Insper
São Paulo

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Insper Working Paper
WPE: 084/2007

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ABSTRACT

The literature reports that patents are commonly seen as isolating mechanisms. But it also points that patents are of limited effectiveness against copying. The purpose of this paper is to identify why pharmaceutical firms file patent applications despite the well known limitations of patents as protective devices. A qualitative approach was used to investigate this topic, and the results are based upon six case studies of pharmaceutical organizations established in the United Kingdom. A common response on why firms engage in the patenting process was the long development time of a new product, and the costs associated with that. Thus, the main purpose of pursuing patents was to protect inventions from copying. In addition, our findings revealed that the motivations to patent also encompass their use: i) to deter entry, ii) to enhance appropriability conditions, iii) to secure royalty income, iv) to use in technology negotiations, v) to influence investors perception, vi) to signal to others, and vii) (apparently to a lesser degree) to incentivise researchers.

Key words: patents, pharmaceutical industry, intellectual property, innovation, R&D

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1. INTRODUCTION

It is widely known that firms pursue patents in order to stop imitative behaviour. However, there is evidence that patents are not perfect mechanisms against copying; their effectiveness may vary across industries (LEVIN; KLEVORICK; NELSON; WINTER, 1987). As patents are not perfect in protecting against copying firms may have other motivations to file patents. Although the literature addresses other reasons firms pursue patents (e.g. to secure royalty income, to engage in technology negotiations) as far as we know there has not been any attempt to systematically investigate the motivations behind firms' decisions to file patent applications.

The purpose of this paper is to fill that vacuum by addressing the reasons firms in pharmaceuticals have to take out patents. Although there might be inter-industry differences in what concerns patenting activity we concentrated upon the pharmaceutical industry for as Levin et al. (1987), and Taylor and Silberston (1973) have shown, pharmaceuticals is one of the industries where patents play a major role as a mechanism to appropriate the returns from innovation. Moreover, Bosworth & Mahdian (1999) have detected that the pharmaceutical industry is where patents are most valued to increase the returns from innovation.

The exploratory character of this research demanded a research method accordingly, and thus our analysis relies upon case studies of six pharmaceutical firms operating in the UK. The UK was the geographic area chosen to develop this study as it exhibits an intensive use of patents. Moreover, the pharmaceutical sector in the UK is one of the most active in the world and encompasses both local and foreign firms generating and marketing innovations.

The next section presents the literature review. The third section describes the research method employed. We turn to the empirical findings in the fourth section, where a discussion of the results is also presented. Finally, we draw some conclusions.

2. LITERATURE REVIEW

Patents (or invention patents) concern technology-based inventions, and are granted when applications are clear about the fulfilment of the requisites for patentability: i) novelty (i.e., previously unknown), ii) inventive step (i.e., non-obvious to someone with ordinary skills in the technology area the invention fits in), and iii) industrial applicability. Thus, patents are legal titles issued upon application which enable their holders (so called patentees)

to enforce, for a limited time (in general, 20 years at most) and geographical area, exclusive rights over an invention by excluding others from making, using or selling it without their authorisation (CORNISH, 1999).

Based upon the characteristics described above, the theoretical literature has made assumptions as to the way firms use patents. Although the empirical literature has provided insights into this issue, they do not always reconcile with the theory. For example, in theory patents are seen as impediments to rivals freely copy firm-specific resources that would otherwise lead to superior performance (RUMELT, 1987). However, empirical evidence suggests that the extent patents play that role varies across industries and firms (LEVIN et al., 1987). More recent theoretical analysis of the effectiveness of patents has addressed that variability (e.g. WINTER, 2000) but the motivations underlying firms' decisions to apply for patents are still unclear. Thus, the prime objective of this piece of research is to explore why firms use patents.

One of the most revealing studies of firms' perceptions about appropriability is that by Levin et al. (1987). They investigated typical conditions of appropriability in lines of business for US firms. The results of their survey suggest that the efficiency of the patent system is restricted. The authors found that process patents are the least effective mechanism of appropriability amongst those examined. Product patents were rated higher than process patents as a method of appropriability. In turn, secrecy was rated higher than process patents but lower than product patents. Their study also detected that lead-time, learning curve, and sales or service efforts are generally more effective than patents to recoup the expenses from Research and Development (R&D).

