THE DYNAMICS OF APPROPRIABILITY REGIMES

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Abstract. Achieving benefits from innovation activities in a firm depends on various things. Innovation and invention are not easy, and once they show results, they need to be protected from imitation, commercialized, and/or utilized with a view to increasing the bargaining power of the firm. In this context, one factor influencing returns on investments is the appropriability regime.

In this study, the appropriability regime is approached and categorized through extending, combining and complementing previous research. The roles of individual appropriability mechanisms are examined in a survey among 299 companies. As a result, a conceptual clarification of the appropriability regime is suggested, and empirical evidence is provided to contribute to understanding of knowledge protection.

Keywords: appropriability regime, appropriability strategy, appropriability mechanisms, dynamics

JEL – codes: O32, O34, K31
1. Introduction

It has long been recognized that many innovating companies may easily end up losing out to their competitors and imitators in the commercialization race. In tackling this issue, the inability of an innovating firm to get returns on its investments in innovation (the appropriability problem, see e.g., Arrow 1962 and Levin 1988) has been studied from a variety of perspectives. Different sources and points of view offer various insights into factors affecting the potential of companies to appropriate profits from innovation. Technological and marketing capabilities, the existing knowledge base, and the ability to learn are some examples (e.g., Jennewein et al. 2004, Baughn et al. 1997, Rao and Klein 1994, Davis 2002). Also, many ways of obstructing imitation have been found and examined (e.g., Teece 1998, Dierickx and Cool 1989, Lippman and Rumelt 1982, Polanyi 1966, Barney 1991). Intellectual property rights (IPRs), especially patents, and the nature of the core knowledge related to innovations (tacit vs. codified, the inherent difficulty in mastering technologies) (e.g., Teece 1998) have had a central role in this discussion. However, closer examination and consideration of previous studies reveal that they form only a part of the appropriability regime, and therefore further research is needed.

The starting point in this study is in the protective approach: ways of defending different types of innovations against imitation. Naturally, securing profit creation is also essential given the incentives to invest in innovation activities and R&D, but eventually it could be seen as an outcome of being able to make innovation proprietary, and utilizing the means to protect innovations more widely than just as a barrier to imitation (e.g., to create profits more directly or to achieve a better competitive positioning).

As McEvily et al. (2004) note, for example, despite its theoretical and practical importance, protection has been the subject of limited empirical research. With a view to redressing the balance, this study examines different appropriability mechanisms by means of a survey conducted among 299 Finnish companies from nine different fields of business. The purpose was to find out what the roles of such mechanisms are, how strong they are, and how this affects the extent to which they are used. To this end, the reasons for using certain mechanisms (appropriability strategies) are considered, together with the perceived importance of individual appropriability mechanisms. Closer empirical examination follows a discussion on previous research related to appropriability regimes, some possible extensions to them, and the appropriability strategies of firms.
2. The appropriability regime of the firm

2.1 Studies on appropriability regime

The appropriability regime of a firm has been defined in previous research as the extent to which knowledge and innovations can be protected from imitators. It consists of appropriability mechanisms – the means to protect both the innovation itself and the increased rents due to R&D (Cohen and Walsh 2001). Two mechanisms have been emphasized in earlier studies: core knowledge in innovation, and the efficacy of legal protection for intellectual assets (Teece 2000, Teece and Pisano 1998, see also Levin et al. 1987).

However, also other mechanisms that promote taking control over developments and intellectual assets (and fit the general definition) exist (see e.g., McEvily et al. 2004, p. 714 and McEvily and Chakravarthy 2002, p. 288). Certain means of protection may easily be overlooked because all of them are not equally advantageous and interesting, and because the role of the different mechanisms is not necessarily unambiguous. This makes it easier to concentrate on particular mechanisms, such as patents or trade secrets, instead of taking all of them under examination simultaneously. They are linked to each other, however, thus forming a web of interrelated mechanisms. Consequently, revisiting and revising earlier research may reveal new points of view.

