Universities need to teach business students about patents: a suggested approach

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ABSTRACT

An understanding of IP should not be confined to the graduates of law schools. In today's knowledge-based economy, patents often play an important role in business. Yet many students graduate from their management programmes knowing little about intellectual property (IP) in general and patents in particular. Too often managers only learn about patenting when already working for a firm. They learn through trial and error. It is time for business schools to provide integrated, interdisciplinary IP programmes because innovation requires the expertise of a variety of professionals: inventors, business professionals and legal advisors. Innovation is essentially a team activity, demanding that participants understand at least some aspects of each other's expertise, as well as effective communication across areas. While a general IP course could already be offered at the bachelor level, a specialized patent law and strategy course for managers at the master level is a must and not just for those who have opted for technology management. A course that combines patenting theory and the kind of errors so commonly made by managers in practice would be of great value.

Keywords: Management education; Technology and innovation management; Patent law; Patent strategy; Competition tools

1. INTRODUCTION

The World Intellectual Property Organization (WIPO), which is an agency of the United Nations dealing with intellectual property policy and cooperation, has estimated that in 2013 there were more than 9.45 million patents in force worldwide. That year the number of patent filings rose. The WIPO reports that a total of 205,300 PCT filings (international filings under the Patent Cooperation Treaty) were registered in 2013; up 5.1 percent on the previous year. The European Patent Office (EPO) received more than 265,000 patent filings in 2013. This was a 2.8% increase over 2012 (WIPO, 2014).

Patented inventions are everywhere. The range extends from high-tech digital technology, such as mobile phones and tablets, to the more mundane, such as juice cartons and whistling kettles. Our homes are full of inventions that are still or have been the subject matter of a patent. In the average kitchen alone the patent count is high: from patented components on pieces of equipment like the coffee machine, the microwave and the dishwasher to the cleaning agents kept under the sink.

The number of patent applications filed by small to medium enterprises (SMEs) is considerably less than the number of those filed by large corporations. Nor will these smaller firms have patent portfolios like those of the large corporations; a large corporation may have a patent portfolio with thousands of active patents. For example, a few years ago Philips reached a milestone with a patent portfolio of 100,000 active patents (Berkhout & Hartmann, 2008: 351). Nonetheless, patenting activity is by no means confined to large firms. For example, a survey commissioned by the Chamber of Commerce and Patent Centre in the Netherlands in 2010 showed that 94% of businesses that filed a patent belonged to the SME sector. (Van der Poel, Seip & Snoei, 2010).

Intellectual property (IP) is a vital asset for many firms today. Patent protection can be just as essential for the small firm as the large, for high-tech as well as more low-tech firms. And patent portfolios can be extremely valuable. Yet all too often managers know little about patent law and patent strategies. This ignorance can be costly. Managers may waste substantial sums of money on the research and development of inventions that cannot be patented. An expensive patent may have been acquired for an invention, but in that particular business context a patent was useless or not the best option. More skilful competitors are able to undermine poorly worded patent claims that stand in their way, or use a variety of other patent strategies to hinder the goals of their less knowledgeable and less experienced counterparts. In today's business world, a manager unfamiliar with patenting risks being outpaced and outmanoeuvred by the competition. Business schools must therefore now reassess their curricula to reflect that an increasingly knowledge-based economy means that knowledge assets are becoming "the main game" (Nonaka & Teece, 2001: 1).

In this article, I suggest an approach to constructing a patent law and strategy course for business studies. However, introducing law into a core course for a business school requires an interdisciplinary outlook. Although universities often expound the importance of interdisciplinary research and education, in practice academics and the courses they teach

often remain locked in their own fields of specialisation. It is time to review the way we teach our students.

2. WHY SHOULD UNIVERSITY BUSINESS SCHOOLS TEACH BUSINESS STUDENTS ABOUT IP?

For a long time, businesses would have described their main assets in terms of their physical assets, such as land, buildings and equipment. Yet today, in many industries the value of a firm's IP is substantially higher than the value of its other assets. More and more, a company's market value is being determined by its intangible assets rather than its tangible assets (Mok, Sohn & Ju, 2010; Takeuchi, 2001). As IP commercialization has become important for private, public and even non-profit organizations (Markman, Siegel and Wright, 2008), so has the management of IP grown in importance.

2.1 IS IP EDUCATION PRIMARILY FOR LAW STUDENTS?

The shift in value from the tangible to the intangible assets of the firm has driven a demand for lawyers with expertise in IP law. Not all law schools have yet adjusted their curricula adequately to reflect this demand. However, some universities have already responded to the growing need for IP trained lawyers. For example, it has engendered a "big bang" in the creation of advanced IP law programmes at some American law schools. Beginning in 2000, US law schools launched more than fifteen new IP programmes in a five-year period (Gomulkiewicz, 2011).