Those results appear to confirm the UK findings of Taylor and Silberston (1973) that patents do not provide perfect appropriability. Levin et al. (1987) also detected that many patents can be circumvented, others are not so effective when subject to stringent legal requirement for proof that they are valid or are being infringed, and some innovations are difficult to patent. The effectiveness of patents as a method of appropriability thus seems to be limited, it being difficult to generalise how effective a patent can be. Moreover, there are inter-industry and inter-firms differences on the perception of how useful patents are, and that the incentives patents provide to increase the rate of innovation are very small in most of industries (MANSFIELD, 1986). One exception is the pharmaceutical industry where Levin et al. (1987) detected that patents are rated as being more effective to appropriate the returns

from innovation than all other means of appropriability. Their study however does not provide evidence as to why this is so, but the authors suggest that the discreteness and easy differentiability of the patentable subject matter of that industry help to develop a comparatively clear standard of assessment of a patent's validity, and hence patents can be more easily defended if challenged. Although the reasons presented by Levin et al. (1987) are quite plausible, they are largely based on the authors' personal opinions rather than based on the scrutiny of research investigation. Our paper therefore provides new insight into firms' rationale to apply for patents.

Even if patents do not provide perfect protection against copying, Mansfield (1986) found that the bulk of patentable inventions are patented and firms generally prefer to rely on patents than on trade secret protection. According to the author the reasons firms rely upon patent protection are manifold. Firstly, there has been an increase in perceived competition. Secondly, there has been a change in firms' product mixes, with more sophisticated product lines, which are more likely to be patented. Finally, technological path involving analytical equipment has reached a stage where it has been easier for a rival to detect what innovators launch on the market. Again, these arguments were not derived from a particular investigation but rather from the author's own perception.

In a recent analysis on appropriability mechanisms used to reap the returns from innovation Cohen, Nelson, and Walsh (2000) surveyed managers in R&D laboratories within US manufacturing industry. They observed, again, that the effectiveness of patents varies across industries, but in the majority of manufacturing industries patents tend to be the least effective mechanism. One finding they came up with was that secrecy appeared to be more heavily employed across industries than it was previously, according to the results by Levin et al. (1987), and by Mansfield (1986). In addition, they detected that despite being judged low effective patents are still applied for as often as they were. According to Cohen et al. (2000) one reason for explaining that is the sufficient value patents add at the margin when they are used with other mechanisms. Although this argument resorts to their perception as opposed to research findings, what they really observed was that patents are mainly used to prevent copying. However, their results suggest that the second best reason to use patents is to block competitors' attempts to patent a closely related invention, by controlling a technology path which enables them to settle themselves in a specific market.

Although the paper by Levin et al. (1987) does not explore the reasons why pharmaceutical firms apply for patents, their research provides evidence that for their sample firms from various industries patents are used not only to prevent duplication but also to secure royalty income. Moreover, recent work by Hall and Ziedonis (2001) has shown that patents are widely used in technology negotiations in semiconductors. Although firms in that industry may be more reliant on cross-licensing than are other firms this behaviour is not exclusive to that industry. Granstrand (1999), for example, has detected that Japanese firms from various industries often use cross-licensing. Pitkethly (2001), however, found that exercise to happen more often in Japan than in the UK, which means that the legal framework may contribute to the extent that firms engage in technology negotiations. In this piece of research we are not particularly interested in the extent that each motivation to patent induces firms to file applications (though this should be matter for further research). Thus, we do not envisage any harm in restricting our analysis to the UK.

Possibly, there can be added to the above other motives why firms pursue a patent. For example, in studying a few Japanese corporations from various sectors Granstrand (2000) detected that patents can be used as reasonable indicators of inventive performance, and hence can be used and thus applied for as part of incentive structures for research workers. However, Duguet and Kabla (2000) found no robust evidence for this motivation in French manufacturing industry. In addition, Bosworth (2005) argues that patents are part of a firm's appropriation strategy. In fact, some argue that patents can enhance appropriability conditions when used as complements to other appropriability mechanisms (GRAHAM; SOMAYA, 2004).

So, despite the limited effectiveness of patents as a means of protection against copying, under particular circumstances patents might be beneficial to firms. Therefore, when a firm takes out a patent it purchases an option (albeit on an asset the value of which is difficult to estimate) that can be defended in due course if necessary and that the cost of the option is not particularly expensive (GEROSKI, 1995). However, to the best of our knowledge there is no particular effort to systematically identify what options firms purchase when they take out patents. Thus, there is still a gap in our knowledge, which this research aims to fill.

