the territory where the earlier trade mark is protected (Article 8 of Council Regulation (EC) No. 40/94): *http://oami.europa.eu/EN/mark/aspects/pdf/4094enCV.pdf*.

In the European Union, trade marks are protected at national level by trade mark laws that have been harmonised on the basis of the Trade Mark Directive (89/104/EEC, consolidated version enacted as 2008/95/EC). In addition, the Community Trade Mark Regulation has established a uniform regime for protection operating at Community level.



Patents: Only inventions can be patented and they will be disclosed to the public. The patent office will examine the patent application to determine whether the stringent requirements for a patent grant are met.

Copyright: Copyright includes, for example, literature, art, drama, music, photographs, recordings, broadcasts, etc.

Trade marks: Trade marks are distinctive signs or indicators of the source of a product or service, e.g. names, logos, colours applied to the owner's products or services, which distinguish them from products or services provided by competitors.

Registered designs: Registered designs protect the external appearance of a product. They do not give any protection for technical aspects. They include new patterns, ornaments and shapes. To be officially registered, designs need to be original and distinctive. The artistic aspects of a design may also be protected by copyright.

Unregistered designs also enjoy some protection. An unregistered design is a free, automatic right that you get when you present a design to the public. It gives you the right to stop anyone from copying your design but typically the protection afforded by an unregistered design is of more limited duration than that available for a registered design.

Trade secrets: This is an alternative to patents. Trade secrets cover information not known to the public. If the possessor of such information is careful to keep the information confidential (e.g. by **signing non-disclosure agreements** with employees/partners) he can sue anyone who steals it. However, trade secrets offer no protection against reverse-engineering or against competitors who independently make the same invention.

Infringement of trade mark rights occurs if an identical mark is used for identical goods or services, or if an identical or similar mark for identical or similar goods or services gives rise to a likelihood of confusion, or if use of a mark which has a reputation without due cause takes unfair advantage of or is detrimental to the reputation or the distinctive character of the infringed trade mark. The proprietor of an earlier mark is also entitled to oppose the application for, or cancel the registration of, another mark which would be infringing.

Registered designs (USA: design patents) protect the ornamental design, form, appearance or style of objects. Registered designs only protect the aesthetic aspect and they are not intended to protect any functional aspect of the product. Designs can be registered with a national office, with the EU's Office for the Harmonization of the Internal Market (OHIM) for EU-wide protection or through the Hague System for the international registration of industrial designs, which is administered by the World Intellectual Property Organization (WIPO).

A Community registered design may be obtained by deposit (no substantive examination is undertaken) at OHIM. The requirements are absolute novelty and individual character. The duration of protection for a Community registered design is a maximum of 25 years from the date of application to register. They are granted in five-year terms which are renewable.

Unregistered designs also enjoy protection under certain conditions. You get a free, automatic right when you present an original design to the public: it gives you the right to stop anyone from copying your design but typically the protection afforded by an unregistered design is of more limited duration than that available for a registered design.

A Community unregistered design requires no formalities for subsistence. Like the Community registered design, the requirements for a Community unregistered design are absolute novelty and individual character. The duration of protection for a Community unregistered design is a maximum of three years following publication of the design in the European Community.

Other forms of IP not shown here include plant variety protection (USA: "plant patents"), semiconductor topography and trade secrets.

A **trade secret** does not represent a right itself – it is a piece of information that is protected by law under certain conditions. A trade secret is information that is (a) not known to the public, (b) more valuable if not known to the public and (c) subject to reasonable efforts to maintain secrecy. Such reasonable efforts include for example **non-disclosure agreements** (NDAs) with employees and business partners and measures to prevent industrial espionage.

The exact determinants of trade secrets and the protection they offer depend on national law. Trade secrets offer limited protection; only improper means of discovering the trade secret are prohibited. Competitors are not prohibited from developing and using the same technology independently or from reverse-engineering the technology.

All these intellectual property rights concern different aspects of intangible assets and can potentially help an inventor to protect his innovation **at the same time**. For example, the inventor might use a patent to remain the only company that offers a certain feature and a trade mark and design patents to communicate the special features of his products to consumers. He might also choose to keep some aspects of the production process secret, and if he makes serious efforts to maintain secrecy then he can enjoy the protection of trade secret law.

Slide 4:
Some IP found in a mobile phone

Many students will not be aware of the wealth of intellectual property it takes to make and market a mobile phone today.

Examples of the different kinds of IP discussed in the previous slide are given for a mobile phone. This will help students understand how to protect different aspects of their own intellectual creations.

Trade secrets are not mentioned here simply because we don't know what secrets mobile phone companies and their suppliers might have.


Some IP found in a mobile phone
Trade marks:
• Made by "Nokia"
• Product "N95"
• Software "Symbian", "Java"
Patents:
• Data-processing methods
• Semiconductor circuits
• Chemical compounds
• ...
Trade secrets:
?
Copyrights:
• Software code
• Instruction manual
• Ringtone
• ...
Designs (some of them registered):
• Form of overall phone
• Arrangement of buttons in oval shape
• Three-dimensional wave form of buttons
• ...

Slide 5:
Importance of intellectual property

In today's knowledge economy, intellectual property is very important. Start-up companies use IP in order to protect themselves from large industrial competitors copying their products (examples given: Dolby and Gore, see below). Large companies also use IP in order to reap the benefits of their investments. Even seemingly "traditional" industries like the steel industry use IP to protect their intangible assets such as newly developed steel formulations (example given: Sandvik, see below).

Most technical inventions need substantial investment before they can be produced and used. In order to attract funding, inventions must offer the potential to generate income. This perspective is greatly enhanced if IP protection is available. (If there were no IP protection, then competitors could offer the same products or service at a lower price because they didn't invest in research and development.)

Intellectual property laws allow the owner to transfer the right to use the intellectual property to another party, i.e. to grant a licence. The conditions under which the licence is granted can be determined by the owner of the IP. For this reason, buying a film on DVD almost never means actually buying the intellectual property – rather it usually means that the owner of the film sold a licence to use the film under certain terms, for example excluding the right to rent the DVD to others and excluding the right to copy it. Licensing is very common.

Because the licensor (the owner of the IP who grants the licence) can determine the terms of the licence, IP can actually be used to enforce "public ownership" of intellectual property. For example, open source software developers rely on intellectual property protection (copyright) to ensure that people building upon their work have to adhere to certain terms. Because they own the copyright, Linux developers are able to demand that improvements to the Linux code (that they give away for free) have to be free to use, too. You cannot develop or adapt the Linux code if you do not agree to these terms. In that way, the Linux developers ensure that their IP is not exploited by anyone to set up new proprietary rights. It is the intellectual property system that enables Linux developers to create free knowledge that will remain free. This could be compared to a wealthy family buying a natural forest in order to ensure that nobody will grab the land and cut down the trees for personal profit. If there were no property rights, then the family could not protect the forest from those wanting to cut down the trees.

Another (fairly advanced) example is the Creative Commons licence (see *www.creativecommons.org*) that enables an author to allow everybody to use his work, subject to certain conditions, e.g. that they must state his name or that the work cannot be used commercially. If the audience is not familiar with licensing, we suggest not mentioning this example.

Other examples of using the IP system for public benefit rather than to achieve profits are organisations such as TransFair (Fairtrade coffee) and the Forest Stewardship Council (wood produced without devastating natural forests). These organisations licence their trade marks (FAIRTRADE; FSC) only to those companies prepared to sign up to certain environmental and/or moral criteria. And the IP system ensures that unlicensed use of the trade marks can be prevented. So consumers can be confident that all products bearing the mark really do adhere to the promised standards.

Company examples:
Sandvik is a maker of special steel products. It is worth EUR 10 000 million on the stock exchange. A subsidiary recently set up to hold all the intellectual property of the firm has a book value of EUR 1 800 million (the subsidiary has approximately 12 employees).

Dolby Laboratories pioneered noise reduction technology in the 1960s. They used a combination of patents to protect the technology and trade marks to identify Dolby as an indicator of quality to customers. In this way, what was a small start-up company was able to do business with large established companies and became a successful, growing high-tech company.

W.L. Gore was founded by the Gore family in the basement of their house in 1958. W.L. Gore developed and patented new products based on PTFE (Teflon®). Enjoying patent protection for their major products and being able to build strong brands such as Gore-Tex®, the company now has 8 000 employees.

Note:

Sandvik's subsidiary company, which holds the IP, has only 12 employees and has a book value of EUR 1800 million (in 2007).

Dolby Laboratories

- Invented noise-reduction technology in the 1960s.
- Used a combination of patents to protect the technology and trade marks.
- Became a successful high-tech company.

W.L. Gore

- Founded by the Gore family in the basement of their house in 1958.
- PTFE (Teflon®) related high-tech products.
- Patent protection and strong trade marks (Gore-Tex®).
- Now has 8 000 employees.

Additional examples for audiences familiar with the concept of licensing technology:

ARM Ltd.

- Develops energy-efficient microprocessors but does not make them (earns licensing royalties)
- Founded 1990, now market leader in microprocessors for mobile phones
- ARM founder Hermann Hauser: *"I gave (the design team) two things which National, Intel and Motorola had never given their design teams: the first was no money; the second was no people. The only way they could (design a microprocessor) was to keep it really simple."*

LINUX

The Linux operating system and other open source software are free to use, but users must accept the general public licence (GPL), which includes an agreement to put any improvements under the GPL too.

Creative Commons

A range of sample licences for books, software, photos, etc. Authors may grant free use but require, for example, that their names be stated or that use be non-commercial.

ARM Ltd. was founded in 1990 to develop energy-efficient microprocessors. The company develops the technology and then licenses its intellectual property to third parties who actually make the products. More than 10 000 million ARM microprocessors have since been manufactured under licence from ARM. The company has grown to more than 1 800 employees and is the world leader in mobile phone microprocessors. (Here is an amusing anecdote that describes how ARM started: ARM founder Hermann Hauser recalls the early days of processor development at ARM and their success factor: *"I gave (the design team) two things which National, Intel and Motorola had never given their design teams: the first was no money; the second was no people. The only way they could (design a microprocessor) was to keep it really simple."*

If your audience is not familiar with the concept of licensing technologies, you do not need to mention ARM or the Creative Commons licence at this point.

Slide 6 (optional):
Examples of valuable intellectual property

Explaining the value that can be created with intellectual property could be an important motivator for a student audience. This slide contains examples of the value of a number of intellectual property assets.

Coca-Cola (registered trade mark): Value of the brand (brand = trade marks and the whole Coca-Cola customer experience) is estimated to be EUR 27 000 million (estimates published by Millward Brown Optimor, *http://www.brandz.com/upload/BrandZ_2007_Ranking_Report.pdf, and interbrand, http://www.interbrand.com/best_brands_2007.asp*).

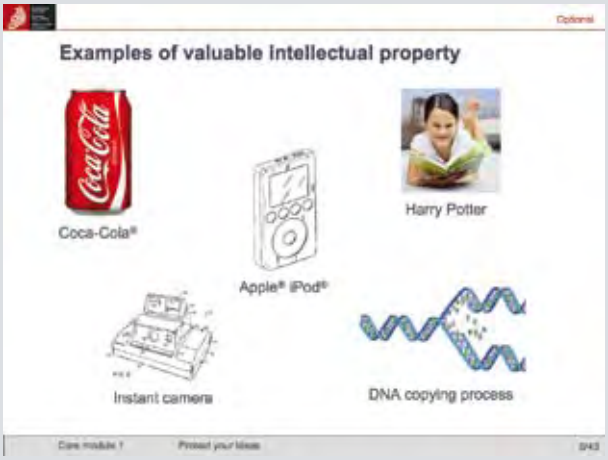
Apple iPod (registered trade marks and registered designs, also some patents): The extremely successful iPod bases its competitive advantage not so much on technical innovation but on customer experience and distinctive design. Apple has filed several US 'design patents' (called registered designs in Europe) on the iPod's design. Apple also applied for user interface-related patents on the iPod.

Harry Potter (registered trade marks and copyright): The author of the original Harry Potter book, J.K. Rowling, held all associated IP rights. This meant that she was the only person allowed to write a sequel to that book. She is reported to have earned EUR 750 million from her intellectual property rights on the Harry Potter story.

Instant camera (patents): Before the advent of digital cameras, instant camera technology was very valuable. In 1991, Kodak was found to have infringed patents held by Polaroid and was required to pay Polaroid EUR 550 million in damages.

DNA copying process (patents): The Nobel Prize-winning and patented DNA polymerase invention sold for EUR 190 million in 1991.

For comparison: The **"Hope diamond"**, one of the largest and most valuable blue diamonds in the world, is worth about EUR 125 million. At 2008 prices, gold is worth around EUR 18 000 per kg. That means J.K. Rowling converted her imagination to the equivalent of 42 tons of gold – true intellectual property magic!



Coca-Cola:

Brand worth EUR 27 000 million according to various market research firms. TRADE MARK

Apple iPod:

More than 100 million units sold. TRADE MARK, REGISTERED DESIGNS, PATENTS (user interface)

Harry Potter:

Author J.K. Rowling converted her imagination to the equivalent of 42 thousand kilos of gold – true intellectual property magic (she earned approximately EUR 750 Million from her COPYRIGHT).

Instant camera:

Kodak had to pay EUR 550 million to Polaroid for having illegally used Polaroid's patented inventions.

DNA copying process:

Nobel Prize-winning technology was patented, PATENT sold for EUR 190 million.

Compare the value of IP with the Hope Diamond (a famous large blue diamond): EUR 125 million.

Slide 7 (optional): Patents are all around us

The aim of this slide is to show students that patents are relevant to almost every company – not just high-tech companies. There are a huge number of patents covering almost every product you can buy, so patents are of interest to everyone.