However, an understanding of IP should not be confined to the graduates of law schools. In an economy increasingly based on intangible assets, it is not only IP trained lawyers that are required, but also IP trained managers. A manager may have to deal with a variety of forms of IP. The main forms of IP are copyright, patents (US: utility patents), registered designs (US: design patents), trademarks, and trade secrets. Each form has its own regime. One product may encompass all forms. For example, a smartphone will have copyright on such aspects as the software code, instruction manual and ringtones; utility patents on the phone's technical functioning; design patents on its appearance and the trademark of the producer set in the phone casing. That producer may well have trade secrets and will probably protect its confidential information with non-disclosure arrangements.

Managers need to be able to identify IP. They also need the competence to assess when and how to protect that IP, as protecting a firm's IP comes at a cost. Trademarks and designs should be registered to achieve more secure protection. This requires paying the appropriate filing and renewal fees in the relevant jurisdiction. Trade secrets need to be safeguarded, which may involve physical protection as well as protection in the form of expertly drafted confidentiality agreements. Copyright is automatic and free (although in the US it should be registered before commencing a lawsuit). A patent, unlike copyright, must be applied for and paid for. Acquiring a patent can signify a substantial investment for a firm, particularly for the smaller firm. The firm will have to pay patent filing fees, search fees, examination fees, and any patent attorney fees. The more countries in which the firm wants the invention protected the more money that patent protection will cost. If the patent is granted, the firm

will have to pay renewal fees in order to keep the patent operative throughout the monopoly period. The cost of patenting an invention also rises significantly if the patent strategy is not directed at one single patent but a series of patents, for example separate patents on the component parts of the invention.

Innovation requires the expertise of a variety of professionals: inventors, business professionals and legal advisors. It is essentially a team activity, demanding that participants understand at least some aspects of each other's expertise, as well as effective communication across areas (Thursby, Fuller & Thursby, 2009). Even for those business professionals who prefer to leave IP matters to lawyers, it is still necessary for them to understand how to identify IP and when to take steps to protect it, even if that means merely knowing when to consult a lawyer (Lemper, 2012).

2.2 THE NEED TO TEACH PATENT LAW AND STRATEGY TO MANAGERS

The focus of this article is on teaching patent law and strategy to business students. Patents give extensive monopoly rights and have become an integral part of business practice across a range of sectors and worldwide. What should be patented and how those patents are managed is not just critical for the commercial success of high-tech electronics firms like Microsoft, Apple and Samsung, but may also be vital for firms in some very different sectors. One example is Tetra Pak: the company that decided to patent its milk cartons is now one of the world's largest foods processing and packaging companies. Furthermore, patent portfolios can be highly prized and significant even if the company is a small company. An illustration of that is when Microsoft bought a small company called WebTV back in 1997. It did so primarily to acquire that company's patent portfolio and paid $425 million to do so; a very substantial sum at the time.

Patents are no longer used just as a means of protecting an invention from imitation; they are increasingly used as strategic tools in competition (Cohen, Nelson & Walsh, 2000). It is vital that managers understand that patent strategy is not something separate from a firm's general business strategy, but must be an integral component of that overall strategy.

Large corporations usually have their own specialized in-house counsel to advise managers on patenting issues. Nonetheless, it is important that managers can understand the concerns of and effectively communicate with these specialists. Smaller businesses tend not to have in-house lawyers specialized in patent law. Yet for the smaller firm in particular the decision to patent signifies a considerable financial investment. The cost may even require that firm to look for partners especially if broad international patent protection is desired. Given the importance of this investment, it is above all the smaller firms that need managers who are actively aware of the legal and strategic issues that can arise. For example, a manager who has publicised an invention before filing for a patent may have already ruined the chance for the firm to acquire a patent even before an external patent expert has been consulted. In small firms without the benefit of company patent specialists, the manager will need to take on more responsibility and play an even more important role in the patenting process (Knight, 2013).

Just as law schools have increased their course offerings on IP prosecution, so must business schools proportionately increase the number of courses offered on IP management (Fishman, 2010). Management graduates should not be left floundering, left to find out about IP by first making the kind of mistakes that could jeopardize the commercial success of their businesses. Universities and their business schools need to educate and prepare their management students to understand and deal with IP, and to be able to interact with legal consultants on IP issues. Producing an interdisciplinary, integrated curriculum is vital if business schools are going to respond to a business environment where entrepreneurial managers and leaders building and deploying intangible assets are critical success factors (Teece, 2011). Patents, and the strategic way in which they are used to acquire competitive advantages, have now become such an important element of business that this form of IP in itself justifies a course dedicated to the subject.

3. PATENT EDUCATION IN THE CURRENT BUSINESS SCHOOL CURRICULUM

As one former business school dean said: "The function of the university is to be ahead of best practice, not to be tracking a few steps behind the operating business world" (Bach, 1958: 364). Although patents play a role for so many businesses, small as well as large, high-tech as well as more low-tech, strangely patent law and patent strategy courses do not appear to have assumed a significant position in the curricula of many universities and their business schools. Business schools are in danger of becoming out of step with "the operating business world."

The WIPO Worldwide Academy indicated that most IP courses at universities are offered in law faculties and that most IP courses are elective and often fairly brief (Allman, Sinjela & Takagi, 2008). The full extent of a management student's education on patenting may consist of no more than one lecture given as part of a course dedicated mainly to something else.