3. RESEARCH METHOD

Although the business and economics literatures have made progress in extending our understanding about the role played by patents in enhancing firms' competitiveness (GRANSTRAND, 2003), there are still some gaps in our knowledge, and a few of them of more basic nature. This paper, for example, explores the reasons pharmaceutical firms have to apply for patents. Although there might be inter-industry differences in what concerns patenting activity we concentrated upon the pharmaceutical industry because pharmaceuticals is one of the industries where patents play a major role. The United Kingdom was the geographic area chosen to develop this study due to the relevance of the UK pharmaceutical industry, and the tradition of the UK patent system.

Although quite a few studies have addressed patent issues they have not provided a clear picture on the motivations firms have to pursue patents. We have thus selected a qualitative approach for this piece of work because it is able to provide a more in-depth analysis and to illustrate processes taking place (MAXWELL, 1998). Yin (1994) has suggested that the case study method is an appropriate approach when the investigation deals with a contemporaneous phenomenon, and when the research is focused on the 'whys' and 'hows' of that event, which is particularly the purpose of this research. As suggested by Gillham (2000), semi-structured face-to-face interviews were used as the data collection tools. We also followed Kvale's (1996) recommendations in collecting the information. The ultimate objective was to make the interview process to some extent open but not too vague, keeping the flexibility desired without missing the information that was being sought.

The UK Department of Trade and Industry (DTI) produces yearly a ranking (also known as scoreboard) of firms that spend on Research and Development (R&D). At the time, there were 57 pharmaceutical firms. We randomly selected half firms listed in the pharmaceutical section of the UK R&D Scoreboard to approach, from which six firms were chosen. Although evidence from six case studies is difficult to generalize to the whole pharmaceutical sector, our sample firms seem to encompass a large variety that is expected to find in pharmaceuticals. Table 1 shows some attributes of our sample, and in addition we should mention that our sample comprises firms at various stages of development and whose country of origin is not restricted to the UK.

Table 1 – Interviewed Firms Profile

Firm	Number of Employees	Number of Internal Patent Agents	Number of Patents	Sales (£ million)	R&D (£ million)
A	3,000 – 3,500	3	600	360	57
B	100 – 150	Nil	9	7.8	3
C	50 – 100	Nil	75	1	8.6
D	100,000+	104	15,000	17,200	2,600
E	50,000+	45	10,000	11,400	1,900
F	1,000 – 1,500	6	NA	498	106

Our evidence was collected mostly from interviews with the person in charge of patents in each firm. In particular because there is no source of secondary data that reports the prospects firms envisage when they file patent applications. The interviewees revealed for almost ninety minutes the firms' reasons to pursue patents. Each interview was recorded and transcribed in order to undertake content analysis. Our analysis of the interviews revealed a pattern in firms' responses that did not justify, at least for the purposes of this research, more effort to collect information from other pharmaceutical firms. The findings are thus presented and discussed in the next section.

4. RESULTS AND DISCUSSION

In order to understand firms' rationale to pursue patents we also looked at their perception as to the effectiveness of the patent system. The interviewees, in general, could not envisage that pharmaceutical firms would continue to invest so heavily in R&D if patent protection did not exist. According to the interviews, it seems that the basic premise of the pharmaceutical industry is that in order to get a reasonable return from the investment in R&D a monopoly provided by patents is essential. Thus, the primary reason to apply for patents in pharmaceuticals is the fundamental rationale behind patent systems: to stop others (for a limited period) from freely copying patent holders' inventions. The long development time (including clinical trials and regulatory review) and high development costs of a new product in the pharmaceutical industry were reasons mentioned to reinforce the relevance of patents in this industry. Patents, by granting exclusivity, help firms to earn premium prices enabling them to more effectively cover the costs of their research (including costs relating to products that do not reach the market). That this is so in the pharmaceutical industry is completely consistent with previous studies (e.g., LEVIN et al., 1987; TAYLOR; SILBERSTON, 1973).