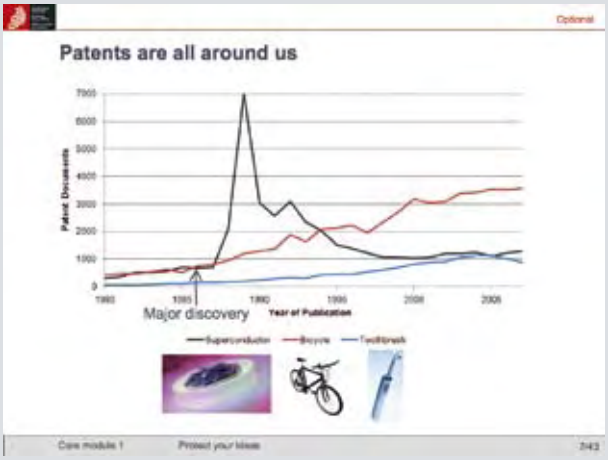
This slide shows charts and pictures illustrating patents in three different technical domains. They will be displayed in this sequence:

1. Superconductors
Patents applications are filed for breakthrough innovations (click with mouse to get first chart).
This chart, for example, shows applications relating to superconductors, a class of materials that conduct electric current without any loss. In 1986, researchers discovered so-called high-temperature superconductors that opened up the possibility of real applications for superconductors. A year later, these researchers received the Nobel Prize in Physics for their invention. They were granted a patent in the record time of 18 months. As you can see, their invention is followed by a huge increase in patent applications in the field: their invention initiated a phase of high inventive activity. However, even today superconductors are still not a mass-market product and most of these patents did not turn out to be valuable at all. It is no wonder, therefore, that research interest has decreased and the number of patent applications for superconductors has reduced almost to the level it was before the discovery of high-temperature superconductivity.

2. Bicycles
Many of the patents applied for are actually for simple inventions that concern things we use every day. You might think that the technology of bicycles is quite old and that there won't be many bicycle patents today but the opposite is the case. In fact, during the last decade more patents have been applied for relating to bicycle technology than superconductor technology! Incidentally, more than 100 million bicycles are produced every year worldwide – so no wonder there are large number of companies in fierce competition in this market. By way of comparison, the number of cars manufactured per year is around 40 million (same source). Global superconductor production was estimated by Siemens in 2005 to be 800 km of wire (bicycle chains: more than 100 000 km).

3. Toothbrushes
Even seemingly trivial things such as the opening of a tetra pack, a razor blade or a toothbrush may be covered by patents. In 2005, more than 1 000 patent documents relating to toothbrushes were published! (Incidentally, one of the many toothbrush manufacturers, Colgate, reported that just one of its factories produces 900 million toothbrushes a year.)

It is important to note that **despite the high number of patents, no company has a monopoly on bicycles or toothbrushes** – not even on superconductors. Instead, many companies have small proprietary technologies that make their bicycles, toothbrushes or superconductors a little better than those of the competition and thus help them to stay competitive.



Superconductors:

1987: Nobel Prize in Physics for high-temperature superconductors invented in 1986. No substantial market until today

Bikes:

100 million bikes sold every year!

Toothbrushes:

Well in excess of one billion sold every year (one plant reportedly manufactures 900 million a year)

Data sources:

The chart shows the number of patent documents found on the free worldwide patent database at *www.espacenet.com*. A search for the keywords 'bicycle or bike or bicyclette or Fahrrad', 'toothbrush or Zahnbürste' and 'superconduct*' was performed. The production figures for bicycles and cars were taken from reports by the Earth Policy Institute, the US National Bicycle Dealers Association, and the International Organization of Motor Vehicle Manufacturers.

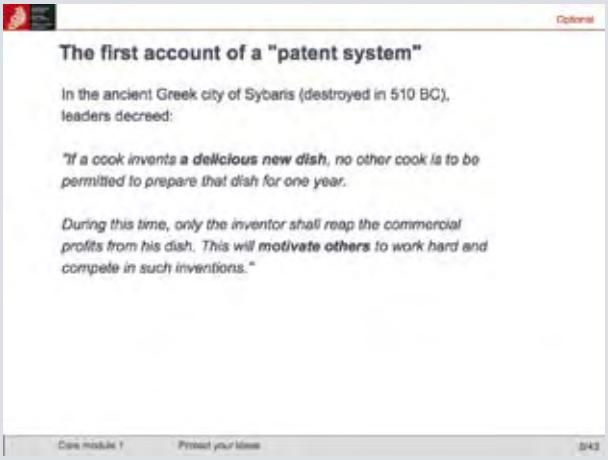
Slide 8 (optional):
The first account of a "patent system"

History of the patent system: the first account of rights comparable to patents is from ... yes: the ancient Greeks!

The Greek writer Athenaeus reported that this decree was alleged to have been in force in the city of Sybaris. Note that although the rule "just" concerns recipes for meals, the Greek writer mentioned the economic profits a cook could generate from a proprietary recipe!

The aim of this patent on recipes for delicious meals is reported to have been to encourage cooks to work hard and compete with each other in "culinary innovation". This goal is very similar to the main objective of today's patent system.

Note:
An important additional goal of the current patent system is the dissemination of information on inventions so that others can build on them.



Aim:

To motivate people to innovate, which is identical to the main aim of today's patent system.

Slide 9:
The patent system

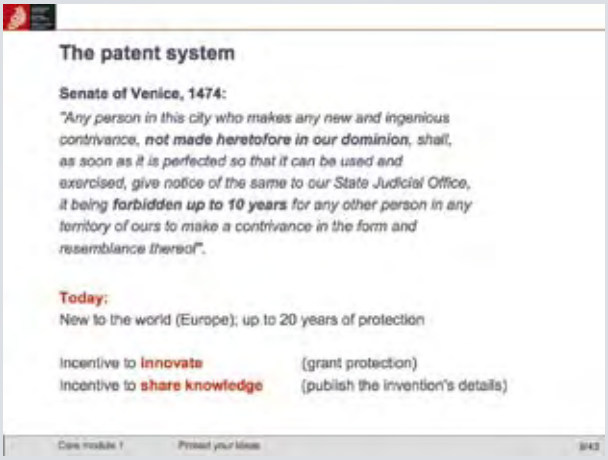
From this slide onwards, the presentation focuses on patents.

The first account we have of a formal patent law dates back to 1474 AD, when the Senate of Venice introduced a patent law. The aims of this patent law were to promote innovation and protect the honour of inventors. Venice is believed to have issued about 600 patents (approximately 5 patents per year) from 1474 to 1594, the year when Galileo was granted a patent.

Galileo was granted a patent on a water pump he invented. He did not provide the details of his invention before the patent was granted – he only stated its prospective use and performance. He was given a privilege to use the invention exclusively, provided he made the device within a year. The requirement to actually make the invention in order not to lose the patent was common in the Venetian patent system.

The text of Galileo's patent reads:
"That by the authority of this Council is granted to Mr Galileo Galilei that for the space of the next twenty years others than him or his agents are not allowed in the city or any place in our state to make, have made, or, if made elsewhere, to use the device invented by him for raising water and irrigating fields, by which with the motion of only one horse twenty buckets of water that are contained in it run out continuously; under pains of losing the devices which will go to the supplicant, and 300 ducats, a third of which will be for the accuser, a third for the magistrate who undertakes the prosecution, and a third for our Arsenal; the supplicant being obligated, however, to have made known this new type of device within one year, and that it has not been invented or recorded by others, and that a patent has not been granted [on the same device] to others; otherwise the present grant will be void."

The main goals of today's patent system are to promote innovation (by offering protection to the results of the inventive work) and to give an incentive to share knowledge (by requiring the publishing of the invention's details when a patent is sought), so that people can learn from each other. This dual nature of the patent system is sometime referred to as a contract between society (which gets the knowledge) and the inventor (who gets the exclusive rights).



Venice patent law:

- Invention new to a certain region
- 10 years
- Details not published
- Galileo Galilei: patent on water pump in 1594

Today:

- New to the world (European Law)
- 20 years
- Details published

Main goals of today's patent system:

(a) Incentive to innovate (protect results so the inventor can reap benefits -> makes it easier to attract investment)

(b) Incentive to share knowledge (to get protection the inventor must publish the details; patent databases promote technology transfer)

This dual nature of the patent system is sometimes referred to as a **contract** between society (which gets the knowledge) and the inventor (who gets the exclusive rights).

Slide 10 (optional): An early English patent issued in 1617

An important motive behind the setting up of patent systems was to encourage investment in technology and innovation. Some of the earliest patent systems did not require an invention to be new to the world. Rather, it had to be new to the country that granted the patent.

The first person or company introducing an invention into the country and making the necessary investments would be given a temporary monopoly in order to enable them to recoup their investment before competitors could enter the market.

In England the Crown (i.e. the King or Queen) historically granted diverse monopolies, not just for inventions, but also on salt, playing cards, etc. The fees collected generated income for the Crown.

In 1624 the English Parliament adopted the Statute of Monopolies, declaring all monopolies granted by the Crown to be void except those based on patents for inventions, on the grounds that the extensive monopolies that had been granted and that did not relate to inventions were against the public interest.

An early patent on an invention granted in England is shown here. It was issued in 1617.

The patent granted a monopoly on making and distributing precise maps of the major cities of England to the patent holders. The publication explains that, in other countries, precise maps of cities have been made using printing techniques, but that in England no such maps exist so far. This is attributed to the high cost of preparing the maps and engravings and the absence of a monopoly on making them. Because the maps might be copied by competitors, rendering the original investment worthless, no one would invest in making them if the King did not grant a monopoly. England was said to lag behind developments in continental Europe because it had not yet granted a monopoly on such maps. The patent privilege was granted by the King in order to overcome that deficit.

At the time, very few patents were granted. Between 1617 and 1769, only 912 patents were issued – about six patents per year on average. Patent number 913 covered the famous invention by James Watt of a radically more efficient steam engine.

Patents had, however, also been granted for more than 150 years prior to 1617. The published patent seen here – "Number 1" – is the first in a more formal system that replaced the ad hoc and arbitrary system which preceded it. Most historians accept that the first English patent was granted in 1449 to John of Utynam, a glass-maker, so that he could share his technological secrets with his apprentices without fear of competition from them. Thus the patent ensured the transfer of knowledge, whilst protecting the inventor for a set period of time. For more information see *http://www.myoutbox.net/popcho1.htm*.

Patents issued in England prior to 1624 were not always granted for inventions. They sometimes covered exclusive trading rights (e.g. the right to import Spanish wine to London) granted by the King to his favourites. As such the system was prone to corruption, which led to the 1624 law which formalised the grounds on which such monopolies could be awarded (e.g. on merit for new inventions).

The main goal of early patent laws was to encourage investment in technology in the country concerned.

The requirement was therefore for an invention to be **new to the country**, not new to the world

In England, the Crown (i.e. the King or Queen) historically granted diverse monopolies, not just for inventions, but also on salt, playing cards, etc.

In 1624 the English Parliament declared all monopolies granted by the Crown to be void except those based on patents for inventions.

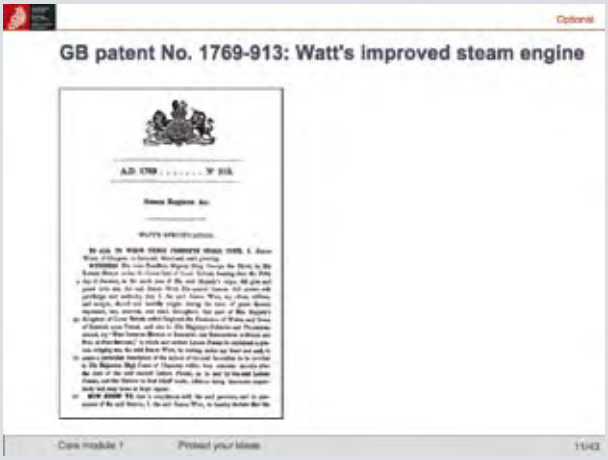
The first patent granted in England gave the holders a monopoly on making and distributing precise maps of the major cities of England. The patent document explicitly states that if no such patent existed, nobody would be prepared to make the huge investment needed to draw and print such detailed maps.

Slide 11 (optional):
GB Patent No. 913 – Watt's radically improved steam engine

The breakthrough steam engine patent granted to Watt was for a "New Invented Method of Lessening the Consumption of Steam and Fuel in Fire Engines". A major improvement was the use of a separate condenser to condense the steam outside the cylinder. This invention reduced fuel consumption by 60%. It also increased the power available from a cylinder of a given size.

At the time patents were valid for only six to twelve years. The patent was about to expire when factory magnate Matthew Boulton founded a company with Watt to begin commercialising the invention. Boulton used his political contacts to achieve a decision by Parliament to extend the patent until the end of the 18th century.

Today, most patent offices grant a lot more than six patents per year. After the breakthrough of James Watt and as steam engine technology spread throughout the world, hundreds of patents were issued for steam engines alone.



The breakthrough steam engine patent granted to Watt related to a **"New Invented Method of Lessening the Consumption of Steam and Fuel in Fire Engines"**.

- Contained separate condenser to condense the steam outside the cylinder
- Reduced fuel consumption by 60%
- Increased the power available from a cylinder of a given size.

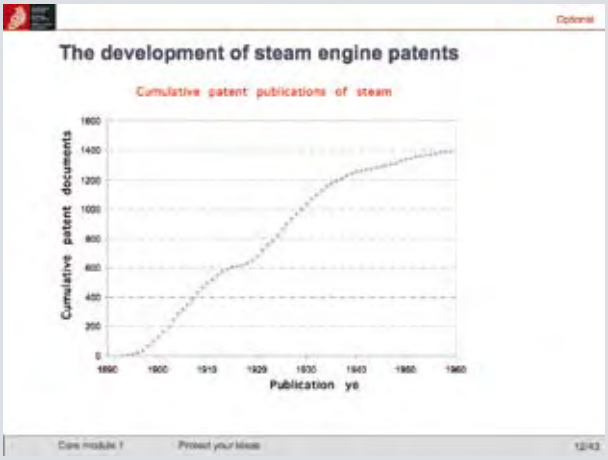
Note that this is the 913th patent of the year 1769. It is not the 913th patent since 1617. Patents were issued in the same number sequence each year. So there would be a patent number 913 in 1769, 1770, 1771 and so on.

Slide 12 (optional):
Development in the number of steam engine patents

This chart shows the development in the number of steam engine patents over time. While in the early years of steam engine technology very few patents were applied for (among them some by James Watt himself), there was a sharp increase from the end of the 19th century onwards. From about 1930, other technologies such as steam turbines and diesel engines began to replace steam engines in practical applications. For example, in the USA all steam locomotives had been retired by the mid 1950s.