Even the textbooks used by management students do not always reflect the importance of patents as a business tool. Despite a leading role for patents in business strategy, patents and patent strategy are practically absent from leading business strategy textbooks (Cantrell, 2009: xiii). The bottom line is that many business students will know little about patent law and patent strategy before leaving full-time education.

3.1 VOICES OF CONCERN IN EUROPE

In Europe, the European Patent Office (EPO) has voiced concern over this failure to teach students about patenting. It points to the knock-on effect this ignorance has on their management ability. The EPO strongly recommends that universities address this problem as a matter of some urgency. It is a concern mirrored at a national level by individual patent offices, although their approaches to solving the problem may differ.

For example, in the Netherlands, the Dutch Patent Office has responded by adopting an active policy to raise awareness about patenting at universities. It makes available its members of staff for guest lectures and workshops. A task force, with members both from

universities and major corporations like Shell and Philips, was also set up in the Netherlands focusing on university patent policy. One of the major recommendations made by that task force was to incorporate patent education into the curricula of students (Van Dongen, 2007).

The UK Intellectual Property Office (IPO) has changed its policy from delivering individual seminars or presentations to universities to concentrating its efforts on encouraging universities to embed IP into the curriculum. From research initiated by the IPO, it would appear that UK university graduates are entering industry with little or no IP knowledge, as IP does not feature in the vast majority of university courses. This is despite the fact that the students themselves apparently acknowledge the need for IP education. In a survey of 2,000 students carried out in 2012 by the UK National Union of Students (NUS) and funded by the IPO, 80% of the students responding to that survey considered that knowledge of IP was important for their future careers, but only 40% of them were of the opinion that their current understanding would be enough to support them in the future (IPO, 2012).

3.2 RESEARCH PROJECT ON PATENTING KNOWLEDGE WITHIN SMES

This failure to educate managers came to the fore in a qualitative research project I carried out to examine patenting knowledge within SMEs. The main purpose of the interviews was to gain insight into how much the managers of small firms knew about patenting or had known about patenting when considering their first patent application. Two sets of individuals were approached: those whose professions involved dealing with patent law, such as patent examiners, patent attorneys and legal consultants to companies; and those who worked as managers of SMEs producing technical inventions. Most of the interviews were held in the Netherlands: four interviews were with Dutch patent lawyers/agents and five interviews with Dutch managers of small firms (firms without in-house patenting expertise). To have some comparative material, four interviews were conducted in the UK: two interviews were with managers of English SMEs and two with English patent agents. The selection criteria was influenced by contacts in law firms, suggestions made by legal consultants, by the Dutch Order of Inventors and by the willingness of those approached.

In total thirteen interviews were held. The interviews were semi-structured in order to have a set number of questions that were the same but also to give interviewees the opportunity to describe their experiences with patenting in their own words. The interviews were audiotaped and transcribed. Legal consultants were asked to share their experiences, as were the managers.

Legal consultants were asked such questions as:

- In your experience, before they speak to you have managers of small firms already searched in patent databases to see if something similar has a patent application?
- Have they already searched in patent registries to see if an invention they might wish to use is still covered by a patent?
- Do you think that managers have a clear idea of what a patent can actually do?
- What are the major problems that you encounter, as an advisor, when you are speaking to SMEs?

Care was taken in the structuring of the interviews with managers: it was necessary to take into account that managers would not necessarily be forthcoming with respect to mistakes made in protecting the firm's inventions because of ignorance of patent law nor that they would be eager to disclose wasting money on pointless R&D. Managers were asked such questions as:

- Have you at any time followed a course/workshop on intellectual property and in particular on patents?
- Have you looked at patent registries?
- What is your opinion of the clarity of the present patent regime? Do you feel that the present patent regime is easily understood by those without expert knowledge, or is it too complicated for the average lay person?

After transcription, the question topics were used to help form categories, one of which was 'patent education while attending an educational institute'.

These interviews confirmed the fears of the WIPO and the EPO. None of the managers interviewed in this project had been taught about patenting at any of the educational institutions they had attended. This was the same whether they had followed a technical degree or a business related degree, whether they were older or younger. Nor had managers attended a course on patenting prior to their first patent filing. One of the managers interviewed said that since becoming a business manager he had learnt a lot about patenting. He also confided that the learning curve had not always been pleasant: "I know a lot about patenting *now*, but I had to learn by first making mistakes!" [2] Based on the experiences of the patent lawyers and the interviews with these managers, it would seem that managers of firms without in-house patenting expertise tend to find out about patents not through education but by trial and error.

3.3 OBSTACLES TO EMBEDDING IP EDUCATION IN CURRICULA

Despite external pressures from companies and patent offices to include IP education in mainstream university education, IP is very far from being seen as a core subject at many university business schools. If IP education is to become grounded in the business school curriculum, it is necessary to identify and then remove any possible impediments to its implementation.