2.2 Extending the appropriability regime

As one of the most obvious and studied entities related to innovation protection, the intellectual property regime consisting of several rights provides a starting point for examining appropriability mechanisms. Patents, copyrights, trademarks, trade secrets, and other IPRs provide protection for different objects, and they also overlap. For example, trademarks can be used with patents very effectively, as several examples of brand significance show (e.g., Cook 2002, Teece 1986, Jennewein et al. 2004). Even when the patent expires, the trademark can preserve the image of the innovation or product to such an extent

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1 In this study all legislation is considered from the European, and especially the Finnish perspective. Because of the differences between countries, extensive generalizations are difficult to make. The fact that the data was collected among Finnish companies supports this limitation.
that it forms a de facto barrier to imitation. In more general terms, the registration of rights sends a signal regarding proprietary intent (Baugn et al. 1997), and defending rights actively (e.g., through aggressive litigation and well-considered reactions to infringement claims) makes attacks against exclusivity less likely.

IPRs are probably the most evident form of institutional protection, formal means of protection provided by society to innovators, but other legislation also provides a shield for intellectual assets, (legally-binding) contracts being one example. Through contracting it is possible to institute arrangements that resemble exclusive rights provided by IPRs (see e.g., Kemppinen 2004), and the flows of codified knowledge – which is difficult to protect as such – can be controlled by using non-disclosure agreements (NDAs), for example (York 1998).

It is not only codified and explicit knowledge, but also its counterpart, tacit knowledge, that needs to be protected – even if there are inherent differences between the two. Tacit (technological) knowledge is implicit and idiosyncratic, and on the organizational level it is embedded in organizational routines and capabilities (Teece 1995). Because of these features, tacitness itself provides a defense against imitation (i.e. it is an appropriability mechanism as such). For example, the tacit component in core technological know-how makes technology transfer difficult, if not impossible. However, tacit knowledge can also move from one company to another, such as through the transfer of key individuals/employees with critical skills (Boxall 1998). Yet another form of institutional protection, labor legislation, may have an important role as an appropriability mechanism in these cases. The norms of labor legislation facilitate the use of non-competition contracts or clauses\(^2\) and the drafting of employment contracts so as to fully exploit the employees’ duty of loyalty that is inherent in employment relationships: long-term employment contracts with sanctions related to resignation may be used for this purpose (see Rousseau and Wade-Benzoni 1994 on different types of employment contracts). These kinds of arrangements may help in keeping the skills of the personnel within the firm. Moreover, the employer’s right of direction in assigning tasks to employees is a key aspect in managing knowledge flows. Collective labor agreements may include rules enhancing appropriability (e.g., through defining which rights belong to the employer, and which need to

\(^2\) According to Finnish legislation, the term of non-competition contracts can continue for six months, and in some cases for one year, after the employment relationship has ended. However, such restrictions are not enforceable in California, USA, for example. Differences in regulation and legislation should thus be recognized.
be transferred separately from the employee), similarly to legislation on employment inventions\(^3\) setting rules for transferring IPRs from individual employees to the firm.

Consequently, the company as an employer has a variety of rights at its disposal. The existence of these rights needs to be separated from the ways in which the firm utilizes them and handles its human resource management (HRM), however. Decisions related to recruiting and dismissing personnel and directing their work may be very relevant in the light of appropriability. In fact, it has been said that “control over human resources is a primary means for protecting intellectual capital” (Baughn et al. 1997, p. 112). Employees’ freedom of communication needs to be monitored if the firm wants to prevent unintended knowledge flows (Liebeskind 1997), particularly in situations of collaboration with other organizations. These kinds of arrangements provide opportunities to learn, and even if contracts or IPRs cover products and processes, uncontrolled information disclosure may emerge. Being aware of the appropriate interface points and the information channeled through them is important, since the firm may unintentionally make information available through one access point, which would have been constrained by another. The employees at the interface could be seen as both gatekeepers and receptors of partner know-how (see also Chesbrough 2003, p. 46 on employees identifying and accessing external IP). Thus, hiring practices and personnel rotation should be carefully considered in collaborative arrangements (Baughn et al. 1997, Norman 2002), especially given the transferability of tacit knowledge. On a more general note, the (im)mobility of human resources is an important aspect of the protective approach. Despite causal ambiguity and social complexity, there is little doubt that key employees and their skills eventually become visible to competitors’ ‘head-hunters’ (Boxall 1998). The commitment created through HRM practices has an influence on the willingness of employees both to stay and to implement their duty of loyalty based on labor legislation (Rousseau and Wade-Benzoni 1994). Here it is not that much a question of legal rights and obligations, however, but rather a matter of softer, psychological issues, as well as option arrangements and other incentives that increase commitment.