As regards the importance of the subject matter in determining effectiveness, the interviewees reported that patent protection is important in pharmaceuticals because inventions once disclosed are simple to copy. Due to specificity the core product (drugs) of the pharmaceutical industry is relatively easy to protect from copying. A firm can stop others from copying because copies in pharmaceuticals are easy to detect due to technology and market structure. We were told that firms are able to easily detect whether another drug infringes the scope of their patents. These properties make patents a useful protective mechanism in this industry, and are in line with the reason mentioned by Levin et al. (1987) as to the easy differentiability of the patentable subject matter.

Although interviewees agreed that the patent system in general is very important in pharmaceuticals, the effectiveness of individual patents in protecting property rights was reported to be variable. This was not unexpected on the basis of prior studies (e.g. LEVIN et al., 1987). According to the interviewees patent effectiveness depends upon the extent to which the property rights can be protected by the courts. Any difficulty in defending a patent in court comes down to: (i) weakness in the patent itself perhaps resulting from limited declared information substantiating its scope, making it liable to be challenged by competitors and/ or; (ii) the legal frameworks in some countries which restrict the extent to which a patent can be enforced. Moreover, it was revealed that patents may take too long to be issued which increases the uncertainty of the returns to a particular innovation. Although the respondents agreed that the litigation process itself is uncertain[1], they complained that the usefulness of patents is somewhat limited in environments where little can be done to overcome infringement. Thereby, the legal system governing the markets in which firms operate considerably affects the effectiveness of patents to those firms.

The above issues raised by the interviewees parallel Teece's (1986: 287) concept of regimes of appropriability which "refers to the environmental factors, excluding firm and market structure, that govern an innovator's ability to capture the profits generated by an innovation". As the author observed in a recent review of his seminal article, "imitability is a function of both legal impediments (…) and the inherent replicability of the technology" (TEECE, 2006: 1134). Although interviewees have argued that the weakness of a patent can be a result of limited declared information in the patent application that substantiates its scope, information can be limited due to the own nature of knowledge embedded in the technology. As observed by Saviotti (1998), depending on the technology life cycle tacit

knowledge can be more prevalent, and hence more difficult to demonstrate in a patent application. However, it might be that knowledge is strategically omitted to avoid excessive disclosure to competitors. But the latter behaviour implies that firms are also taking the risks of their applications not being accepted by patent examiners due to the lack of information.

The limited effectiveness of patents was also justified because inventors may only be able to block competitors in terms of specific products rather than broad areas of technology in that there might be different ways of doing the same thing, or closely related products ('relatives' as one of the interviewees said) may not be covered by the patent. Often it seems that patents can make things more difficult for, but cannot completely stop, the competition. However, according to our interviews, the role of patents as an entry deterrent is pivotal in firms' decisions to apply for patents. Firms, especially larger firms, reported that they take out and even hold portfolios of patents in order to undermine the technological development of competitors, delaying, or sometimes even blocking, access to a market niche. The effectiveness of this approach, however, was said to be variable because rivals may generate knowledge outside the domain of a patented invention. But this approach was said to be, on average, more efficient than relying on just one patent. As most pharmaceutical firms operate world-wide, they hold very large numbers of patents (up to as many as one per product per market), and in such circumstances it is only by managing the whole portfolio that they will generate the full benefit of patents and limit, but not necessarily stop, the operations of (potential) competitors. This result is in accordance with the findings of Bresnahan (1985) for the plain paper copier market, where the author detected Xerox's attempt to patent as many features as possible of the copier technology. In turn, smaller firms we interviewed also signalled the possibility and interest in using patents as an entry deterrent, but they stated that they had insufficient funds to enable them to maintain 'sleeping' patents in force on a regular basis. They have to be more selective when they pay renewal fees. Yet, on occasion, even if patents are not perceived as perfect protective devices their role as entry deterrents justifies firms' pursuit of patent protection.

Our reporting firms indicated that they tend to keep things secret (either using trade secrets or pure secrecy) regardless of their decision as to the patentability of the invention. Although the basic premise of patent protection is that patented knowledge will be disclosed to the world, and innovating firms agreed this is a drawback for their competitiveness, interviewees said that on occasion knowledge disclosed may not be enough to perform an

invention. Know-how is always important and when the technology is in the very beginning of its life cycle other firms may have particular difficulty in copying the knowledge released. However, this does not happen very often and firms informed that their focus on secrecy is to assure that knowledge revealed in a patent application is disclosed to the extent that patent examiners will be convinced that a patent should be granted. Secrecy was said to be more prominent when it is difficult to police the invention (such as new processes or equipment). Interviewees also described that there might be situations where know-how is outdated quickly and in such cases it might not be worth seeking patent protection.