There must be the will to implement changes to the curriculum. University programmes may have little space for more core courses. Offering an IP course as an elective may lead to an undesirable thinning out of participants across all the available electives. Each academic will see his or her own subject as important, and academics may be reluctant to cut back on teaching their own area of specialization to make space for an IP course. Faculty have a tendency to make curriculum decisions based on their own disciplinary interests rather than the interests of students who need a more integrated curriculum (Teece, 2011). IP education must therefore be recognized as a vital element in preparing students to function in an increasingly knowledge-based economy.

Based on a sample of twenty universities, Allman, Sinjela and Takagi identified three main challenges to the implementation of IP programmes: updating programmes to keep up with dynamic and rapid changes taking place in IP laws; obtaining up-to-date materials for teaching emerging IP issues; and enhancing the curriculum to enable an interdisciplinary approach (Allman, Sinjela & Takagi, 2008).

The latter is a major sticking point. An IP course for business students requires an integrated programme that cuts across disciplines. The legal aspect cannot be ignored: a course on patenting requires not just the insights of business strategy specialists but also of lecturers familiar with patent law. One obstacle to integration has been a tendency in the USA, but also for example in the UK, to establish business schools that remain independent from the rest of their universities (Phan, Siegel & Wright, 2009). Faculty identification with the academic culture of their own disciplines can also be a factor hindering integration. Becher & Trowler analysed university communities in terms of academic 'tribes' with their own distinct cultures. These tribes are intrinsically linked to their 'territories', the disciplinary knowledge they explore. Academic tribes are characterized by sets of taken-for-granted values, attitudes and ways of behaving. The effect is to make the members of a tribe less open to the input of outside disciplines (Becher & Trowler, 2001).

From my own experience as a trained lawyer working in both the Law School and the Management School of the same university, there are significant differences in analytical approach between the disciplines of law and business administration. For example, business students will often base their findings upon a statistical analysis of independent and dependent variables. For most lawyers statistical analysis is an alien concept; they will base their findings upon legal reasoning. Looking at impediments to knowledge transfer within the firm, one of the factors stressed by Szulanski was the arduousness of the relationship between source and recipient (Szulanski, 1996). That would certainly seem an applicable factor here: the two disciplines speak different languages. Yet business school lecturers may be reluctant to take on the legal aspects of the course themselves; it is out of their comfort zone and they may feel they do not have sufficient knowledge and expertise (Gimenez, Bonacelli & Carneiro, 2012; Soetendorp, 2008; correspondence with UK IPO officers). The problem can be solved: universities could make their interdisciplinary policies more of a reality than is often the case at present and, as IP becomes embedded in business school curricula, future academics will have been trained in an interdisciplinary approach.

Where compartmentalisation of education in university faculties is set aside, new ways of structuring courses and teaching them open up. Resistance from some academics to the introduction of new core subjects in traditional curricula, and to the integration of different disciplines in university programmes, may have to be overcome. However, this resistance from within the academic community, which has always been a factor, is by no means the only obstacle. With the 'massification' and 'marketization' of higher education, Becher & Trowler point to a fundamental shift in power relations in terms of who defines what counts as useful knowledge and whose discourses achieve dominance. State intervention in education has increased and with it an emphasis on corporate management standards: "Managerialism's three key aims are economy, efficiency and effectiveness, defined in particularly loaded ways. The pursuit of these has had a substantial, often painful, impact

on academic communities." (Becher & Trowler, 2001: 13). Changes in the curricula that are required by new societal or technological developments can often not be achieved by universities due to the incentives placed by governments on university administrators: the aim is to process the growing mass of students as efficiently and economically as possible through the system. The way funds are allocated within universities has become less the province of the academics and their departments and more the province of administrators. Therefore if there is to be a new pedagogy, it will need the vision and determination of those in leadership positions both at the state and academic level. As this article focuses upon incorporating IP education into the core syllabus of business schools, and how a patenting course could be developed for business students, it is beyond its scope to explore these factors. Nonetheless the importance of this wider context is acknowledged.

4. TEACHING PATENT LAW AND STRATEGY FOR MANAGERS

If universities are to rectify this shortcoming and teach management students about patenting, how should such a course be constructed? In what ways should a course on patenting for management students be similar to or different from the kind of course on patenting that law students might receive? Should it be taught at undergraduate or postgraduate level?

4.1 THE TARGET AUDIENCE

If IP is taught to management students it is often associated with the postgraduate level, such as in the MBA or in Management of Technology Master's programmes. The rise of a knowledge-based economy and the trend for even non-profit organizations to be more aggressive in protecting and exploiting their IP have led to growing international recognition of the narrowness of technology management education as currently practiced (Phan, Siegel & Wright, 2009). Various initiatives have been taken to broaden the scope of technology management education (Barr, Baker, Markham & Kingon, 2009). While such initiatives are to be applauded, there is no intrinsic reason why IP education should be reserved for master level students. As Soetendorp observes, there is much to be said for inculcating IP awareness at an early stage of a student's academic studies, regardless of the discipline (Soetendorp, 2008).