The development of steam engine patenting mirrors the development of the patent system itself; with today's huge technological knowledge stock, a huge number of inventions are made and patented every year, most of them representing quite small improvements rather than the major technical leaps of the early days of technological development.

In the 18th century, it was easy to be aware of all the relevant patents in a particular industry as there was just a handful of them. Today that situation has changed radically, and not only in steam engine technology. This represents a significant challenge to companies endeavouring to avoid infringing other companies' patents.



From about 1930, other technologies such as steam turbines and diesel engines began to replace steam engine technology. In the USA all steam locomotives had been retired by the mid-1950s.

Data source:

The data was collected from the *esp@cenet* online database. The *esp@cenet* coverage of patents issued in the 18th and 19th century in particular is not complete, which is why the number of steam engine patents per year prior to 1893 is zero.

Slide 13 (optional): Worldwide patent applications per year

The chart shows the number of inventions for which patent protection has been sought per year worldwide. Multiple international patent applications covering the same invention are counted only once. The total number of individual worldwide patent applications is much higher than the number of inventions, as generally patents on the same invention are applied for in multiple countries (by the same patent applicant).

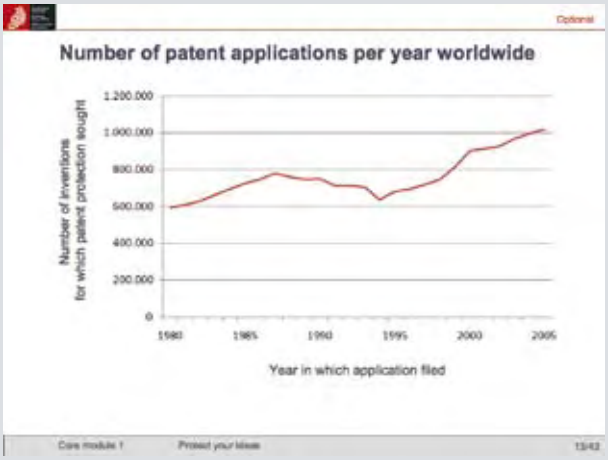
The data shown here include inventions applied for at more than 80 patent offices around the world, including the European Patent Office, the United States Patent and Trade Mark Office and the Japan Patent Office.

Individuals and companies currently apply for patents on about 1 million inventions each year! Some of these applications are rejected by the patent office(s) concerned, but the majority lead to a patent being granted.

The large number of patent applications is not a completely new phenomenon: even in 1980 protection was being sought for more than 600 000 inventions per year and, since then, countries such as Korea and China have joined the race for technological innovation.

The long-term trend, which can actually be traced back to the end of World War II, is towards even higher numbers of inventions.

Data source: PATSTAT, the European Patent Office's Patent Statistical Database, October 2007 edition.



The graph shows the number of inventions ("patent families") for which patent applications have been filed at around 80 patent offices worldwide.

The actual total number of individual patent applications around the world is much higher, as many companies apply for patents for the same invention in more than one country.

Trends in patenting mirror technological and economic development.

The next slide shows which countries have driven growth since the mid-1990s

Source: the EPO's PATSTAT database.

Slide 14 (optional): Filing rates at selected patent offices

As can be seen in this graph, the number of worldwide patent applications has increased tremendously since the end of World War II, reflecting the unprecedented impact of technical innovation on economic growth that has occurred since then.

During the last 25 years, the number of patent applications in Korea has grown at an extraordinary rate, reflecting the economic growth in Korea. In China, patent applications have soared over the last ten years.

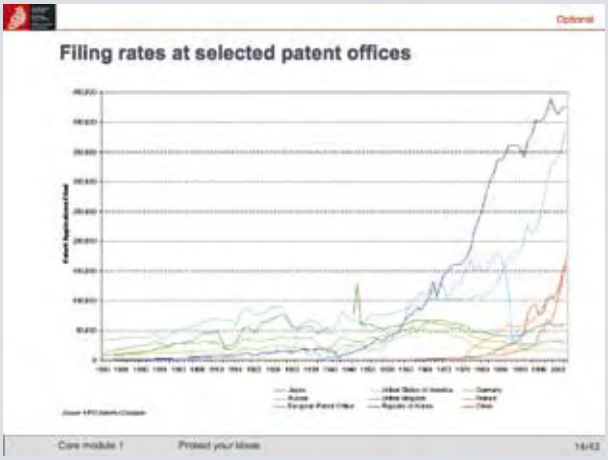
However, although the Korean and Chinese patent offices now receive more patent applications than the German, French and UK offices combined, this does not necessarily mean that China and Korea are more innovative than these European countries. Many Western companies apply for patents in China and Korea but no longer apply for patents at national level in Europe. This is because, since 1977, it has been possible to obtain European patents via the European Patent Office.

It is also interesting to note the sharp drop in patent applications in Russia when the Soviet Union collapsed. Also, in three of the post-war decades (the 1960s, 1970s and 1980s) more patents were applied for in Russia than in the USA, an amazing fact given the economic system at the time!

Obviously, patents served a different purpose in communist systems; while the possibility of receiving a patent to exclude others from using the invention existed, most patents were not meant to exclude (state-owned) companies from using the invention. Rather, the patent system was intended to motivate inventors by providing a means to receive both public recognition and monetary compensation for the use of the invention.

As the majority of inventors are employed by a company or organisation, in our current free market economy these inventors "only" receive public recognition plus a small monetary compensation (depends on national employee inventor law). Thus, from the personal perspective of the majority of inventors, the "communist" and "capitalist" patent systems actually did not differ a great deal. Hence it is not that surprising that both systems produced a comparable number of inventions.

Data source: WIPO, *http://www.wipo.int/ipstats/en/statistics/patents/index.html*



This chart: patent applications **per office** (the same invention may appear multiple times if patented in multiple countries).

High growth rate since the end of **World War II** reflects the technological and economic prosperity of the post-war period.

In the last two decades: high growth rate in **Korea** (from 1983) and **China** (from 1998) reflects the increasing economic importance of these two countries (many of the patent applications in these countries are filed by foreign – i.e. European and US-based – companies).

Note the large number of patent applications in the **Soviet Union**. From the employee-inventor perspective (who in our current system effectively does not in most cases own his own invention), the two patent systems (communist and capitalist) might often not have been so different: Both systems effectively provided employee inventors with public recognition and a small monetary compensation.

More statistics are available at: *http://www.wipo.int/ipstats/en/statistics/patents/index.html*

Slide 15 :
The "social contract" implicit in the patent system

Patents are sometimes considered as a contract between the inventor and society. The inventor is interested in benefiting (personally) from his invention. Society is interested in ...

- encouraging innovation so that better products can be made and better production methods can be used for the benefit of all;
- protecting new innovative companies so that they can compete with large established companies, in order to maintain a competitive economy;
- learning the details of new inventions so that other engineers and scientists can further improve them;
- promoting technology transfer (i.e. from universities to industry).

So both parties are interested in a contract that grants protection to innovators (thereby also increasing the motivation to innovate) in exchange for disclosure of the invention. This social contract is institutionalised in the form of patent law.

In this context, two requirements for patent protection emerge almost naturally: first, if the invention is not new to the world, then the inventor doesn't have anything to disclose, and society has no reason to conclude the above-mentioned contract with him; second, if the invention is new but obvious to a person skilled in the art, then the inventor doesn't possess anything the public is eager to learn and there is also no reason to exchange exclusivity for the publication of the invention.

The inventor benefits from the patent system because he or she is granted the exclusive rights to commercially exploit the invention. These rights are transferable. In particular, the owner of the patent can licence the patent to third parties so that they may use it subject to certain conditions.

Background note:

Inventions need to be new to the world to be granted patent protection (in Europe):
If an invention has already been revealed to the public there is nothing to "trade" for exclusivity, and therefore no "social contract".

Patent owners can forbid others from using their invention for a certain time. They can also can choose to license their invention to others or to allow everybody to use the invention for free. Thus, whether or not a patented invention is used by one company only depends on the patent owner's decision. Many important technologies such as CDs, DVDs, mobile phone technology and digital TV are covered by numerous individual patents that companies license to each other (cross-licensing).

Slide 16:
Rights conferred by the patent

The patent owner has the right to prevent others from making, using, offering for sale, selling or importing a product that infringes the patent, for a limited amount of time. If you own a patent, you can exclude everybody from commercially using the invention – even inventors who subsequently independently make the same invention. However, some exceptions exist. For example, if another company independently makes the same invention and starts using it before the patent owner applies for the patent, in many jurisdictions the first company will be allowed to continue using the invention. The legal rights conferred by patents also do NOT extend to acts done privately and for non-commercial purposes or acts done for experimental purposes relating to the subject-matter of the patented invention.

Patent rights can be transferred, for example by selling, licensing or donating the patent.

The patent does not grant the right to use the invention. For example, before a new drug can be sold to customers it needs the formal approval of government agencies.

If using your invention means using the intellectual property of others, then you need to have their permission! For example, if your biotech invention involves copying DNA, then you need to have the permission of the company that owns the intellectual property (Roche). Given that owning a patent doesn't give you the right to use the invention, it is important to know what other intellectual property rights might interfere with the usage of the invention. **To establish whether or not you are free to use your patented invention, you have to perform a patent search.** It is best to do this before starting development in order not to waste time and effort by duplicating what others have already done. If in doubt, ask a patent professional or patent attorney.

Given the enormous number of patents that exist today, it is quite difficult for many companies to ensure that their products do not unknowingly infringe a patent. But despite the difficulties, companies have no option but to carefully search and analyse patents.

Patent infringement cases can be very costly, especially in the United States. Besides demanding licence fees and infringement damages, the patent holder can forbid the production and distribution of all the products covered by the patent. Some statistics on the number of court proceedings on patent infringement (approximate figures only): US: >1000/year; Germany: 600/year; France: 300/year; UK: 70/year; Netherlands: 50/year.

The average cost for patent infringement court proceedings (excluding the resulting licence fees and indemnification for the patent owner!) is about EUR 125 000 in the UK and about EUR 25 000 in Germany – the sum largely depends on the values at stake. Some insurance companies offer insurance to cover the cost of court proceedings, but only if the client has a reasonable patent monitoring process in place. For more information on patent litigation and associated costs see the presentation by Walter Holzer, available at *http://www.ip4inno.eu/*

Some uses of patent rights might potentially conflict with competition law – i.e. if large companies use their IP to foster monopolies. Further legal information on this topic can be found at *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2004:101:0002:0042:EN:PDF.*

Ownership of patent rights
If an invention is made by an engineer working for a company or another institution, he is usually required either by law or by his employment contract to transfer his rights to the invention to his employer. This depends on national law. Article 60 of the European Patent Convention states:

(1) The right to a European patent shall belong to the inventor or his successor in title. If the inventor is an employee the right to the European patent shall be determined in accordance with the law of the State in which the employee is mainly employed; if the State in which the employee is mainly employed cannot be determined, the law to be applied shall be that of the State in which the employer has his place of business to which the employee is attached.

(2) If two or more persons have made an invention independently of each other, the right to the European patent shall belong to the person whose European patent application has the earliest date of filing; however, this provision shall apply only if this first application has been published under Article 93 and shall only have effect in respect of the Contracting States designated in that application as published.

The text of the European Patent Convention is available at: *http://www.epo.org/patents/law/legal-texts/epc.html*

The legal rights conferred by patents do **not** extend to:

– acts done privately and for non-commercial purposes
– acts done for experimental purposes relating to the subject matter of the patented invention.

If commercialising your invention means using the intellectual property of others, then you need to have their permission!

To make sure that your invention really is yours, you need to carry out a patent search. If you are not a patent expert, ask a patent professional, e.g. a patent attorney.
It is best to perform the patent search before starting development in order not to waste time and effort!

Patent applications can be filed by the inventor or the inventor's employer. **Inventions are usually the property of the company that employs the inventor.** This also holds true for university researchers in many – but not all – countries.

Slide 17:
What does a patent look like?

More about bibliographic information

A patent application will usually name the inventors and the person or organisation that applied for the patent. The patent may show the proprietor of the patent at the point in time when it was granted rather than the original applicant. The bibliographic data contained in a patent also includes the date of filing and the date the patent was granted, the patent number and the technology class. The date of filing is very important because this determines the date the patent will lapse (20 years after the date of filing; some exceptions exist) and it is also important for determining the prior art (the prior art is everything communicated to the public before the date of filing).

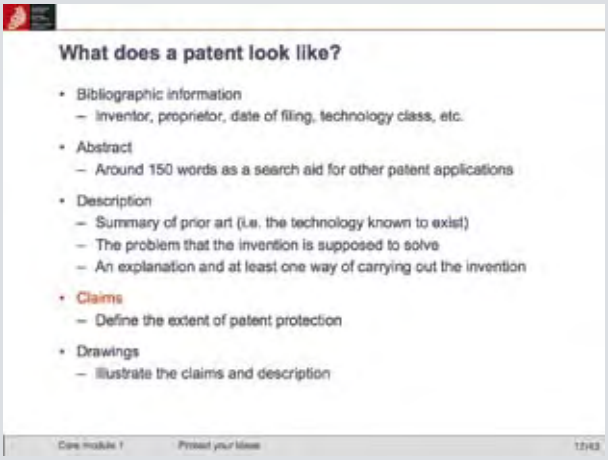
The technology class is important because this class allows you to search easily for all patents that pertain to a specific technology domain. This is discussed in sub-module A on searching patents. The rest of the bibliographic information is also useful for finding relevant patents. For example, to find the patents applied for by certain companies or inventors in a field, you can perform a search for their names. However, it is important to be aware that the patent applicant named on the patent application might no longer be the owner of the patent. When a patent is sold or transferred, for example when a company is bought, the new owner is not obliged to inform the patent office and the patent office will not issue a new patent publication even if it learns about the transfer of ownership (patent reassignments known to the patent offices are available in special databases only).

More about claims

From a legal perspective, the most important part of the patent document is the claims, as they define the extent of the patented technology. If a company's product or process falls within the scope of the claims then there may be an infringement and the patent owner can stop the company's activity through an action brought in the courts. Damages and other remedies may be awarded by the courts if an infringement of the patent is found to have occurred.