It seems, therefore, that a combination of patents with other mechanisms is the way firms enhance the degree of appropriability over their innovations. This is corresponding to Graham and Somaya's (2004) evidence for the US software industry, and the argument of Cohen et al. (2000) that patents can add sufficient value at the margin when combined with other mechanisms. We have thus observed that firms apply for a patent because it enhances appropriability conditions. The limited role of patents as protective devices can be moderated when other appropriability mechanisms are employed. We were often told that generally a combination of things is required to enhance firms' appropriation. It was said that firms cannot rely solely on patents and expect that their success will be guaranteed. Overall, in order to reap the benefits from R&D they have to use a broad spectrum of elements that both underpin their sales and avoid other firms to step into their market niches. Although they were not asked to pin point which elements they were talking about sales force, secrecy, and brand (trademarks) were frequently mentioned by the interviewees.

According to both theoretical (e.g. GALLINI; WINTER, 1985) and empirical (e.g. PITKETHLY, 2001) literatures the motivation to patent however does not derive only from the possibility of solely market an invention. Firms can appropriate the returns from their innovative effort by out-licensing their inventions as well. In fact, the possibility of out-licensing a technology was reported to be taken into consideration by all the interviewed firms[2]. Moreover, the interviewees felt that they need to have their technology patented in order to out-license it. Our findings thus reconcile with the literature. However, prior literature has not explored further this motivation. In conducting our research we noticed that smaller firms place more emphasis on this issue than do larger firms; it seems that out-licensing may be more important to the former than to the latter. This might be a result of their lack of global production and distribution networks. As such their existence might

depend more heavily upon their ability to convince other companies to in-license their technology. We were informed that if inventions are not well protected by patents it is less likely that larger pharmaceutical companies will in-license them. Although agreements might be made if a patent is still pending, smaller companies reported they tend not to even seek agreements for non-patented inventions. Not least, smaller companies may have more problems in covering the costs of clinical trials, regulatory review and product launch and as such may need to collaborate more often with larger companies. Their limited bargaining power in the absence of patent protection as well as their lack of control of complementary assets were said to put them at a disadvantage in negotiations with larger corporations. If they have an invention that is neither patented nor has a patent pending, they tend not to approach other companies; behaviour reinforced by the problems of maintaining non-disclosure agreements. Larger companies, who tend to operate world-wide, will on occasion consider out-licensing a technology (e.g., to access a particular market) but we were told that even to them, patent protection is a paramount requirement if they want to secure royalty income.

In addition, we were told, patents are used as assets during cross-licensing negotiations. Although cross-licensing was not reported to be key to guarantee freedom to operate for the interviewed firms, as it is, for example, in semiconductors (HALL; ZIEDONIS, 2001; GRINDLEY; TEECE, 1997), it is an option that should be kept open, the interviewees said. Our interpretation of the interviewees opinions is basically that patents prove valuable in trading for technologies controlled by others, and thus even if an invention is not of particular interest to the firms, it may be patented in order to be used in acquiring more useful technology elsewhere. Although interviewees said that firms may engage in patent pools[3] with other firms, our sample firms reported it does not happen very often to them.

Adding to the above the companies in the sample considered patents to be at least partly useful as an incentive mechanism, though we were unable to judge whether patents were effective in this. None of the companies, however, reported that patents have a direct relationship with researchers' salaries; behaviour that seems to differ from that found in Japanese firms (GRANSTRAND, 2000). For obvious reasons we could not identify whether this is a sectoral difference or a cultural one. However, our findings revealed that, in the sample firms, patents are only one item amongst many used to measure the performance of human resources (others might include for example publications in academic journals). As

there might be areas where it is easier to patent than others it was argued that it may be unfair to use crude number of patents as a performance indicator. In fact, there may be areas where the output of inventive activities will not be patentable at all, and hence the usefulness of patents as an incentive mechanism is limited.

Whilst reasons to patent were mentioned in prior studies, they were not always reliant on factual data explored for that purpose. So, using a more rigorous approach our findings have confirmed most of what the literature previously addressed. In addition, our investigation has revealed two other reasons that, as far as we know, have been neglected in the empirical literature, which we list below.