One of the current curriculum debates on teaching IP is whether a course should adopt a survey approach or a silo approach: should it be a general IP course or should it specialise in one form of IP, such as patents? One solution would be to offer all business students a broad overview of the various forms of IP at the bachelor level. A survey approach would ensure that students are aware at an early stage that an innovation may generate more than one form of IP, and be sufficient to enable students to identify all the forms relevant to a particular innovation. Specialising in patent law and strategy could then take place at the master level. Nonetheless, a specialised course on patent law and strategy should not be the sole province of those who have specifically opted to manage technology. Given the use of patents as a strategic tool, it should also be offered as a part of any strategic management

master programme and, as innovation is vital to entrepreneurship, it has a role to play in an entrepreneurship master programme.

4.2 DESIGNING A PATENT LAW AND STRATEGY CURRICULUM FOR BUSINESS STUDENTS

One of the recommendations made at the WIPO symposium on IP education in 2005 was to develop curricula tailored to the needs of different target groups, such as engineers and business managers (Allman, 2008). That is a sensible suggestion. As Soetendorp observes, at its simplest, syllabus content should answer the question "what does a non-law student need to know?" (Soetendorp, 2008)

The aim of an IP course for business students is not to turn the students into legal experts - that is the task of law schools - but to instil a level of IP awareness and competence that will help that student function in a managerial context and enable them to interact with legal consultants.

4.3 THE PATENT LAW COMPONENT

Law and business are not two separate worlds: law can have a major impact on the running of a firm. That will become apparent to students as they study patent law. Giving students a good overview of patent law requires dealing with the basics for patentability and addressing jurisdictional variations, such as the main doctrinal differences between patent law in the United States and in Europe. (In Europe the European Patent Convention has been implemented into the patent legislation of all its signatory member states, resulting in a considerable level of harmonization.) The relevant intellectual property treaties also have to be addressed. But if the course is to be tailored to management students, rather than law students, the aim should be to achieve an awareness of the type of legal issues that could arise for a firm when patenting, not an in-depth, detailed study of the patent law of one particular country. The skill the business student should acquire from the course is to know when to consult a patent law specialist and to communicate effectively with that specialist.

4.4 PATENT STRATEGY

Patent strategy is the other vital component of any patent course for management students. Teaching patent law without teaching patent strategy is like giving students only one half of the equation. Patents are essentially a strategic tool in competition and patent strategy is directly related to the business context. This was also one of the conclusions drawn from the Carnegie Mellon Survey of the US manufacturing sector held in 1994. These firms often used patents as strategic tools, rather than as simply a means of protecting an invention from wrongful imitation. The strategies included blocking rivals from patenting related inventions, as protection against infringement suits and using patents in negotiations over technology rights (Cohen, Nelson & Walsh, 2000).

4.5 COMBINING THEORY AND PRACTICE

According to Holdrege, one fundamental bias that infects Western educational culture is: "the strong propensity to take abstract conceptual frameworks more seriously than full-blooded experience" (Holdrege, 2008: 323). In a patent course, there is much to be said for combining the theory of patent law with practical examples from the world of business. Hennessey identified five different ways of teaching IP: the case method, the problem solving method, the simulation method, the clinical method and the doctrinal method. Hennessey suggested that different approaches can be combined, although the only way to find out which method works best in a particular situation is to experiment (Hennessy, 1999).

The importance of using real-world cases as examples in patent courses was stressed by Straus (Straus, 2008). Furthermore, for law lecturers grounded in the common law system with its doctrine of binding precedent, teaching using cases would be an integral part of the legal component. The problem solving method can also be utilized as a means of helping students to identify legal and business issues in litigated cases. It is suggested here, however, that another element will also resonate with management students: to connect the theory to the kind of mistakes that so often trip up managers in practice. Students will understand the theory better and learn a great deal from studying these common mistakes.

5. USING PATENTING MISTAKES AND IGNORANCE AS AN ELEMENT OF THE PATENT COURSE

In the interviews I conducted in the UK and the Netherlands, patent lawyers had an opportunity to describe their experiences with SMEs and the managers of SMEs had an opportunity to describe how they had dealt with their inventions. Although the sample was small, a picture soon started to emerge of what managers knew about patenting and what they did not know but should have known.

Roberts points out that although largely neglected in management studies, the subject of ignorance has attracted attention across a range of other disciplines. Even though ignorance is an intrinsic element in social organizations it has attracted limited interest from management scholars. Yet knowing what is not known can be as important to organisational performance as knowing what is known. Organisational error can often be traced to the actions of individual actors as well as organisational systems; managers may have an inflated view of their own competence, or simply be unaware of what they do not know (Roberts, 2012).

Teaching from the perspective of ignorance was the starting point of a pioneering programme set up for medical students in 1985 by Witte, Kerwin and their colleagues. The course was orientated chiefly to expose 'what we know we don't know, what we don't know we don't know, and what we think we know but don't'. Ignorance, Witte argued, should not be seen as a void, but as a dynamic force in learning and research. Medical knowledge does not stand still, so rather than only teaching students how to apply the transient knowledge

of the day to problems it is preferable that students recognise the unknown and learn to question critically and creatively (M.H. Witte et al, 1989, 2008). Many of the components of that course have been transferred to other fields and the curriculum has been adapted for psychologists and journalism students (S.H. Stocking, 1992).