The claims will often change during the application process; frequently they will be narrowed down because part of the invention claimed in the application is found not to be new (i.e. prior art exists against the patent) or because the patent office considers that what is being claimed by the patent applicant is much broader than he has disclosed in his explanation of how to repeat the inventive process. This second issue is called insufficiency of disclosure.

Patent claims are often difficult to read. Legal interpretation of the claims of a patent is a task best performed by patent attorneys or other patent professionals. However, engineers, scientists and managers can benefit from a basic understanding of patent claims so that they can make a quick estimate of whether a certain patent might cover their products or not. In **sub-module C: Understanding patent claims**, you will find presentations designed to give students a basic understanding of patent claims. The lecture is based on practical examples from diverse technical disciplines.



Bibliographic information:

Who applied for the patent, who invented it, etc. – the technology class is very useful for searching (discussed later)

Abstract:

Useful to search for patents and quickly browse through search results.

Description:

Contains a full and detailed description of the invention so that others can understand and replicate it.

Claims:

Define the scope of patent protection.

Drawings:

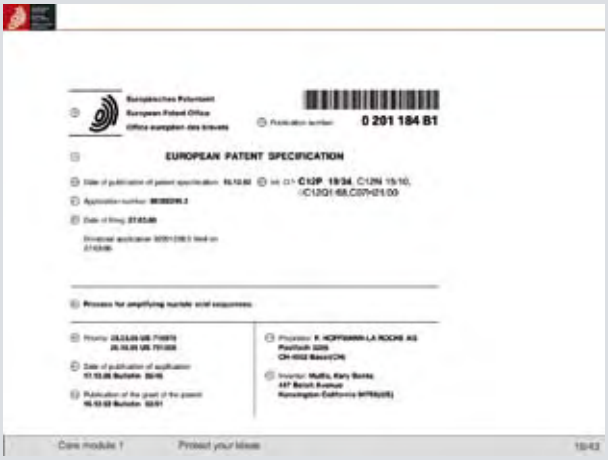
Help with understanding and interpreting the claims and the description.

Slide 18:
Sample patent

This slide shows the front page of a sample patent.

The application was filed at the European Patent Office in 1986 following a patent application in respect of the same invention filed with the US Patent and Trademark Office in 1985. The patent was granted in 1992 – six years after it had been filed and one year before the inventor received the Nobel Prize for this invention.

The main claim of the patent is (not shown on the slide): *"A process for amplifying at least one specific nucleic acid sequence contained in a nucleic acid or a mixture of nucleic acids wherein each nucleic acid consists of two separate complementary strands, of equal or unequal length, which process comprises: (a) treating each of the two strands of each different specific nucleic acid sequence being amplified with a primer under conditions such that for each different sequence being amplified an extension product of each primer is synthesized which is complementary to a nucleic acid strand, wherein said primers are selected so as to be substantially complementary to the different strands of each specific sequence such that the extension product synthesized from one primer, when it is separated from its complement, serves as a template for synthesis of an extension product of the other primer; (b) separating the primer extension product from the templates on which they were synthesized to produce single-stranded molecules; and (c) treating the single-stranded molecules generated from step (b) with the primers of step (a) under conditions such that a primer extension product is synthesized using each of the single strands produced in step (b) as a template."* (European patent application No. EP0502588A2)



This slide shows the **front page** of a sample patent as published.

The patent was applied for by Cetus Corporation, the employer of inventor Kary Mullis, who invented the Polymerase chain reaction, a basic tool of biotechnology.

Before the European Patent was granted, Cetus Corporation sold it and other related patents to Hoffmann-La Roche AG (reportedly for approximately USD 300 million). This is why the document shows Hoffmann-La Roche as the proprietor.

The inventor was awarded the Nobel Prize in Chemistry in 1993.

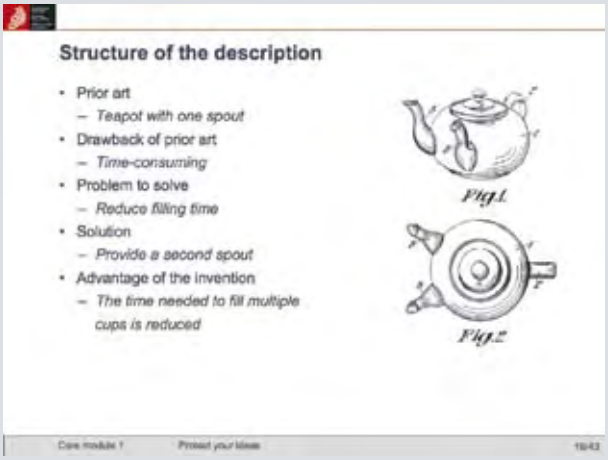
Slide 19:
Structure of the description

The items shown on the slide will be found in most patent documents as part of the description. They give a rough overview of what to expect from this part of the patent document.

For reference, Rule 42 EPC, which lays down the legal requirements for descriptions of European patents, is given below:

(1) The description shall:
- (a) specify the **technical field** to which the invention relates;
- (b) indicate the **background art** which, as far as is known to the applicant, can be regarded as useful to understand the invention, draw up the European search report and examine the European patent application, and, preferably, cite the documents reflecting such art;
- (c) disclose the invention, as claimed, in such terms that the **technical problem**, even if not expressly stated as such, and its **solution** can be understood, and state any **advantageous effects** of the invention with reference to the background art;
- (d) briefly describe the **figures** in the drawings, if any;
- (e) **describe in detail at least one way of carrying out** the invention claimed, using examples where appropriate and referring to the drawings, if any;
- (f) indicate explicitly, when it is not obvious from the description or nature of the invention, the way in which the invention is industrially applicable.

(2) The description shall be presented in the manner and order specified in paragraph 1, unless, owing to the nature of the invention, a different presentation would afford a better understanding or be more concise.



This slide shows the typical structure of a description in a patent. The description relates to the drawings. Often a picture is worth a thousand words!

The invention shown is from the UK. It can be found in patent application GB360253, which was filed in 1930.

Slide 20:
What can be patented at the European Patent Office

Under the European Patent Convention *"European patents shall be granted for any inventions, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application."*

An invention must be new to the world in order to be considered for a European patent; at the date of filing, there should have been **no previous public disclosure** of the invention, be it in the form of a publication, a talk at a conference, a prototype presentation or a blog on the internet, etc.

There must also be an "inventive step", which is quite difficult to assess because the EPO must compare the invention with what would have been obvious to an imaginary "skilled person".

Background information
The European Patent Office uses the so-called "problem-and-solution approach" to assess inventive step. In this approach there are three main stages: (i) determining the "closest prior art", (ii) establishing the "objective technical problem" to be solved, and (iii) considering whether or not the claimed invention, starting from the closest prior art and the objective technical problem, would have been obvious to the skilled person.
(Source: *http://www.european-patent-office.org/legal/gui_lines/e/c_iv_9_8.htm*).

Patentability requirements vary from country to country. In particular, the USA has a patent system that is quite different from the European system in many important details. In this patent teaching kit, we only refer to a few differences that we feel are of most interest to students. For example, countries such as the USA and Japan have a so-called **grace period**: After having disclosed the invention (in any way, see above) you still can apply for a national patent during the grace period (which is one year in the USA). So students who have already published their invention might still be able to get some patent protection.

Patents cannot be granted in respect of ideas, concepts, discoveries, computer programs as such, business methods, teaching methods, diagnostic methods, medical therapies, etc. However, if a computer algorithm is used to achieve a technical result, e.g. in an electronic control device, it can be patented. The technical effect of the computer algorithm must go beyond the normal physical effects involved in the execution of the program (e.g. of electric currents flowing in computers when calculating). For more information on this topic see the Guidelines for Examination in the European Patent Office (Section C.IV.2.3.6) (*http://www.epo.org/patents/law/legal-texts/guidelines.html*)

Each jurisdiction has its own exclusions from patentability. For example, in the USA patents on software as such and on business methods were regarded as patentable for some time. However, in recent court decisions this practice has been limited.

Other conditions also apply; the invention must have an industrial application and not interfere with morality or ordre public, etc. (see Article 53 EPC). For example, the requirement of industrial applicability may be a hurdle in biotechnology.

Articles 52 and 53 of the EPC provide a comprehensive list of matter excluded from patentability in Europe. Article 52 covers what is considered not to be an invention and Article 53 covers what is excluded from patentability even if it is an invention. The text of the European Patent Convention is available at: *http://www.epo.org/patents/law/legal-texts/epc.html*

This slide refers to patent applications filed with the European Patent Office (under the European Patent Convention, or EPC).

The patent will cover only those aspects of your invention that are new and inventive.

Note:
The USA has a one-year grace period – you can apply for a US patent up to one year **after** having disclosed the invention to the public.

Inventions must have an industrial application in order to be patentable. However, the patent office does not examine whether the invention is of economic value. This requirement is only very rarely a practical hurdle for patent applications (exceptions exist for example in some fields of biotechnology).

Slide 21:
What not to do when considering filing a patent application

This slide elaborates on the previously mentioned requirement of novelty. For an invention to be novel, there must be no public disclosure of the invention prior to the filing of the patent application (for exceptions see note below). Only the **aspects that are new** can be protected by a patent.

Any public disclosure prior to filing the application will destroy the novelty of your invention. Public disclosure can include talking about the invention in a lecture, a seminar or an exhibition, publishing an article or mentioning it in a blog entry. Furthermore, selling a product that incorporates the invention may be considered a public disclosure (see the case law of the Boards of Appeal of the European Patent Office, 5th edition, 2006, I.C.2. pages 67ff., available at *http://www.epo.org/patents/appeals/case-law.html*).

It is therefore important that you do not tell anyone about your invention (especially in writing) before you apply for a patent. However, you can tell qualified (registered) lawyers, solicitors and patent agents because anything you say to or show them is legally privileged. This means it is in confidence and they will not tell anyone else.

If you need to discuss your invention with someone before you apply for a patent, a non-disclosure agreement (NDA) can help. If possible, consult a qualified patent agent or lawyer if you are thinking about disclosing your invention to someone else. The UK Intellectual Property Office has prepared some further information on non-disclosure agreements (*http://www.ipo.gov.uk/patent/p-applying/p-should/p-should-otherprotect/p-should-otherprotect-cda.htm*).

Note:
There are a few exceptions to the requirement that an invention cannot have been disclosed prior to the date the patent is filed. One is if the publication was due to an evident abuse in relation to the applicant. See Article 55 EPC for details: *http://www.epo.org/patents/law/legal-texts/epc.html*

Note for students who have already published/disclosed their invention:
In some countries it is still possible to apply for a national patent after first publication, provided you do so within a certain time limit ("grace period", 1 year in the USA). In Europe, no such grace period exists and any publication or disclosure prior to filing the first application will destroy the novelty.

Remember the "social contract"? If you have already revealed your invention to the public, you will have nothing to "trade", so you won't get a patent. **It does not matter if it was you who made the invention public!**

There is no problem if you present/publishing/ sell your invention AFTER you have filed the patent application.

If you need to talk to potential customers or investors before filing a patent application, sign a **non-disclosure agreement** (NDA) with them first!

Slide 22:
Where to apply for a patent

Patents must be obtained in each country where protection is sought – there is no such thing as an "international patent" There are several possibilities when filing a patent application, though: filing a national patent in the country of residence and/or any other country; filing a patent application at the EPO; filing an international patent application through the PCT. All of these options have their advantages, drawbacks and implications with regard to cost and time frame.

A European patent is mostly equivalent to national patents in those countries for which it is granted. The latter are chosen from the EPO's member states by the applicant and there are cost implications. European patents are granted by the EPO. However, when a European patent is granted, it has a legal effect similar to a bundle of national patents in all the countries where the patent owner has decided to protect his invention. The cost of a European patent depends on the number of countries that the patent owner has designated. On average, patent owners designate about six countries in which they wish to have protection. After the grant of a European patent, any legal proceedings that arise, such as infringement or invalidity actions, are not dealt with by the EPO but by the national courts of the country (or countries) where the actions arise.

A national or European patent application can serve as a basis for a later application for the same patent in other countries. For a period of 12 months after the date of filing of a national or European patent, the applicant can file for patents on the same invention at any other patent office and claim the first date of filing as the "priority date". This means that his patent application in that country will be considered as if it had been filed on that "priority date". This can be very important if in the meantime another inventor has applied for the same patent in that country or if somebody has published the same invention. The term "priority date" is used because if two persons apply for a patent on the same invention, the person that applied first (or invented first, in the USA) is given the priority, i.e. the person who can claim the earlier "priority date" will be entitled to be granted the patent in most jurisdictions.

If more than a year has passed before a further national, European or international patent application is filed in another country, this application will not be treated as having been submitted on the date of the first filing. This may mean that the invention disclosed in the later patent application is not regarded as novel any more (see Article 54(3) EPC). Furthermore, any publication made in the meantime will be considered to belong to the prior art. If more than 18 months have passed since the initial filing of the patent application, it will usually have been published and no further patent applications can be filed internationally for the same invention, because the invention is not new to the world anymore and it cannot claim an earlier priority.

Because patenting in multiple countries can be very costly and because often the prospects of the invention are not clear, 12 months is a very short time for many patent applicants. However this "thinking time" can be extended to up to 31 months through the PCT application system.

Although the PCT provides a central way to apply for a patent "internationally", the PCT application process will eventually lead to multiple national patent examination procedures – one for each country in which protection is sought (a PCT application can also lead to a European patent application).

Within one year of the first filing of a patent application, applicants may file an application for the same invention with other patent offices. Such inventions are treated as if they were filed on the date of the first application (for the purposes of examining novelty and inventive step).

PCT applications can be filed at a national patent office, the EPO or with the World International Property Organization direct.

The PCT procedure allows for a single application which is later split into many national patent applications. The EPO accepts patent applications filed under the PCT in its capacity as a receiving office, international searching authority, international preliminary examining authority and/or designated or elected office. However, it is important to stress that there is no such thing as an "international patent".

There is no international patent as such, but there is such a thing as an international patent application procedure!