In addition to the above-described appropriability mechanisms, the use of different practical or technical means limiting access to certain (proprietary) information, such as passwords and digital signatures, copy prevention, and cutting off access to information on a particular date, may increase protection and appropriability as long as they cannot be circumvented (Davis 2001). Practical

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\(^3\) In this study, this form of regulation is classified as labor legislation because transferring the rights is based on the existing employment relationship.
concealment and secrecy are often linked to HRM or trade secrets, and their relevance in this context may thus be overlooked. Nevertheless, ‘general’ secrecy in the sense that the knowledge is kept within a limited group of people can be included in this category. In any case, keeping information from competitors in this way may be essential for the company if it wishes to use other appropriability mechanisms such as the above-mentioned IPRs, or lead time as described below.

According to Saviotti (1998, p. 850), “Appropriability is expected to fall systematically during the maturation of a technology”. He continues, “This tendency can be counteracted by a fast rate of displacement of the technological frontier, which […] reduces the possibility of imitation”. As Zander and Kogut (1995, p. 80) note, “The ability of the innovating firm to improve the product should deter imitation, even if important aspects of the manufacturing capability are widely diffused”. Indeed, companies can overcome the appropriability problem by being the first to enter the market with a new product and/or being ahead of their rivals (Carow et al. 2004, López and Roberts 2002, Davis 2001). This appropriability mechanism, called lead-time, has often been suggested to be among the most effective ones (e.g., Levin et al. 1987, Cohen et al. 2002, Harabi 1995, Arundel 2001).

Given the means of protecting innovation described above, the appropriability regime of the firm can be summarized as shown in Figure 1. The varying features and roles of the different mechanisms allow for other expressions to be built in. Not all mechanisms are available or strong enough to contribute to the protective barrier of the appropriability regime. Availability and efficacy can be affected not only by external factors, but also by other mechanisms, and therefore it is useful for managers of intellectual assets to be aware of the linkages between them. As a result of these interfaces, the appropriability regime may take different forms.

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4 The links between secrecy, IPRs and lead-time are discussed in more detail later in the context of interconnections between appropriability mechanisms.

5 These factors are beyond the scope of this particular study. However, they could include the resources and capabilities of the company, and the limitations and requirements set by society, governments and legislators.
2.3 Interfaces of appropriability mechanisms

Many appropriability mechanisms have a dual role. They may be appropriability mechanisms as such, in other words they provide protection independently of other means of protection, but they may also enable or enhance utilization of other mechanisms. For example, NDAs or technical and practical means of protection, such as preventing access to information through the use of passwords and physical restrictions, are required in order to create legally enforceable trade-secret protection: if there is no reasonable effort to keep some information concealed and confidential, it cannot really be considered a trade secret (Hannah 2005). Thus, in this context technical means of protection could be seen as prerequisite appropriability mechanisms. Similar links between different mechanisms emerge in relation to employment inventions: the existing employment relationship (based on labor law) gives a company the right to transfer the IPRs of individual inventors to the firm, thus making them available to the company. In addition, different contracts and aspects of labor law, as mentioned earlier, form the basis for human-resource management as an appropriability mechanism. Naturally, we could approach these linkages from the opposite direction, and talk about derivative appropriability mechanisms as a counterpart to prerequisite mechanisms. For example, lead-time could be perceived as having another role as a derivative mechanism: lead-time and competitive advantage could be created by utilizing the time provided
by other mechanisms. Patent protection may force rivals to find other solutions and delay them from entering the same market, or secrecy or contracts may give the innovator the time needed to make modifications to the original design and to bring the final, competitive version onto the market (Boxall 1998, Bitran and Lojo 1993, Atkins 1998, see Teece 1986 on the preparadigmatic stage and dominant design).