Patent law, like medicine, does not stand still either. Regimes can change the law, as indeed the United States has recently done with the America Invents Act 2011. Judicial interpretations of existing law can shift over time. As technology changes and develops, patent law is constantly adapting to keep up. Learning to question critically and creatively, one of the core components of the medical ignorance course, should be a core component of any patent course. A simple question such as 'but how do you know if this invention shows an inventive step?' does not so much reveal a student's ignorance, but one of the major difficulties in determining patentability. What is and is not an inventive step can depend upon the jurisdiction and the interpretation by the patent examiner or judge of what a person skilled in the art would considered to be an obvious step. Students need to recognise the unknowns in patent law; that there are many grey areas. Nor should they expect that the outcome of patent litigation can always be predicted.

While teaching business students to expect unknowns in the application of patent law, it is also important to teach them what can go wrong if they have no grasp of the basics of the current state of the law. Managers can make simple mistakes. From the interviews I conducted, it appeared that the kind of mistakes commonly made by managers of small firms in the Netherlands were the same sort of mistakes commonly made by their English counterparts. Helping students to learn from the failures and mistakes of others can be a vital part of a course.

Looking at innovation in entrepreneurship programmes, Berry, Kumar and Scott recommend giving students the opportunity to learn from mistakes and for programmes to build up useful databases of these failures and mistakes (Berry, Kumar & Scott, 2014). This approach would also be a productive component in a patent law and strategy course. A number of the mistakes I encountered in the interviews I conducted are set out below to illustrate how ignorance-based learning and managerial mistakes can be used to teach students about patenting.

5.1 IGNORING PATENT DATABASES

Teaching students at least the rudimentary skills necessary to enable them to search patent databases should be part of any course. Patent databases have now become readily available and provide managers with much vital information. Businesses need to search those databases to see whether there are patents already in place that could be a threat to their own line of business. Furthermore, failing to check those databases at an early stage in R&D could be a disastrous mistake. Many thousands of euros may have been poured into an R&D project only to discover that the intended invention has in fact already been patented! The EPO estimates that up to 30% of all R&D is wasted on developing inventions that are already covered by patents or out in the public domain (EPO, 2007).

Patent databases are a fount of technical information: indeed it is often contended that patent databases yield more information than technical journals (Knight, 2013). Yet some managers do not realize that checking patent databases is an excellent means to help them discover their competitors' technology, because if those competitors want a patent they will have to disclose to the public the nature of the invention. Moreover, examining the patent databases is a good way to pick up on market trends.

5.2 FAILURE TO HAVE A PATENT STRATEGY

Business students are of course familiar with the concept of having a business strategy. They must also become familiar with the concept of having a patent strategy as part of that overall business strategy. Before embarking upon the process of patenting, and the necessary costs that will incur, a manager must have a clear idea of what the firm wants to achieve with the patent. A coherent patent strategy will also make it easier to determine when not patenting is the best strategy.

It was a complaint made by several of the legal consultants I interviewed that managers had not always developed a coherent business plan for their invention. They had got carried away by the idea of having an invention, and indeed had an emotional attachment to their invention. However, they had not always analysed the financial risks of bringing the invention to market, or sometimes even whether there was a market for the product, and if there was a market whether they were in a position to use the patent to acquire a competitive advantage. They had failed to analyse whether the value of the invention would be outweighed by the costs of the patent.

One very experienced legal consultant I interviewed said: "Small companies that patent sometimes do it on irrational grounds; it feels good to have a patent; it gives a kind of status. That can be of value in the business. But sometimes it is just because a patent is something they think they are supposed to have." Too often no real assessment had been made of whether the patent would give the firm added value. [3] One of the patent agents interviewed stressed that he did not consider it to be part of his job to give advice on the market potential of an invention; it would be up to the company to decide whether the patent would be worthwhile. His work was simply to assist it with the patent application. [4]

Students need to be prepared to think in terms of a patent strategy. What is the firm trying to achieve with this patent? Is it trying to achieve freedom to operate, so it patents its invention to make sure that its competitors do not patent that technology? Or is it trying to block competitors with a patent making it not possible for them to market an improvement on its underlying technology? Or is the idea not to produce the product itself but to use the patent as a means to acquire licensing fees and/or royalties? Or is the intention to use the patent to leverage cross-license agreements in order to have access to competitors' technology? Patent strategy must be integrated into the overall business strategy.

5.3 IGNORANCE OF PATENT LAW

Students need to understand the basic principles of patentability. These basic principles share certain characteristics across jurisdictions although the terminology may vary. For example, the patent regimes of Europe and the USA both require that the invention is new, involves an inventive step (US: it is non-obvious) and that it is capable of industrial application (US: it is useful). Despite certain similarities, the interpretation even of these basic principles can vary. There is no uniform law of patents. Given the global reach of business, management students do need to be aware that there can be significant jurisdictional variations.