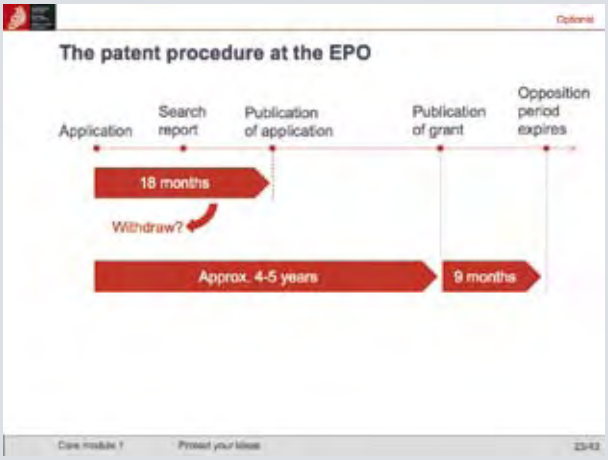
Slide 23 (optional): The patent procedure at the EPO

After receiving a European patent application the patent examiner prepares a search report that is used to examine the novelty and the inventive step of the invention. In the search report the patent examiner reports any prior art that is related to the invention and provides an indication of whether or not this prior art conflicts with the claims of the application. The search report is usually (but not always – there is no legal requirement) created and sent to the patent applicant before the patent application is published. The patent application can be withdrawn at any time. A common reason for withdrawing a patent application is if the EPO search report finds substantial conflicting prior art. By withdrawing the patent application early enough the applicant can avoid its publication.

Patent applications are normally published 18 months after they are filed. The applicant can request that the application shall be published before the usual 18 months. (In the USA, if he does not want to apply for patents elsewhere, the applicant may request that his patent application not be published. As a result, many patents are granted in the US without the application being published first).

On average, the EPO will grant a patent 4 or 5 years after the application was first filed (2007 figures). This is mainly due to the long period of time applicants are given to respond to communications from the EPO (e.g. 4 months) and to make requests (e.g. request for examination) as well as to the large backlog of pending applications.

After the EPO has granted a patent, any person can file an opposition during the first nine months of its life and provide evidence that the patent should not have been granted (e.g. the invention had already been disclosed before, etc.). At the end of the opposition proceedings, which only take place if opposition is filed, the patent can be maintained in full or in amended form or it can be revoked. In general, the number of patents opposed is quite small.



The search report is usually created before the patent application is published.

Applicants can withdraw their application at any time, e.g. if conflicting prior art is found.

If applications are withdrawn early enough, then the application is not published.

During the opposition period, third parties can oppose the patent on the grounds that it should not have been granted (opposition grounds are limited).

The reasons for the long time taken to grant a patent (not just at the EPO, but at most other patent offices too):

- applicants have a long time to respond to communications from the patent office
- there is a substantial backlog of applications due to a surge in patenting activity and international patenting

A published patent application will provide some limited protection even before it is granted (see Art. 67 EPC).

Slide 24 (optional): The PCT procedure

The **Patent Cooperation Treaty (PCT)** allows applicants to file patents in multiple countries by means of a single application which can split into several national patent applications after the international phase. The EPO accepts patent applications filed under the PCT in its capacity as receiving office, international searching authority, international preliminary examining authority and/or designated or elected office.

PCT applications do not lead to an "international patent"; rather they divide into individual national patents. Thus, after the initial PCT phase the cost of a PCT patent corresponds to the sum of the cost of all the individual patents in all the countries where the patent is filed. The total cost for worldwide protection can amount to as much as EUR 100 000 (Gassmann et al. (2007), Patentmanagement, p. 44).

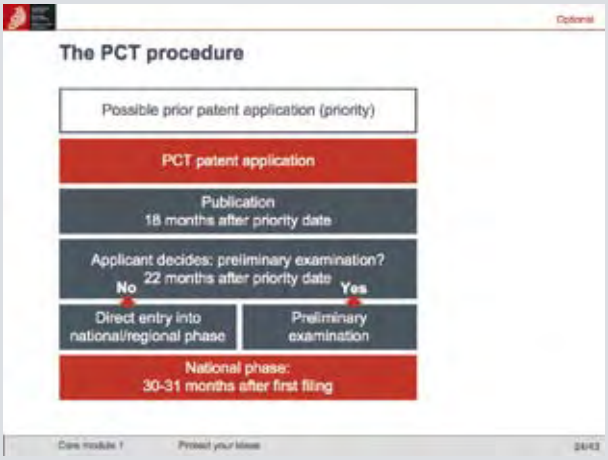
It is often said that the advantage of a PCT application is that the actual filing of the application in each of the countries in which protection is sought can be delayed until the PCT process is completed. The PCT application gives the applicant up to 30 months (instead of 12) to decide if the invention is worth the effort of international patenting and in which countries it will need protection. Given the very high cost of applying for patents in many countries, this gain of 18 months (or 19 months for European patents) can be important. PCT applications themselves cost around EUR 2 600 in patent office fees (plus the usual fees of the attorney), but the cost varies a lot depending on, for example, the number of pages and the designated countries in which protection is being sought.

For an introduction to the Euro-PCT procedure, see the EPO Guide for Applicants Part 2: How to get a European patent (Part 2) – PCT procedure before the EPO ("Euro-PCT") : *http://www.epo.org/patents/Grant-procedure/Filing-an-application/international-applications/guide-for-applicants.html*

The PCT procedure also includes a search report. The report is usually communicated to the applicant around 4-5 months after the filing of the international application (in some cases much longer).

PCT applications can be filed with national patent offices, the European Patent Office or with WIPO direct.

A list of **frequently asked questions** (and their answers) is available on the WIPO website at *http://www.wipo.int/export/sites/www/pct/en/basic_facts/faqs_about_the_pct.pdf*



Main advantages:

- One patent application for up to around 141 states.
- National fees and translation costs delayed; occur only if and when the national phase is entered.
- Entry into the national phase can be delayed by up to 30 months (EPO: 31 months) after filing.
- Compared with the 12-month priority period: **deferral of decisions and costs by up to 18 months**!

Priority date = date of filing of the first patent application for an invention.

Slide 25:
Cost of a national patent application – Germany

The cheapest way to get patent protection in one country is to file a single national patent application. The actual cost varies from country to country. This slide illustrates the cost of getting a national patent in Europe's largest economy, Germany, by directly applying for a patent at the German Patent and Trademark Office.

Although you could theoretically file the application yourself, it is wise to seek advice from an experienced patent attorney. However, before you do so you might want to check up on existing patents. You will learn how to do that later in this lecture.

Depending on the complexity of the case, a patent attorney will charge approximately EUR 1 000 to 4 000 for preparing and filing a (national) patent application and handling correspondence with the patent office.

The German Patent Office charges EUR 60 for filing the patent application and EUR 350 when the applicant requests the examination of the patent. (The request for examination must be filed within 7 years from the date of filing of the application).

Furthermore, **renewal fees** have to be paid throughout the life of the patent (even before it is granted). If these fees are not paid, the patent becomes invalid. The fees start at EUR 70 for the third year and increase to EUR 350 for the tenth year, EUR 1 060 for the 15th year and almost EUR 2 000 for the 20th year (the maximum term of a patent). The cost estimate shown on the slide includes the renewal fees up to the time the patent is granted.

The cost estimate shown here is for a single patent application. However, many applicants choose to apply for multiple patents on what might appear to be a single invention. Their intention is to increase the effectiveness of patent protection. If such a strategy is sought, then the cost of patenting will obviously increase significantly.

The cost of the patent application is usually paid for by the company the inventor works for, because this company will usually be the owner of the patent.

The estimated cost shown is the total cost up to grant of the patent.

The German Patent Office takes approximately three to five years to grant a patent.

Most patent offices require the payment of patent renewal fees to keep the application/ patent valid. These fees are meant to eliminate worthless patents before the maximum term of 20 years.

Note:

One patent on its own will often not be enough to effectively protect a whole new technology. This means that the total cost of patent protection might be substantially higher.

Slide 26:
Cost of a European patent up to grant

European patents give almost the same rights as national patents in those countries for which they are granted (see Article 64 EPC). These rights may differ slightly from country to country. Once granted, a European patent can be regarded as equal to a bundle of national patents. There is no true European Community patent yet.

Until May 2008, patent applications had to be translated into the language of each state in which patent protection was sought. With the London Agreement of May 2008 some member states agreed to dispense with the translation requirements in full or in part, depending on the language in which the European patent application was written (see *http://www.epo.org/patents/law/legal-texts/london-agreement.html*). However, in many cases there will still be translation costs (that depend on the complexity of the patent's claims). Furthermore, the fees of the patent attorney and the European Patent Office and the post-grant renewal fees will vary depending on the countries in which the patent is valid. Thus, the cost of a European patent depends on the specific countries in which protection is sought.

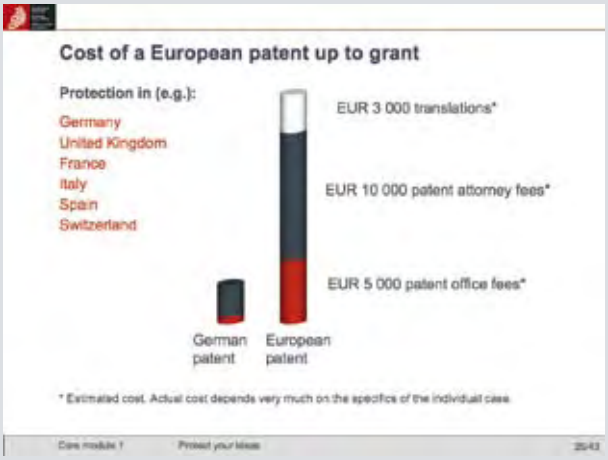
Here we present an example of a European patent valid in six countries. It is important to note that part of the cost (e.g. translations, some attorney fees) only accrues after the European Patent Office has granted the patent (which usually takes about three to five years).

Cost estimates for European patents were taken from a study commissioned by the EPO (*http://www.european-patent-office.org/epo/new/cost_analysis_2005_en.pdf*). The study's results have been updated to reflect the changes in translation requirements in 2008; translation costs have fallen from EUR 3 600 plus EUR 3 000 attorney fees for filing the translations to a total of EUR 3 000. The actual translation cost will depend on the patent applicant's choice of countries. In the case shown on the slide, only Italy and Spain have not yet (May 2009) ratified the London Agreement and the actual cost is probably less than the "representative" EUR 3 000 shown.

The renewal fees to maintain the patent in all six countries during years five to ten (i.e. approximately five years after grant) amount to EUR 4 700.

When it comes to choosing which countries to patent in and via which route, it is advisable to seek the services of a patent attorney, who will help you to draft an efficient patent strategy that fits in with your budget.

Cost of US patents
According to *http://www.ipwatchdog.com/patent/patent-cost/*, these amount to approximately EUR 1 000 in patent office fees and approximately EUR 3 000- 18 000 in attorney fees, depending on the complexity of the application.



Cost of a European patent compared with a German patent:

- Higher fees charged by patent attorney
- Higher fees charged by European Patent Office
- Translations required (depending on countries chosen)

Note:

The costs shown are up to the date of grant of the patent. Renewal fees due after that date are not included.

Slide 27:
Advantages and disadvantages of patenting

Patent owners can exclude others from using their inventions. If the invention relates to a product or process feature, this may mean competitors cannot make products with the same features without obtaining a licence from the patent holder. Hence, the patent holder will enjoy a competitive advantage that can be turned into profits.

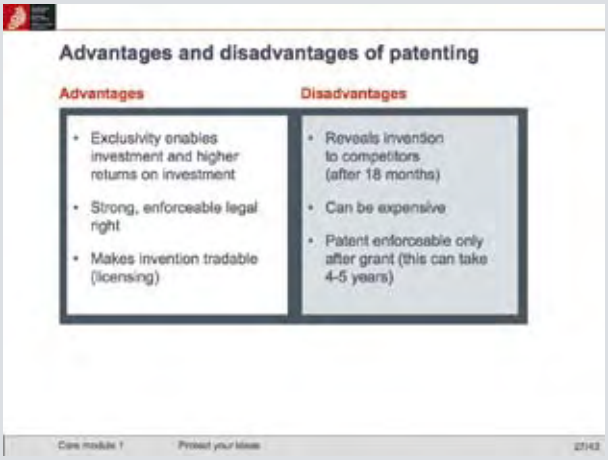
As European patents are examined by the European Patent Office rather than simply registered, patent rights are more certain than many other forms of legal protection available for inventions. Given a valid patent, innovators enjoy strong legal protection. For example, if a patent is infringed, the patent holder can sue for infringement or order customs to intercept imports of the patented products. However, it should be noted that patent enforcement costs can be substantial; see the extended teaching notes for slide 16, "Rights conferred by the patent", for more details.

Patents can be annulled after they have been granted, either by a competitor successfully challenging the patent immediately after grant in an opposition procedure or by invalidation or revocation proceedings at any time.

Another huge benefit of patents is that the invention becomes tradable. Because of the protection offered by the patent, the seller can tell prospective buyers the details of the invention without running the risk of the invention being stolen.

But patenting also has some drawbacks. First of all, patent applications are published after 18 months. This means that everybody (including competitors) can get a blueprint of your invention 18 months after the filing date. Furthermore, as shown in earlier slides, patents can be very expensive if broad international protection is sought.

Sometimes the long time lag of approximately 4-5 years from application to patent grant could mean that, by the time the patent is granted, the invention has already become obsolete. However, the published patent application does offer some limited protection, both factual (competitors have to fear that a patent grant will render their investments worthless) and legal. For details of the latter see Article 67 EPC (*http://www.epo.org/patents/law/legal-texts/epc.html*).



Patent applications are always published 18 months after the date of filing, when they become available on free internet databases.

Patent applications may also offer a certain amount of protection, as competitors may well assume that the patent will be granted and might thus be discouraged from investing in commercialising a potentially infringing product.

Furthermore, some legal protection is also offered (see background notes).

Notes:

– While patents are generally considered to be very strong and enforceable rights, even granted patents can be found to be invalid in court proceedings (i.e. although a patent office might have granted a patent in the first place, judges might later find that they should not have done so).