Sometimes the existence of some appropriability mechanism is not critical, but it is nevertheless beneficial to the efficacy of other forms of protection: other mechanisms may be supportive rather than prerequisite. For instance, the registration of IPRs may increase the loyalty of employees and provide an incentive for R&D personnel to create more innovations if they receive appropriate acknowledgement and (monetary) reward. Signing NDAs or non-competition contracts reminds employees of their obligations related to information disclosure and the preservation of trade secrets (Hannah 2005). This requirement signals the employer’s intent to keep certain information confidential, thus enhancing trade-secret protection and the efficacy of HRM (Morehead Dworkin and Callahan 1998). Moreover, different IPRs can be combined to build extensive legal coverage of intangibles (Davis 2002), and proper human-resource management can create the basis for an effective trademark and brand (Aaker 2004).

The numerous interface points between appropriability mechanisms vary by nature. The enabling and enhancing mechanisms discussed above are important in terms of building protective barriers against imitation, but their role may be more benefit-creating than critical: their absence may not completely prevent the use of other instruments. For instance, trade secrets certainly prevail even if the company neglects their technical protection and NDAs, at least until they are revealed: in such a case it may be very difficult to get any compensation through litigation. There is yet another type of link, however: in some cases the existence and/or utilization of one mechanism makes it impossible to use another. One example of this is the trade-off between patenting (requiring disclosure) and secrecy with the same invention and the related know-how. Furthermore, the nature of knowledge has a major role given the availability of other mechanisms. For instance, a certain amount of disclosure is required in writing an enforceable contract or a patent application. Disclosing information may not be possible if the core knowledge is very tacit in nature, however. Similarly, copyright or model-right protection covers only the expression, not the

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It has to be noted that patents and secrecy can be used for the same product, service or process simultaneously, and very often this is the best alternative. However, it should be pointed out that if some particular piece of (technological) knowledge is revealed in the patent application, it will be published and therefore cannot be kept secret.
underlying ideas, and therefore the codified, explicit form is critical in terms of the scope and usefulness of the protection. Tacitness may also make the diffusion of knowledge through the company so challenging that lead-time cannot be fully taken advantage of (see Tuppura et al. 2005, forthcoming). Moreover, failure in HRM or neglecting the use of non-disclosure agreements may prevent patenting (if the novelty of the invention is compromised) or the use of lead-time, and using restrictions created by means of passwords and control systems may compromise the loyalty of employees and innovation creation if not considered and handled with care.

It can be seen from all these examples that careful management is required. It is not always clear whether it is beneficial or harmful to introduce certain mechanisms. These issues and links should be taken into account when building an appropriability strategy for a firm.

3. Building up an appropriability strategy

3.1 Different dimensions of appropriability

According to Levin et al. (1987, p. 821), “There are very large differences, both among industries and within them, in the effectiveness of various means of appropriating intellectual property.” (see also Cohen et al. (2000)) Even within a single firm there may be differences between the appropriability regimes of products and processes (Levin et al. 1987). Differences in the utilization of appropriability mechanisms can, at least partly, be explained by the fact that their availability is not self-evident. To give a couple of examples, certain descriptive marks that denote quality, value, quantity or other characteristics of the goods or services cannot be covered by trademark protection, and copyright is not issued to works that are not original. In addition, the strength or efficacy of mechanisms varies. This applies, e.g., to the enforceability of contracts (non-competition contracts cannot be enforced in California), and to the validity and enforceability of patents and whether in reality they create obstacles against imitation. The purpose of an appropriability regime is to provide a protective barrier for the company, and consequently

7 In the worst case, employees may think that if they are not trusted, they do not really have any reason to keep confidential information to themselves (Hannah 2005). It should be remembered that the focus is on creating obstacles for rivals, not employees (see e.g., Norman 2002).

8 Availability could be seen as a necessary condition, and efficacy/strength as a sufficient condition for a strong appropriability regime (see Hurmelinna and Jauhiainen 2004).
the strength of the protection is often over-emphasized. However, preventing imitation is not always the most important issue in the appropriation of profits: the effectiveness\(^9\) of the mechanisms may be found in other uses of them. Therefore, also the decisions related to the formation of an appropriability regime and the exploitation of individual mechanisms, in other words the appropriability strategy of a firm, may explain inter- and intra-industry differences.