- To influence investors perceptions. By the time of the interviews, all sample firms, but one, were publicly traded in the stock market. Two of them, the smallest ones, indicated that they use patents to give confidence to investors and in turn to facilitate the financing of innovative activities. As further evidence of this, one of the companies in the sample devoted to patent issues almost one third of the content of its prospectus for admission to the official list of the London Stock Exchange. However, the prospect of holding a patent may, at least to smaller firms, go beyond funding opportunities because, according to the interviews, financiers may also offer information, advice, and credibility to the investment.
- To signal to others. Following similar lines firms said that in holding patents they signal not only to investors but also to other institutional bodies (e.g, competitors, universities, and so on) who they are and where they may go technologically. The disclosure of their technological competence, although not necessarily in their own interest, may sometimes help in opening windows of opportunities (e.g., licensing, mergers, and acquisitions) of which they were not fully aware by the time a patent was applied for. But signalling is not associated only with business opportunities. It can impact, in at least two ways, on other firms' behaviour. For example, a patented technology may divert other firms R&D direction because in following the same technological path as the already patented technology there are risks that resources will be wasted if a newer technology is not outside of the scope of previous patents. Even if a patent is granted for the newer invention there is also the risk of patent infringement. And in this case, incumbent firms' patent portfolio may signal the likely costs of an infringement.

It was also indicated to us that there is a cost to obtaining and maintaining patents as well as tackling infringements. In fact we were told that there are cases where infringements may be ignored by patent holders, a particular reason for which (especially for smaller firms) was the relative cost of patent litigation as compared the benefits the enforcement of the patent would bring. According to the interviews, this depends to a large extent on the strength of a patent (a mixture of scope, and ease to defend in court) and on how close a patent is to the end of its life. In addition, the costs of taking out and maintaining patents were said to be easily overshadowed by the costs of patent litigation. One of the firms, for example, realised that it would be better off spending money in other activities that could strengthen its competitive position (e.g. R&D, marketing) rather than having equal expenses on patent litigation.

5. CONCLUSIONS

In this paper we have explored why firms in the UK pharmaceutical industry pursue patents. The results arise from a series of interviews with appropriate personnel in six various sized firms. In total, the evidence provided by the six firms is perhaps a rather thin foundation upon which to make general statements, thus a more comprehensive, and representative, sample is needed, which we leave to future research. Nevertheless, some reflections seem to be in order.

Our findings revealed that although the main purpose of patents is to limit copying (and the effectiveness of patents in this appears to be determined largely by the enforcement climate and the ability of others to 'invent around' a patent), there are a number of additional reasons for firms to apply for patents. Although our results match prior studies, we also found supplementary information. We observed, at least to our sample firms, that patent applications are underpinned not only by the purpose of excluding others but also by the purpose of attracting others to a particular course of action. According to our findings, the motivations to patent encompass their use: i) to protect from copying, ii) to deter entry, iii) to enhance appropriability conditions, iv) to secure royalty income, v) to use in technology negotiations, vi) to influence investors perception, vii) to signal to others, and viii) (apparently to a lesser degree) to incentivise researchers.

The theoretical literature has addressed patents as either isolating mechanisms (RUMELT, 1987) or appropriability mechanisms (TEECE, 1986). Although appropriation is

to a large extent dependent on isolation our results suggest that firms also use patents as 'gathering mechanisms' in order to appropriate the returns from innovation (e.g. attracting licensees, investors, and competitors to a deal). As such one theoretical implication of our findings is that the notion of appropriability mechanism suits better the role played by patents than does the notion of isolating mechanism.

One managerial implication of our findings is that decision-making as to why to patent should encompass not only the potential protective benefit patents can bring but also the potential appropriative benefits. This does not mean that inventors should always file patent applications but rather that in deciding whether or not to patent the negative aspects of patenting should be compared with patents' full potential benefits to the inventor that we have found to exceed protection. For instance, inventors may not be willing to disclose their technological knowledge to rivals but in doing so they may be opening windows of opportunities (e.g., licensing, mergers, and acquisitions) of which they are most often not fully aware.

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[1] One of the interviewees even emphasised that patents are tickets to court.

[2] Although we have not identified the conditions under which technology would be out-licensed rather than exploited internally by the firm.

[3] Patent pools mean that intellectual property rights have been amounted to be the subject matter of cross-licensing either directly or indirectly (e.g., joint-venture set up to administer the pool).