– Enforcing patent rights may mean going to court, and this can be costly.

Slide 28:
Alternatives to patenting

Instead of patenting their invention, some inventors opt to keep it secret or simply to publish the it, while others do not care about intellectual property rights and do not do any of these.

The most frequent reason for publishing an invention intentionally without patenting it is that publishing costs very little compared with patenting. The benefit of publishing the invention is that others cannot apply for a patent on it any more. Inventions must be new in order to be patentable and if the invention has been published before, then the "second inventor" cannot get a patent any more. In this way, the "first inventor" makes sure he will not be prevented from using the invention by a third party. The drawback of publishing the invention is that it can no longer be patented by the original inventor. Furthermore, publication will disclose the invention to competitors. Improvements might be patented by a third party and this might block the further development of the initial invention.

Keeping the invention secret is another option to avoid the cost of patenting but at the same time to avoid the invention being revealed to competitors. This is especially useful for manufacturing processes that are difficult to observe or reverse-engineer from the end product. In these cases it will be very difficult to find out and prove that a competitor is infringing the patent. Thus, a trade secret can offer the benefit of avoiding information disclosure while not sacrificing much (effective) patent protection. Keeping an invention secret will often also incur costs, at least the cost of signing non-disclosure agreements with employees and partners. Even though trade secret law offers some protection, it is difficult to enforce. You need to prove that competitors have used unlawful means to find out about your trade secret.

Keeping an invention secret can be risky because competitors can reverse-engineer the invention or independently develop the same invention. They could even file a patent on the invention and might then be able to stop you developing your invention further (although the original inventor cannot be stopped from using the invention in exactly the same way as before). Another drawback of keeping the invention secret is that it is often difficult to actually keep secrets. Back in 1985, even before computer security problems could be exploited for industrial espionage on a large scale, a survey found that information on new products and processes became available to competitors on average within a year (Mansfield, 1985: How rapidly does new industrial knowledge leak out?, Journal of Industrial Economics, December 1985).

The final option – to do nothing about IP – is obviously the cheapest way of handling an invention. However, it has no other benefits and presents substantial drawbacks: other people might patent your invention, preventing you from using it unless you can prove that you used it before. You will not enjoy exclusivity – everybody is allowed to copy the invention. And according to the above -mentioned study, it is very likely that it will not be long before others find out about your invention.

Other non-patenting options include lead-time advantages (being the first to introduce the product to the market), learning curve effects (starting to learn about the technology earlier and thus maintaining a technical advantage), network effects (creating a user base or a technical standard first) and customer relations. In surveys, these means have been found to be at least as important as patent protection and other legal instruments. However, they are not only employed as alternatives to patent protection, but are instead often used in conjunction with them.

Information disclosure:

– the invention can be published in any newspaper, magazine, journal, book or public prior art database.

– publication prevents others from applying for a patent on the same invention and will thus keep the invention "patent-free" (however, other prior patents might effectively block its use).

Trade secrets:

– frequently used, especially for inventions that do not qualify for patent protection and for production processes that cannot be reverse-engineered by analysing the end product. In the latter case, patent infringement would be very difficult to prove and thus patents might be ineffective.

– on average, detailed technological information leaks out within a year.

Additional, complementary means of protecting inventions: **lead-time advantages (time-to-market)**, learning curve effects, network effects (i.e. creating a user base), customer relations, etc. In surveys, these options are found to be **at least as important as patent protection and other legal instruments**.

Slide 29:
How patents are used

Patents can be used for a variety of purposes. The most frequent one is to protect a company's products or processes from imitation. This is of obvious importance for the company's profits.

In the world of high-tech start-ups in particular, a company's expected economic success often critically depends on the IP rights owned by the company, because in many cases larger competitors already exist who could otherwise simply copy the invention and sell it more cheaply. Investors will often refuse to invest in a new high-tech company if it does not have strong patents protecting its technology. Thus, patents also play an important role in attracting funding for a new venture, as has been confirmed by empirical studies of high-tech companies.

Patents can serve other purposes beyond protecting the products of a company. For example, owners can license their patents to other companies or use them to block the research efforts of their competitors (i.e. efforts that might endanger their own technological lead). And certainly there are patents that are simply not used.

A large-scale empirical study financed by the European Commission collected information from the inventors of more than 7 000 European patents in a range of industries. The results give an insight into how patent owners actually use their patents:

"Internal use" means that the patent is used to protect aspects of products the company manufactures or aspects of their manufacturing process. "Licensing" means the patent owner allows another company to use the invention for royalty fees. "Cross-licensing" means that two or more companies exchange licences to their patents. "Blocking competitors" means that the patents are not used to protect their own products or processes, but 'just' to hinder competitors from using the invention. "Sleeping patents" are those currently not used for any purpose.

There are large differences in the use of patents depending on country, industry and size of the company. For example, the percentage of patents used for licensing is much higher in biotechnology.

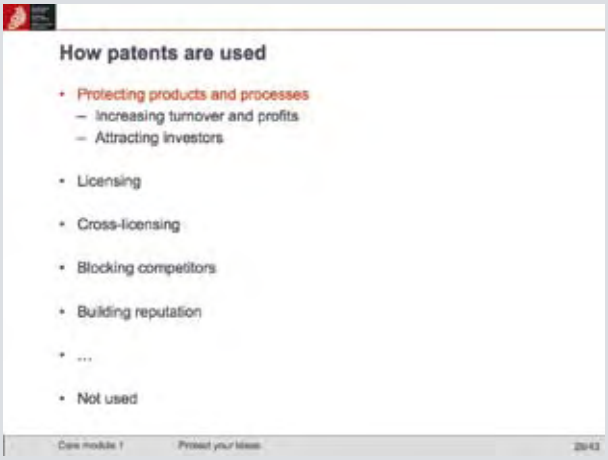
Licensing can be a means of benefiting from the invention without having to actually produce the products and/or set up a company. However, according to recent empirical research, collecting royalties is not the only focus of licensing activities (see below). In particular, giving licenses is often a means to gain access to the patents and knowledge of other companies. Getting access to third-party patents can be crucial. In industries where inventions build upon each other and many patents are needed to be able to make a product (such as in semiconductors and telecommunications) cross-licensing agreements are the norm. Cross-licensing is when two companies grant licences for (some of) their patents to each other.

Patent use

	Internal use (%)	Licensing (%)	Cross-licensing (%)	Licensing and use (%)	Blocking competitors (unused) (%)	Sleeping patents (unused) (%)	Total (%)
Electrical Engineering	49.2	3.9	6.1	3.6	18.3	18.9	100.0
Instruments	47.5	9.1	4.9	4.3	14.4	19.8	100.0
Chemicals and Pharm	37.9	6.5	2.6	2.5	28.2	22.3	100.0
Process Engineering	54.6	7.4	2.0	4.9	15.4	15.7	100.0
Mechanical Engineering	56.5	5.8	1.8	4.2	17.4	14.3	100.0
Total	50.5	6.4	3.0	4.0	18.7	17.4	100.0

Distribution by technological class. Number of observations = 7711.

Source: Giuri et. al. (2007): Inventors and invention processes in Europe: Results from the PatVal-EU survey, Research Policy, No. 36, pp. 1107–1127.



Most patents are worth less than EUR 300 000, but 1 out of every 100 is worth more than EUR 100 million (European PATVAL study).

Universities in the USA receive approximately USD 1 500 million – about 3% of their annual research budget – from patent licensing fees (AUTM US Licensing Survey 2004).

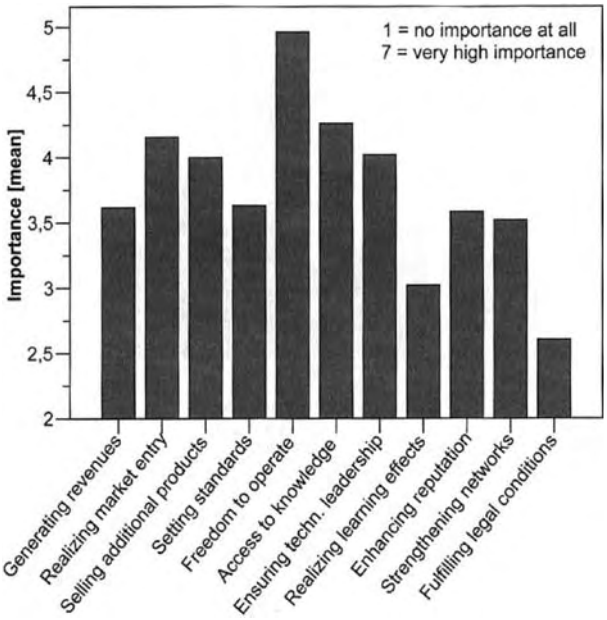
Results from a survey of more than 7 000 patents:

	% of all patents
Protection of own products/processes	50%
Licensing only	6%
Licensing and use	4%
Cross-licensing	3%
Blocking competitors	19%
Not (yet) used	17%

(Substantial differences by country, industry sector and company size)
Source: Giuri et al., 2007.

Cross-licensing is very important for certain industries. Remember the mobile phone example: a common mobile phone has to use technology protected by so many patents that most mobile phone companies have made cross-licensing agreements to allow each other to use their respective patents.

Another important function of patent licences is to set standards (famous standards fostered through patent licences include CDs, DVDs, MP3, etc.). Furthermore, licensing to competitors may be required because customers may demand a second source of the products (for example in the automobile industry). The following chart shows the relative importance of different reasons why companies licence their patents to others.



Source: Lichtenthaler, U. (2006): Leveraging knowledge assets, DUV

In recent years a "new" use of patents has spawned controversy: the (mis)use of imperfections in the patent system, not to protect one's own innovations, but to extract large amounts of money from successful innovators. This disputed practice is predominantly (but not exclusively) observed in the USA and usually involves filing a patent infringement lawsuit and demanding the suspension of shipments of the products concerned, not for the purpose of protecting the exclusivity of one's own products, but simply to extract a large payment in out-of-court settlements or in a final court decision. Companies who behave in this way and who don't do R&D themselves, their only business being to extract licensing royalties and infringement damages, are known as "patent trolls".

The concentration of such activities in the USA has been attributed to particularities in the country's legal system. First of all, infringement damages to be paid by patent-infringing companies are often much higher in the USA than in other countries; secondly, in the USA a patent owner can often prevent the distribution of allegedly patent-infringing products even before a final court decision is made, and before the defendant has had chance to prove that the patent is actually invalid (the latter is true for many countries, including, for example, Germany); thirdly, the USA grants patents on more subject-matter than other countries (in particular: software and business methods) and in these areas it is especially difficult to assess prior art. As a result, an unknown number of invalid patents have been granted by the US Patent and Trademark Office and some of them are now used to put pressure on innovative companies. Finally, defending allegations of patent infringement is very expensive in the USA, where the cost can frequently exceed USD 1 million even if the defendant successfully proves that they have not infringed the patent.

This kind of behaviour can be observed not only in the field of patents, but also with other IP such as, for example, copyright (for an example, see the famous case of the SCO Group and the LINUX operating system at *http://en.wikipedia.org/wiki/SCO-Linux_controversies*).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Slide 30 (optional): Licensing income of US universities

Patents are an important means of protecting innovations, not only for companies and individual inventors, but for universities too.

This chart shows the total licensing income of US universities from 1991 to 2004 (no comparable data exists for Europe). Not all universities participated in the study, so the real figure is higher than the amount shown here.

In 2004, US universities received approximately USD 1 400 million in licence fees. By patenting their inventions, universities received additional funds, companies learned about new technologies when screening patents, and start-up companies could be founded to commercialise patented technologies.

It is important to note that patenting an invention made at a university does not necessarily mean prohibiting other scientists from using the invention. Rather, it means that the university is free to choose who to charge for using the invention, and how much. For example, universities will often choose to let other universities use their inventions for free while charging companies a small licence fee. These licence fees can then be used to finance further research.

A frequent critique of university patenting is the fact that publicly-funded science, particularly projects funded by the National Institute of Health in US universities, has in some instances resulted in private ownership of associated intellectual property rights by pharmaceutical and biotech companies. This has been an unintended consequence of the US Bayh-Dole Act, arguably to the detriment of the public interest in the USA.

Supplementary data
According to a study by the Milken Institute, US universities earn an average of USD 27 825 in licensing income for every USD 1 million of research expenditures. For European universities the corresponding figure is USD 11 988. It must be assumed that this difference is not due to superior research in the US but to a more extensive and professional use of patents by universities in the US.

According to the US Department of Education, there were 3 million graduate students in 2004. Thus, licensing income was equivalent to USD 470 per graduate student.

On average US universities collect about 3% of their research budget from licensing royalties (compared with 1.1% in Europe).

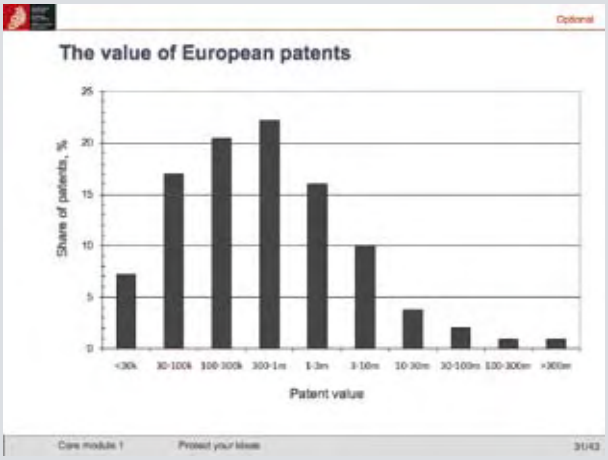
Slide 31 (optional): The value of European patents

This chart illustrates the results of a large-scale empirical study carried out in 2004. The chart shows the distribution of the private value of patents applied for at the European Patent Office (note the approximate logarithmic scale on the horizontal axis that reports the value). According to these estimates, about 50% of all patents are worth up to EUR 300 000, about 20% are worth between EUR 300 000 and EUR 1 million, and 3% are worth EUR 100 million or more.

The distribution is skewed; many patents have a low value and very few patents have a high value. It is therefore not useful to consider the "average value" (approx. EUR 6 million according to this study) as the value of a "typical" patent. Rather, the "typical" patent value is EUR 300 000, the median of the distribution.