3.2 Inherent dynamism of appropriability regimes

The appropriability regime available to the company sets the limits on the strategy, which in turn should define how the mechanisms are used or whether they will be acquired in the first place (see Figure 2)\(^{10}\). However, these limits are constantly changing, since the regime is inherently dynamic. For one thing, appropriability mechanisms are included in the regime and extracted from it according to their availability. For example, a contract is available as an appropriability mechanism as long as it is in force (although some terms, such as confidentiality, may outlive it). Patents become available at the latest when they are granted, and they expire after a certain time (20 years from the filing). The costs of maintaining certain rights may turn out to be too high, and the rights may be given up before the legal expiration date is reached. Labor law may be at the company’s disposal all the time, but it really only binds the current employees of the firm. Moreover, the force of the different mechanisms changes over time. Whereas the value of trademarks may increase radically over time (see Teece 2000), trade secrets may be revealed as time goes by, and patents may lose their efficacy as new inventions and solutions emerge. Further, despite the difficulties in knowing who the innovators actually are in some particular firm, or where the competitive advantages lie, the intellectual assets eventually may become discernible to competitors and imitators. Finally, the linkages between appropriability mechanisms discussed above reinforce their dynamic nature of the appropriability regime.

\(^9\) Effectiveness of appropriability mechanisms indicates their suitability for the goals of the company. This will be discussed in more detail below.

\(^{10}\) To give an example, it is not possible to decide whether to use a patent for preventing imitation or for getting licensing revenues if it cannot be issued or if its efficacy is limited because competitors know that it does not cover the technologies they use.
Figure 2. The relationship between the appropriability regime and the appropriability strategy

3.3 A strategic approach to appropriability mechanisms

The dynamic nature of the appropriability regime is also reflected in the strategy of the company. The dynamism is not only a result of the different life cycles of appropriability mechanisms, it also exists because the mechanisms are not always utilized in the same way. The strategy needs to bend according to the emerging opportunities and threats. According to Teece (2000, p. 26), firms need “the ability to sense and then to seize new opportunities, and to reconfigure and protect knowledge assets, competences, and complementary assets and technologies to achieve sustainable competitive advantage”. A proper appropriability strategy increases the readiness to use suitable mechanisms in exploiting new possibilities and securing existing ones.

All appropriability mechanisms have the potential of making knowledge more protected, but some of them can also make the know-how more transferable and tradable. Patents, for example, may increase the bargaining power of the firm, or they can be licensed out to create new revenue streams (see e.g., Hurmelinna and Silventoinen 2005, forthcoming, for more ways to exploit patents). Trademarks can be used to increase profits through merchandising or franchising, and contracting with other companies may enhance learning, growth and internationalization. This feature offers several opportunities, but it also
presents a challenge to management. It may be very difficult to know when it is the right time to start offering certain know-how to other organizations instead of building own capabilities and revenues on it.

Sometimes a trade-off between maximizing the protection and maximizing the value is simply inevitable. IPRs and the tacit nature of knowledge, for instance, can certainly prevent imitation, but at the same time they may obstruct the transfer of knowledge in situations in which it would be preferable. Adopting, redeploying or transferring competences and capabilities, i.e. (partial) replication, within the firm is one example of such a situation. Utilizing positive network effects and externalities, as well as gaining benefits from standardization, may also be difficult if the protection approach is over-emphasized (see e.g., Davis 2001). Imitation is not always harmful (Davis 2002), and compatibility between competing technologies and products may end up being the source of profits. Thus, sometimes the protective barrier may be deliberately eroded. As a consequence, the appropriability strategy shapes the appropriability regime together with availability and strength of various mechanisms.

3.4 The structure of a firm’s appropriability regime

Many factors affect the appropriability regime and strategy of the firm, and its decisions to use certain means of protection. Only a couple of examples are presented here, the first one being the perceived importance, i.e. the strength, of appropriability mechanisms in protecting innovations. When asked about the efficacy of different mechanisms, managers have often replied that there is no point in paying for patents because they will not prevent imitation anyway (see e.g., Cohen et al. 2000, Harabi 1995, Arundel and Kabla 1998). Similar problems are related to other means of protecting knowledge. Contracts can be breached, and employees may disclose information unintentionally or deliberately. First-mover advantages may give way to first-mover disadvantages, making lead-time less attractive (Lieberman and Montgomery 1988). Providing another example of the role of strength, Arundel (2001) notes that if trade secrets are found to be effective, they are preferred over other means of protection. This suggests that the more effective a particular mechanism is perceived to be in preventing imitation, the more it will be used, and leads to the first hypothesis to be examined:

**H1: The stronger an appropriability mechanism is perceived to be, the more it is used**
The strength of appropriability mechanisms is only a starting point, however. The underlying reasons for obtaining it also have an effect on the need for and use of protection (see e.g., Pitkethly 2001, Ojanen and Vuola 2003). If the reason for seeking it is to prevent imitation, patents disclosing information may not be the first choice (even if they may be effective), and tacitness, the practical concealment of information, lead-time, and HRM would have a more important role. A different kind of approach is taken when obtaining licensing revenues is the reason for acquiring protection (see Pitkethly 2001). In that case the safe transferability provided by IPRs is more important than preventing imitation. In view of this and similar short-term advantages (e.g., improving bargaining power), tacitness, HRM and the practical concealment of information may not be that important, because it may be hard to extract value from them. However, given the time needed to obtain protection (especially in the case of patents), it may be that lead-time is more significant in relation to short-term value creation, and that HRM has a greater role in terms of long-term value, such as image improvement (see e.g., Aaker 2004 on the importance of personnel for brand building).\(^1\) IPRs, for their part, could be seen as “an indication of value to potential investors” (Davis 2002, p. 15). In sum, the relationship between appropriability mechanisms and the reasons for obtaining and using protection are the focus of the following hypotheses:

**H2: There is a relationship between the strategic goals related to appropriability and the usage of appropriability mechanisms**

**H2a:** The more the company seeks short-term value, the more it utilizes lead-time and IPRs as appropriability mechanisms

**H2b:** The more the company seeks long-term value, the more it utilizes HRM and IPRs as appropriability mechanisms

**H2c:** The more the company concentrates on creating barriers to imitation, the more it utilizes tacitness and practical/technical means for protecting its knowledge

Sometimes certain appropriability mechanisms would be very useful for the company, but they simply are not available. For example, Cohen et al. (2000) found in their study that the difficulty in

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\(^1\) However, concealment may not be so important, but other aspects of HRM become more relevant. Then again, the personnel may have a critical role in preserving sources of competitive advantage if and when IPRs and practical secrecy start to lose their protective efficacy. Tacitness may also be important in this respect.
demonstrating the novelty required for patent protection was one of the major reasons not to acquire patents. Moreover, the costs were often too high (Cohen et al. 2000, see also Arundel and Kabla 1998, Lerner 1995). Another example concerns the availability of tacitness: once it is lost, it cannot really be retrieved and furthermore, certain types of knowledge are inherently explicit (see e.g., Zander and Kogut 1995, Winter 1995). Then again, the presence of tacitness may be fixed: tacit knowledge may well not be transformable into a codified form despite the efforts of the firm (see e.g., Nelson and Winter 1982, Norman 2002, Saviotti 1998 and Polanyi 1966 on tacitness). IPR availability may be easier to control than tacitness, since companies can enhance the likelihood of achieving protection through effective management (see Hurmelinna and Silventoinen 2005, forthcoming), or decide not to acquire particular IPRs. HRM, labor legislation, contracts, and practical and technical means of protecting know-how resemble IPRs in this respect, and the threshold for acquiring or utilizing them is generally lower than for getting IPR protection. Nevertheless, to a certain extent, companies cannot do anything about the availability of appropriability mechanisms. This creates challenges for management, since availability (or the lack of it) may have several implications, including the fact that its strength of an appropriability mechanism may detract from its relative importance. To illustrate the role of availability, we examine closer the availability of IPRs in the following hypotheses:

**H3**: The relationship between strength and usage in appropriability mechanisms is moderated by their availability

- **H3a**: when IPR availability is low, the usage is low regardless of the strength
- **H3b**: when IPR availability is high, the level of usage depends on the strength

The three hypotheses are depicted in Figure 3.
4. Empirical evidence

4.1 Sample and data collection

The population was defined as Finnish companies from several industrial sectors engaged in R&D. The sample was constructed so as to represent a range of sectors with a view to achieving heterogeneity and increasing the generalizability of the findings. The sample frame comprised all firms with at least 50 employees from selected industry sectors. Contact information was obtained from the Blue Book Database. A total of 1140 companies were identified, and 881 of them were contacted by telephone between February-March 2004\textsuperscript{12}. Two hundred firms refused to participate. The 681 companies that agreed to take part received a pretested questionnaire and an introductory cover letter by mail, following