A good example of an important variation relates to the disclosure of the invention before filing for a patent. In the USA, as in several countries, there is a grace period allowing the original inventor to still patent the invention in the US for up to a year after its disclosure. That, however, is not the case in many countries. For example, under the European Patent Convention (EPC), and 38 countries are signed up to that Convention, if the invention has been disclosed to the public before filing it is no longer new. If it is no longer new it fails the legal criteria for patentability. Although there are several exceptions to this rule, in Europe there will be disclosure if, for example, the invention has been presented at a conference, mentioned in a catalogue, published in a journal or an Internet blog. The chance for a patent in Europe has then been lost. The legal experts I interviewed complained that managers of SMEs often did not know even such basic patent law concepts despite the fact that such information was available online.

5.4 NOT UNDERSTANDING THE NATURE OF A PATENT

One of the common mistakes made by managers is mistaking the nature of a patent. The essence of a patent is the exclusionary right it gives to prevent others from using, manufacturing, selling, or importing the invention in the country or countries where the invention has patent protection for up to 20 years from the patent filing date. Managers do not always realise that a patent does not give them the right to actually *use* their own invention.

Inventions usually build upon other inventions. Businesses often develop inventions that are an addition to or an improvement upon an existing invention relevant to their business. The right to use the underlying technology, however, could still be covered by someone else's patent. The legal consultants I interviewed pointed out that this was something managers of SMEs had not always taken into account; that using their invention could mean having to use the intellectual property of others and that they would need to have permission to use it if still patented. One of the managers in my sample had indeed made this mistake. He considered that as he could buy component parts for his invention in the shop, he was free to use that technology. He had not understood that if the underlying technology is still patented, his firm might need to pay a license fee or royalties. In the worst case scenario, a patent owner could simply refuse to allow the technology to be used. A patent owner may even be maintaining that patent simply to block competition. Using a patent as a blocking strategy is common practice: indeed recent Japanese research has revealed that 30% of

Japanese patents are filed to do exactly that (Okuda & Tanaka: 2013). Blocking is a common form of patent strategy and could result in a firm having paid for a patent for an invention it can do little with.

5.5 NOT UNDERSTANDING THE NATURE OF PATENT DOCUMENTATION

Some managers fail to appreciate that a patent is not just a technical document; it is also a legal document. Naive managers have a tendency to think that they can draft the patent documents themselves, particularly as that would save money for their firm. In the sample of managers of SMEs I interviewed, there was one manager who had drafted his own patent documents. With a practical exercise, it will be easy to show students why they should not do this.

An engineer may be able to describe his own invention - although putting that into words is far from being an easy task. However, unless trained that engineer does not command the words and phrases necessary to satisfy the legal aspects of the patent document. While the help of the inventor is essential in order to write the patent description that explains how to make and use the invention, it is the patent claims that define the scope of the legal protection. Drafting patent claims is a highly skilled task, requiring not only an understanding of the technology but also of legal formulation. Indeed many inventors say they can hardly recognize their own invention when a professional patent agent has drafted the patent documents. All the managers I interviewed were amazed by the legal language of the patent claims. Not paying for the services of a good patent agent is a false economy. If the invention is a success, the poor wording of the patent claims will allow competitors to undermine the patent.

5.6 NOT BEING PREPARED FOR THE UNPREDICTABILITY OF PATENT CLAIM INTERPRETATION

Patents are a form of intangible property. At an early stage in the course business students need to be made aware of the distinction between tangible and intangible property because the boundaries of intangible property are more unpredictable than those of tangible property. Tangible assets have physicality whereas intangible assets, like patents, lack a physical form. With respect to tangible property, for example land, it is relatively simple to determine the boundaries of that property. A surveyor can provide a clear demarcation of the land boundaries and the parties concerned can walk along those boundaries. But it is much more difficult to define the boundaries of an invention. Those boundaries depend upon the interpretation of the words in the patent claims, because it is the patent claims that map out the legal boundaries of the patentee's property. In a patent infringement lawsuit, it may be difficult for the parties to predict with any certainty how the judges will interpret the patent claims. Understanding this essential difference between tangible and intangible property will help students to appreciate the importance of patent claims, and why a lawyer/patent agent will spend so much time formulating them, but also why the scope of a patent claim can be difficult to gauge.

Even if a firm has paid for the services of a good patent agent and great care has been taken in the wording of the patent claims, managers must not presume that a patent always gives absolute guaranteed protection against competitors. If there is an infringement of the patent resulting in legal action, what the patentee believes to be covered by the patent claims may not be what the court will consider to be covered by the patent claims. An infringement action may fail because the judges see the claims as too general (and so may be considered by the court to cover pre-existing inventions) or because the language of a claim was too precise, (giving competitors room to work around the patent claim). As the words that lawyers use are sometimes vague, and the rules for interpretation can be unpredictable, Bessen and Meurer concluded that there is "no reliable way of determining patent boundaries short of litigation" (Bessen & Meurer, 2008: 53).