Background
A questionnaire was sent to the inventors of a random sample of patents applied for at the European Patent Office between 1993 and 1997. The questionnaire was returned by 9 600 inventors out of the 27 000 polled. In one of the questions, the inventors were asked, given all the information they had learned so far, to estimate the amount of money the patent owner could have sold the patent for to his strongest competitor on the day the patent was granted. Inventors responded by choosing one of the ten value categories shown here.

Data source
Ceccagnoli et al. (2005), Study on evaluating the knowledge economy – What are patents actually worth?; Final Report to the European Commission, Tender No. MARKT/2004/09/E; available online at *http://ec.europa.eu/internal_market/indprop/docs/patent/studies/patentstudy-report_en.pdf*, p. 27.



The figures shown here represent the responses from a survey of more than 9 000 inventors of patents applied for at the European Patent Office in the 1990s. Inventors were asked in 2004, long after the patents had been applied for.

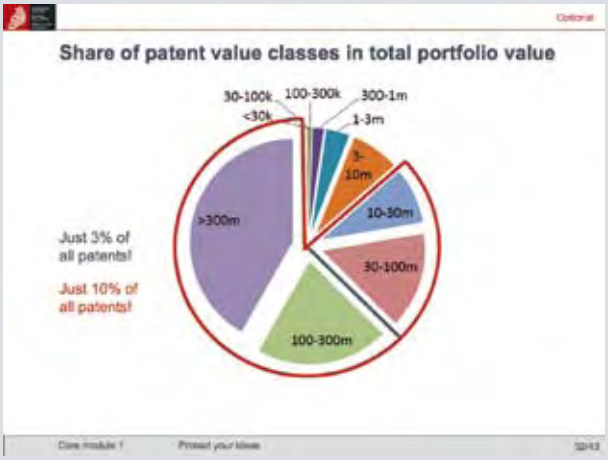
Average value: approximately EUR 6 million.
Median (50% worth less/more):
EUR 300 000 = **typical** value.

Source: Ceccagnoli et al., 2005.

Slide 32 (optional):
Share of patent classes in total portfolio value

This chart shows the same data set as the previous chart but it visualises the approximate share of each class of patents (value classes) in the total value of all patents investigated. This gives insights into the expected value distribution of a large portfolio of European patents.

It is immediately clear that all patents with a value of less than EUR 300 000 do not significantly contribute to the overall portfolio value. However, more than 50% of all patents pertain to this category of patents, with low relevance for overall value. More than 50% of the overall value of this large patent portfolio is derived from the 3% of high-value patents. More than 80% of the overall value is derived from less than 10% of all patents.



More than 50% of the overall value is derived from just 3% of all patents.

More than 80% of the overall value is derived from just 10% of all patents.

Thus, in large-scale patent portfolios, attention should be focused on the small number of high-value patents!

Source: Ceccagnoli et al., 2005.

Slide 33 (optional): Patent management

In order to profit from the patent system, established companies and start-ups alike should draft a patent strategy for decisions in this area. This patent strategy should be dependent on the company's overall strategy.

It should reflect the company's main motivation for patenting: Is it to exclude competitors from making the same products? Is it to focus on research and development and license the technology to manufacturers? Or is it to achieve freedom to operate (to avoid being excluded from using essential technology)? Of course, many companies will pursue several goals simultaneously. However, knowing what the focus is, and why, will help in the decision-making processes of everyday business. The patent strategy should also include thoughts on whether these goals will be pursued in an offensive way (e.g. proactively searching for patent infringers and suing them), or in a defensive way (e.g. by publishing some inventions rather than patenting them). Finally, a company's business type, financial resources and business model will determine its international patent strategy (remember that patent rights are territorial in nature – there is no such thing as an international patent).

Patent information is an important topic in patent management. It is essential for staying abreast of science and technology (see slides 36 onwards). Furthermore, a company can only avoid infringing patents of other companies by actively searching for such patents. In today's complex technological (and patent) landscape, this is a difficult but essential task. Failing to discover patents that cover one's own products (in other words: infringing patents) can be very costly. Consider the famous RIM vs. NTP case in which the manufacturer RIM paid more than USD 600 million to patent-holding company NTP (see *http://en.wikipedia.org/wiki/NTP,_Inc.*).

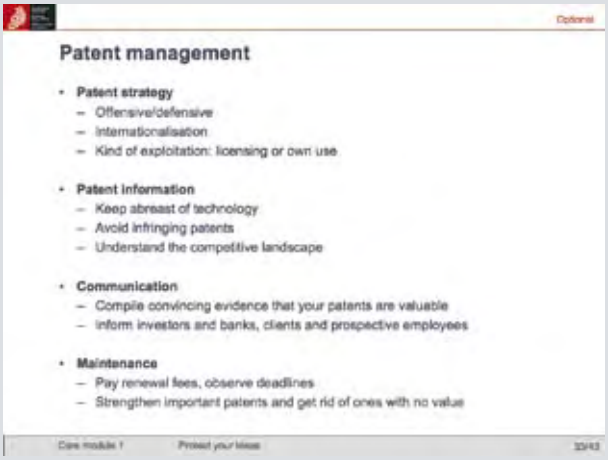
Patent information also allows innovators to discover who the main players are in a certain technology field and what their individual patent position and strategy is. It is therefore an invaluable source of information for use in developing a sound technology strategy.

Because patents are an important tool and a significant source of value for many high-tech companies, they can be employed to convince investors to invest or banks to give credit. Venture capital firms investing in high-tech start-ups usually require a strong patent position as a prerequisite for considering investment.

Some patents turn out to be important competitive tools. Using the advice of patent professionals, such patents should be strengthened, for example by supporting them with further patents and other IP.

In most countries a patent will lapse if the owner does not pay the regular patent maintenance fees, so keeping track of the deadlines is an important task (often performed as a service by patent attorneys)

Not all patents are valuable. In fact, many patent applications that seemed worthwhile at the time of the invention turn out to be irrelevant later, or simply become outdated. If such patents or patent applications are found in a patent portfolio review, they could be withdrawn or allowed to expire in order to save money.



Patent strategy should support a company's overall strategy.

Offensive:

e.g. actively searching for companies infringing the patents

Defensive:

e.g. publishing instead of patenting

Internationalisation:

Patents are territorial rights. In countries where the company is not active, licensing opportunities might still exist.

Competitive landscape:

Patent information holds detailed information on the technology of most competitors worldwide. If analysed correctly, it can give important insights into the industry in general and the strategy of competitors in particular.

Slide 34:
15-25% of all research efforts in vain

Many researchers, scientists and engineers do not review what has already been invented before starting a new project. As a result, many research projects yield results that others have not only already published, but perhaps also even patented. In many cases, inventors only find out that "their" invention has already been patented when informed to this effect by the patent office examining their application.

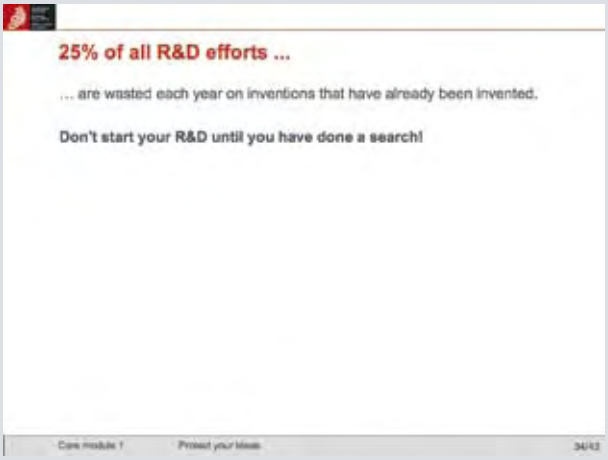
The precise extent of duplicative R&D efforts is not known, as statistics are not available. But because patent offices search for prior inventions for each and every patent application they receive, they have some idea of the extent of the phenomenon. The Austrian Patent Office estimates that in Europe, EUR 60 000 million are wasted each year on inventing what has already been invented (*http://www.patentamt.at/geschaeftsbericht2006/de/srvverschenken.html*).

In 2005, the president of the Austrian Inventor Association noted that the extent of duplication in R&D means that "up to 10 000 of the 30 000 inventors active in Austria work to no avail" (see Mario Wally (2005): "Doppelt gemoppelt", profil extra, February 2005, p. 24-25).

ProVendis, the technology transfer agency of several German universities, estimates investments in duplicate R&D in Germany to be EUR 12 000 million per year, or 25% of total R&D spending (*http://www.lifesciencepatente-nrw.de/fileadmin/provendis/downloads/Mickeln%20Innovationsschutz%2007.09.2005.pdf*).

Lessons to be learned:

- Search the journal literature and patents (and other information sources) before starting any project.
- Search again at project milestones; your project goal might have changed and other inventors might have been active too.



Replication of R&D results costs anything up to EUR 60 000 million a year in Europe alone.

The Austrian Patent Office estimates that EUR 60 000 million are wasted per year in Europe, including EUR 1 000 million in Austria.

The President of the Austrian Inventor Association estimates (2005) that up to 10 000 of the 30 000 inventors who are active in Austria work "to no avail".

The technology transfer agency ProVendis estimates that 25% all of German R&D investment is wasted by duplicating R&D already done.

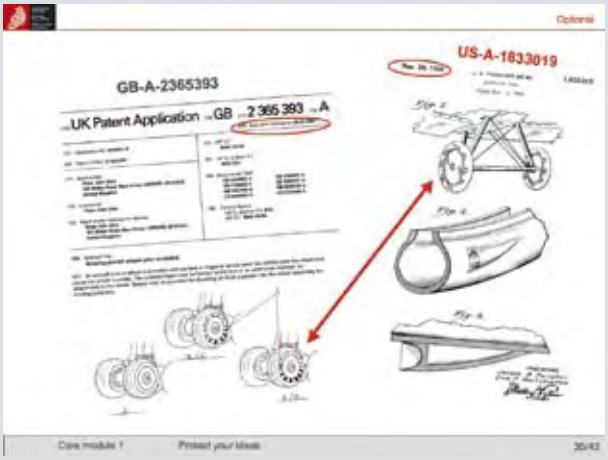
- Review the literature (including articles and patents) **before you start** your project.
- Search again at project **milestones**: your project might have changed and other inventors might have been active too.

Slide 35 (optional): Re-inventing the wheel – literally

Reinventing aircraft wheels
Slide 34 gives estimates for the extent of the duplication of R&D efforts. This slide presents a practical example in which someone literally reinvented the wheel.

In 2000, a patent application was filed for an invention that solves the problem of excessive wear (or even explosion) of aircraft wheels due to high acceleration when touching the ground. It uses small pockets on the side of the tires that make the wheel spin in the wind without the need for an additional electrical motor. What the inventor did not know was that this invention had already been made in the early days of airplane technology: in 1929, a US patent application had been filed (and almost forgotten) that described the same invention.

This case highlights two important points:
- Searching the patent literature is worth the effort.
- Many people have invented clever solutions (often a long time ago). The problem you are looking to solve might already have been solved, and the solution might even be free to use (the 1929 patent expired long ago).



Reinventing the wheel – literally

Problem:

excessive wear (or even explosion) of aircraft wheels due to high acceleration when touching the ground.

Proposed solution:

small pockets on the side of the tires that make the wheel spin in the wind without the need for an additional electrical motor.

Patent already applied for in 1929!

Slide 36:
Much information only available in patents

Patents as a unique source of information:
Empirical studies indicate that around 80% of all the information contained in patent documents cannot be found anywhere else (see references below).

The exact percentage depends on the technical domain and the value of the knowledge. The more valuable a piece of scientific or technical knowledge, the more likely it is that it will be published in a patent.

In a recent large-scale study in the field of chemistry (Bregonje, 2005, see below), a total of 34 000 new chemical compounds in various domains such as polymers, alloys etc. were traced in scientific journals and in the patent literature. It was found that, depending on the field, up to 77% of new compounds were published in patents only, and not in journals. In total, 10 300 compounds (30%) could only be found in patents. Only 1 200 compounds documented in patents (11% of what was found in patent documents) had also been published in journals.

In addition to the absence of many R&D results from journals, there is another important difference between the two information sources: research papers focus on the research findings (the contribution to science), while patents focus on how to actually make the invention work.

Reviewing the journal literature only would mean missing out on a large amount of valuable knowledge.

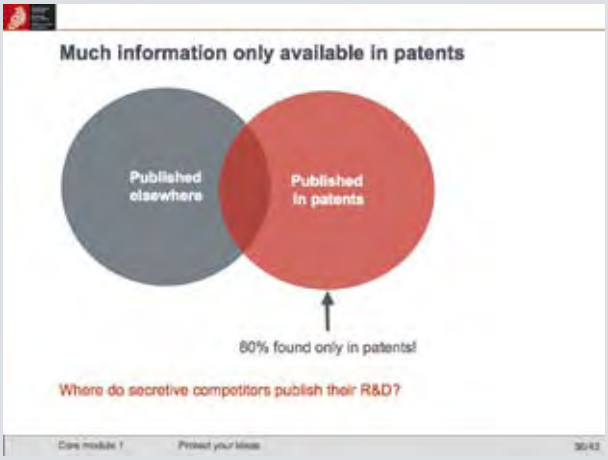
Furthermore, companies often do not want to disclose their new product development activities and do not publicly report such information. But very few companies intentionally forego patent protection for the sake of surprising competitors with new products. As all patent applications are published just 18 months after the priority date, patent data contains new information on a company's new product development activities which cannot be found elsewhere.

The time factor
Patent applications take 18 months to be published. This may seem like a long time. But publication in peer-review journals takes time too. In many cases, the patent application will be published before the corresponding academic paper. This issue has been empirically investigated in the above-mentioned study on chemical compounds (Bregonje, 2005). The authors found that in approximately 50% of the cases where both journals and patents contained the description of a new chemical compound, the patent was published earlier.

Additional benefits of patent information
- Patents have a uniform structure throughout the world.
- Almost all patents can be viewed free of charge. So access to them does not depend on your library's financial budget.

References:

- Demidowicz, B. K., Oppenheim, C. (1981), The overlap of patent and journal literature on animal feedstuffs. World Patent Information, 3: 82-83.
- Eisenschlitz, T. S., Lazard, A. M., Willey, C. J. (1986), Patent groups and their relationship with journal literature. Journal of Information Science, 12: 53-58.
- Walker, R. D. (1995), Patents as Scientific and Technical Literature, Metuchen, N.J.: The Scarecrow Press.
- Bregonje, M. (2005): Patents: A unique source for scientific information in the chemical industry?, WPI, No. 27, pp. 309-315.



Approximately 80% of the information which can be found in patents is not available anywhere else in comparable detail.

Patents focus on **how to make things work**, while scientific articles focus on the scientific contribution.

-> Read patents as a complement to the scientific literature!

Also note that your competitors will "announce" their new products in patents if they want to have patent protection!

Source: Empirical studies.

Slide 37:
Solutions found in patent documents

Most documents in patent databases concern inventions that are free to use by everyone. Depending on the patent office, the figure can be as high as 90%. This is due to several reasons:

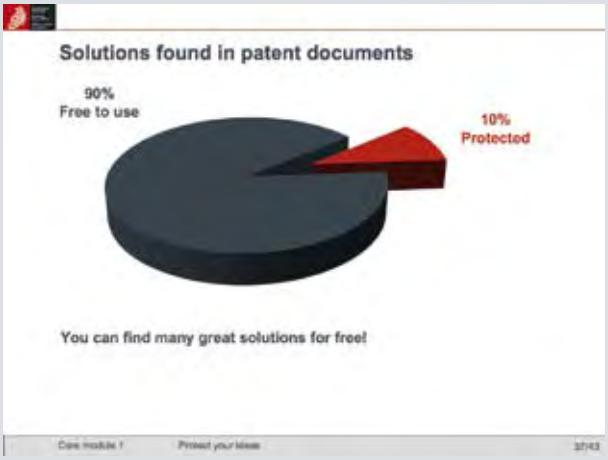
- A substantial number of all published patent applications are withdrawn by the applicant or rejected by the patent office. This means that these patent applications never became patents. Although an application might have been withdrawn, the published application document can still be retrieved (except if the application was withdrawn before the publication was made). Furthermore, some patents are found to be invalid in opposition proceedings or in the courts.

- To maintain a patent, the applicant or owner must pay renewal fees. If the patent does not appear economically attractive any more, the owner will discontinue payment of the renewal fees and the patent will lapse. From that point in time onwards, anybody can use the patent for free. This does not only apply to worthless inventions; patent holders may not have realised the full potential of a patent or they may have simply abandoned it because it did not relate to their core business.

- Even if renewal payments are made, a patent will last a maximum of 20 years from the date of filing (some exceptions apply). Thus, almost all patents filed more than 20 years ago are free to use. There are many examples of "old" inventions are not necessarily outdated, including pharmaceuticals, superconductors and the internet (invented in 1973!).

The figures shown on the slide are a conservative estimate based on a study carried out by Professor Helge B. Cohausz in 2004. He found that 94% of all patent documents represented patents or patent applications that had been withdrawn or rejected, or that had lapsed or were not in force for other reasons. According to his study, 2% of the documents represented patents that were in force but were actually invalid from a legal perspective, and the remaining 4% represented patents that were in force and valid.

The legal status of patents and patent infringement
The legal status of a patent can usually be ascertained with the help of the EPO's free patent databases (see next slide). But to be absolutely certain, it is better to consult the patent office or a patent attorney or other patent professional. Firstly, the patent or an equivalent patent in another country might still be valid. Secondly, even if the patent is valid it might not be as easy as it seems to know whether you are infringing that patent or not (it depends on the patent claims and these are difficult to interpret). Furthermore, you may not find all the relevant patents (ask a search professional for help). Additionally, the use of an invalid patent's technology might be blocked by other, valid patents. Thus, while the patent in question might be invalid, this does not necessarily mean that you can use the technology. Patent infringement should be checked by a patent attorney or other patent professional.



Reasons why most patent documents describe inventions that are free to use:

- **Application rejected/withdrawn** or patent invalidated
- **Payment of renewal fees discontinued** (owner sees no further value in the patent)
- **Patent has lapsed** (usually after 20 years)

"Old" solutions are not necessarily "outdated".

Examples: antibiotics, superconductors, the internet (**the internet was invented in 1973**).

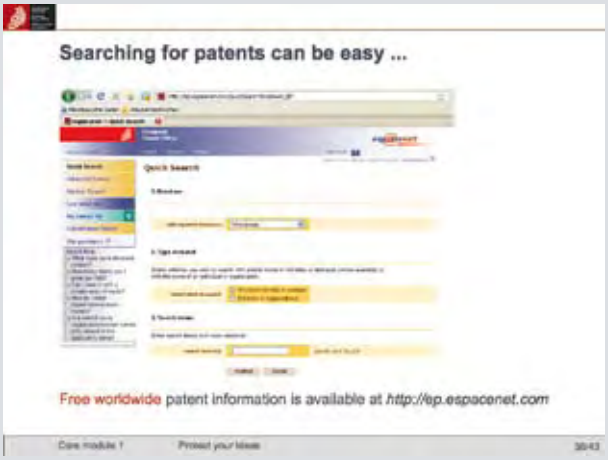
Slide 38:
Searching for patents can be easy ...

The European Patent Office and many other patent offices offer free patent databases. What is special about the EPO's free *esp@cenet* database is that it contains most worldwide patents in one database. At *www.espacenet.com* or *ep.espacenet.com* you will find not only the search interfaces, but also online help and many tools that make finding patents easier.

esp@cenet offers both a simple "quick search" and more advanced search options. To start with you could try using *esp@cenet*'s quick search function to search for the name of a well-known researcher (tick "persons or organisations" to the right of "select what to search").

When viewing a patent in *esp@cenet*, you get links to other patents cited in the prior art search report and to the patents that cite the patent that you are viewing. Furthermore, you will also find information about the countries in which protection is sought ("patent family") and links to the legal status information.

The worldwide coverage of *esp@cenet* (it includes documents from more than 80 patent offices) can be viewed online at *http://patentinfo.european-patent-office.org/_resources/data/pdf/global_patent_data_coverage.pdf*



- Easy to use
- Comprehensive (80+ countries, more than 60 million documents)
- Online assistance
- Free of charge

Hint:

Try searching for a well-known researcher's name!

Slides 39-43:
... but some basic knowledge is needed

Authors of research papers usually aim to use language that is easy to understand and precise. But authors of patents first of all try to get patent protection that is as broad as possible. Therefore, the language used in patents is often characterised by a very general description of concepts. Instead of using a common word for the concept, the inventor describes it with multiple words that allow for a broader interpretation. Furthermore, sometimes patent applicants do not want others to find their patent applications and so try to avoid using intuitive keywords. For example, an inventor might claim his invention to be related to a "writing instrument" instead of saying he has improved a pen. In this way, he ensures that others cannot circumvent the pen-related patent by selling other types of writing instruments that use the invention, and at the same time reduces the probability that a competitor will learn about his patent.

Thus, simple keyword-based searches are somewhat limited. They can be useful as a first step, but they won't necessarily find all relevant patents.

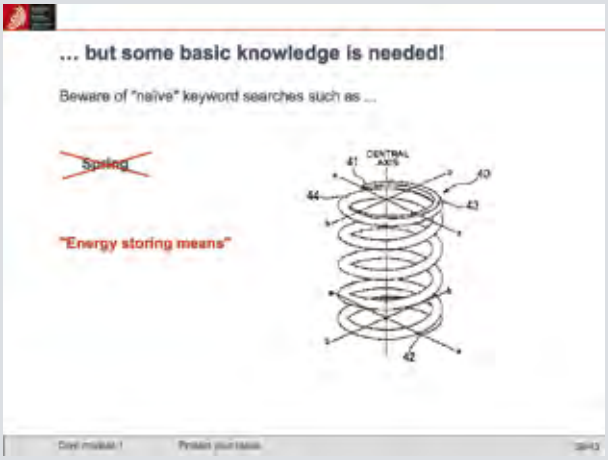
However, such difficulties can be overcome. One way of finding patents irrespective of the words used by their authors is to search for technology classes. Patent documents are classified by experts in the technical field into detailed technology classes. Although several different classification schemes exist, almost all patents are also classified using a common classification scheme, the International Patent Classification (IPC). At the European Patent Office, the European Patent Classification (ECLA) is used. The ECLA is very similar to the IPC.

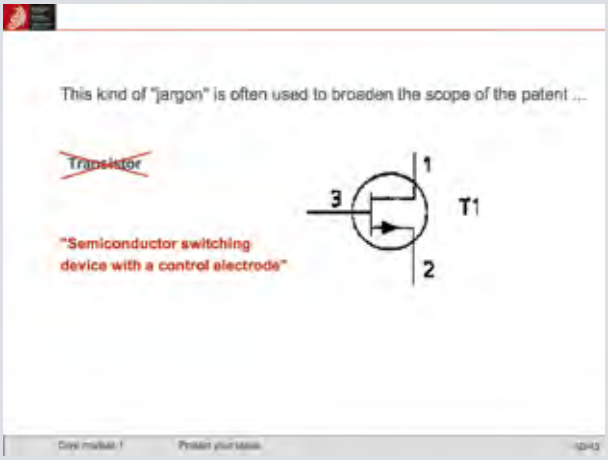
Both the ECLA and the IPC are hierarchical systems of technology classes that start with very broad technology domains at the highest level of the hierarchy: physics, chemistry, etc. Each further level of the IPC narrows down the technology contained in that class before reaching very specialised technology classes. You can explore the IPC at *http://www.wipo.int/classifications/ipc/ipc8/?lang=en and the ECLA at http://ep.espacenet.com*.

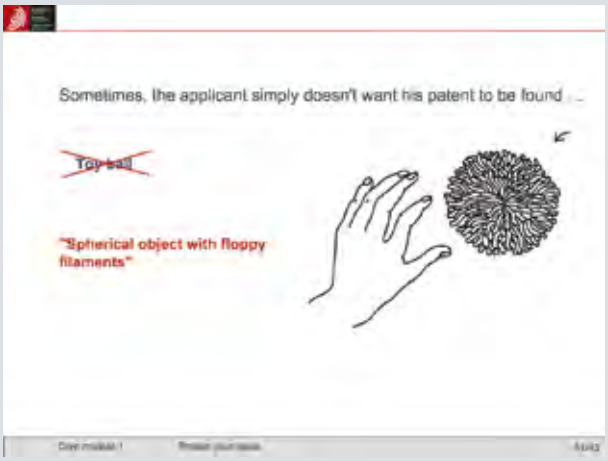
In principle, you just need to know which technology classes are of interest to you and you can then retrieve the majority of the relevant patents easily. You cannot expect to find all the patents relevant to your specific question within one class, though, because the definition of that technology class will not necessarily be an exact match with your personal definition of what you are interested in. Another reason for incomplete search results is that examiners cannot always know all the possible applications of an invention and thus might "forget" to assign a relevant class to an invention.

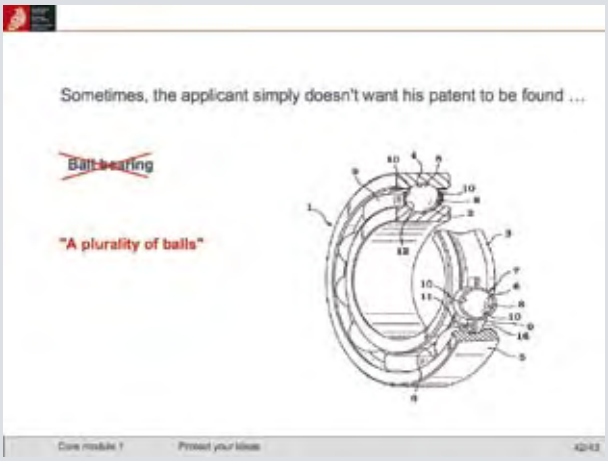
Despite its remaining imperfections, the technical classification of patent documents within the IPC or ECLA represents a key advantage of patent information. Journal articles are not classified in a comparable way. So it can be much easier to find most of the relevant patents than to find most of the relevant journal articles.

Note:
More examples of patent jargon from several fields can be found in sub-module A, "Searching for patents", which contains an introduction to patent searching using the European Patent Classification system and the EPO's free *esp@cenet* service.



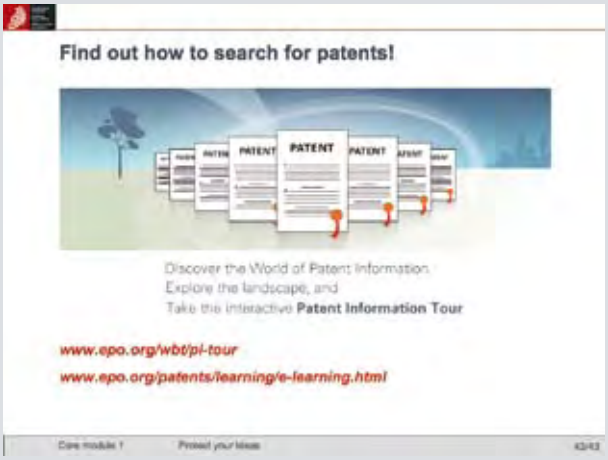






Simple, "naïve" keyword searches have very limited effectiveness. Applicants frequently use **broad concepts instead of intuitive keywords** to describe their inventions, either to broaden the scope of the patent or to deliberately make it harder to find.

This and the following examples of "patent jargon" are meant to provide an amusing conclusion to the lecture. You may like to introduce them with a humorous comment, along the lines of: "We engineers like to call a spring a spring. But that's not how patent attorneys see it. Let's have a look at the language they use."



One way of circumventing the problems with keywords is to use the **European Patent Classification** (ECLA) or International Patent Classification (IPC) instead.

Patent examiners classify each patent document into one or more technology classes, which can be searched for in databases. ECLA is a hierarchical system that allows both very broad and also very detailed searches.

To find out more about searching with ECLA and other methods of effective patent searching, visit these websites. They contain e-learning modules designed for everyone, from the absolute beginner to the expert searcher.

The **Patent Information Tour** is a good place to start.