Yet often smaller firms, having spent a lot of money on a patent, have no money to defend their patent if a competitor infringes it. This may be an acceptable strategy if the managers were aware of this fact and had calculated that the patent would still be useful as a deterrent even if litigation was beyond their firm's resources. Patent litigation is notoriously expensive. Most of the managers of the small firms I interviewed said that if the infringer was a larger firm, they simply would not dare to take the financial risk of litigation. However, those managers also admitted that not having the money to enforce their patent if it were infringed had not been considered as a factor when deciding whether to file for a patent. This failure was one recognised by the legal consultants I interviewed.

Inadvertent patent infringement is also a constant danger and one that students must be made aware of. This is particularly the case in areas of technology covered by patent thickets, where a multitude of different patentees hold patents on certain small components or features, as in the smartphone sector. For years now, there has also been a tendency to move away from single patents on inventions to multiple patents on the same main invention: a separate patent is filed for each individual component of the invention. A firm wishing to bring its own invention onto the market might be confronted with having to check out these multiple patents. Larger companies in particular make use of wrap-around patents, as they have the financial resources to do so. This strategy forces competitors to examine all related patents, making it difficult, time consuming and therefore expensive for competitors to see what is protected and what is not. The chance that a competitor will be found to have inadvertently infringed one of the claims in one of the many patents is then higher.

5.7 FAILURE TO ASSESS ALTERNATIVES TO PATENTING

It is vital that in any course on patenting attention is paid to the alternatives to patenting, as patenting will not in all circumstances be the best approach. Another form of IP such as copyright may be available as a form of protection. As copyright is automatic and free, it would certainly be a less expensive option than patenting. Informal methods of protection may also be more appropriate, such as secrecy and minimising time to market.

Managers need to give serious consideration to these alternatives to patenting. According to several of the legal consultants I interviewed, sometimes managers of small firms patent for

the sake of patenting rather than with a clear patent strategy in mind. In some cases keeping their invention secret rather than patenting may have been a better option. Patenting does mean public disclosure of the invention and is costly.

Secrecy alone will not be effective in all cases; if a product can be easily reverse-engineered then secrecy without other forms of IP protection will not be a sufficient form of protection. Nonetheless, secrecy could be effective if competitors cannot easily reverse-engineer the invention and that is more likely to be the case where the invention is a process that does not leave a clear 'fingerprint' on a product. The findings of Cohen at the turn of the 21st century confirmed the findings of Levin back in the 1980s: patent protection is more suited to product innovations than to process innovations (Cohen, Nelson & Walsh, 2000; Levin, Klevorick, Nelson, & Winter, 1987). Although it is hard to amass empirical evidence on the use of secrecy, litigation on the wrongful appropriation of trade secrets at least indicates the top of the iceberg. Students will see that the damages awarded in these cases give an indication of the value of the trade secrets. What these litigated cases also reveal of course is the danger of trade secrets being stolen.

In some cases, minimising lead time and getting to the market first might even be enough without patenting. Just speed to market was enough in the case of the glass markers produced by a Dutch company. These glass markers are a means for guests at parties to distinguish which glass of wine is theirs, as each glass marker has a distinctive colour and character. The glass markers were very cheap to produce, not highly technical, and the Dutch company had established its product and its name internationally before competitors came onto the market. The product manager I interviewed told me that his company had learned over the years that it was not necessary to patent every invention and that the profit on these glass markers would have been marginal after deducting the expenses of patenting. [5]

6. CONCLUDING REMARKS

If business schools are not to be out of step with business practice, it is time to reassess the curricula. In an increasingly knowledge-based economy, IP can no longer be optional or confined to the margins of business education. An integrated, interdisciplinary programme is required to produce business graduates who will manage effectively in an environment where the intangible assets can be the key to a firm's success. Innovation necessitates effective communication and teamwork between technology, law and business experts.

A general grounding in IP would already be desirable for business students at the undergraduate level. Specialization could take place at the master level. Offering a course focused on patent law and strategy at the master level would be more than justified, not just in management of technology master programmes but also in strategic management and entrepreneurship programmes. Patents strategies have become vital for many businesses not just as a means of preventing imitation, but as a strategic tool in competition.

The design of such a course should incorporate theory and practical elements. Litigated cases can be used to illustrate the theory and give students an opportunity to analyse the

legal and business issues. It is suggested here that this can be combined with another method that forms a useful bridge between theory and practice: learning from common managerial mistakes. From the interviews I conducted as part of my research project on patenting knowledge within SMEs, it soon became apparent that mistakes had often been made by managers because of their ignorance of patent law regimes and the ways in which firms obtain a competitive advantage by using their patent portfolios. These common mistakes can be used as a means to help educate business students rather than leaving them to learn about patenting from making those mistakes themselves. Forewarned is forearmed.

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[2] Interview with the product development manager of a Dutch company producing household items, held in February 2013.

[3] Interview with a legal consultant held in the Netherlands in April 2012.

[4] Interview with a patent agent held in England in June 2012.

[5] Interview with the product development manager of a Dutch company producing household items, held in February 2013.