\textsuperscript{12} In this phase, 100 companies were found ineligible, and others were not reached, most likely indicating that the company no longer existed given the delay in updating the database.
a telephone conversation. A reminder e-mail was sent to those who had not sent their responses within two weeks. Of this sample, 299 companies responded, resulting in an effective response rate of 33.9% (299/881). This rate could be considered satisfactory as the questionnaire was very extensive, and as the respondents were mainly chief executive officers or managing directors with busy time schedules. Of the participating companies, 7% operated in the food sector, 12% in the forestry sector, 7% in the chemical sector, 34% were metal and machinery companies, 9% operated in electronics, 8% were service companies, 17% were in the ICT sector, 3% in the furniture sector and 3% were professional research and development companies. Non-response bias was checked on a number of variables by following the suggestions of Armstrong and Overton (1977), and the results indicate that it did not appear to be a problem.

4.2 Measures and descriptive statistics

The perceived strength (efficacy) of appropriability mechanisms in protecting innovation was assessed on the following question: “How significant have the following mechanisms been during the past three years in protecting product innovations from imitation by (potential) competitors?” A list of 17 different mechanisms followed, and the respondents rated the significance of each one on a five-point scale (1 = slightly significant, 5 = very significant). The mechanisms were grouped as follows: (practical/)technical means (concealment/secrecy, passwords and limited access), labor legislation (employment contracts, employee non-competes), contracts (cooperation and other), IPR (patents, copyright, trademarks, utility models, design, trade secrets), lead-time, tacitness, and HRM (restrictions on employee mobility and communication, altering contact persons in collaboration). The Cronbach alpha reliability coefficients for the multiple-item scales are shown in Table 1. The reliability of labor legislation is poor, but the other coefficients exceed the .60 limit, and could be considered acceptable.

The use of appropriability mechanisms was measured using different types of questions. IPRs, practical/technical means and HRM use were assessed as the percentage of products that were protected by those means. The use of tacitness was measured on three Likert-scaled items ranging from one to seven. The aim was to approach the degree of codification, and the item wordings were as follows: (1) in our company, we normally do not write down things learned through experience; (2) we have extensively documented our successes and failures (coding reversed); and (3)
our company has extensively documented the critical parts of its processes (coding reversed). The use of lead-time was covered by asking which of the following alternatives best described the company’s entry timing strategy: (5) being the first in the market; (4) being in the market as soon as possible; (3) being in the market as soon as possible with a product of the highest possible quality; (2) not being in the market until the complementary products or technologies were there; and (1) these issues are not important - our product may be ready months before launch.

The measures for the goals of appropriability were derived through principal component analysis of 15 items, which yielded three components with eigenvalues greater than one, see Appendix A. The first component describes the goals related to long-term-value creation for the company, whereas the third includes items related to creating value in the short term. The second component consists of goals related to creating barriers for competitors.

The availability of IPRs was measured as a mean of seven five-point Likert-scaled items describing the reasons why the IPRs would not be used. These included the costs of acquiring, maintaining and defending the rights, the difficulties of detecting infringements, the complexity of legal regulations, the length of time taken to acquire the rights, the lack of information about them, and the failure of the product to meet the requirements set for IPR protection.
Table 1. Descriptive statistics

<table>
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<th>Variable name (scale)</th>
<th>Scale</th>
<th>Mean</th>
<th>Std.dev.</th>
<th>Alpha (items)</th>
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<td>.73 (5)</td>
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<tr>
<td>Tacitness strength</td>
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<td>1.04</td>
<td>.68 (3)</td>
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<td>Contracts strength</td>
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<td>.62</td>
<td>.60 (2)</td>
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<td>Labor legislation strength</td>
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<tr>
<td>Lead-time strength</td>
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<td>23.10</td>
<td>29.13</td>
<td>n.a. (1)</td>
</tr>
<tr>
<td>Tacitness use</td>
<td>1-7</td>
<td>4.38</td>
<td>1.13</td>
<td>.57 (3)</td>
</tr>
<tr>
<td>Technical use</td>
<td>0-100</td>
<td>40.80</td>
<td>30.79</td>
<td>n.a. (2)</td>
</tr>
<tr>
<td>HRM use</td>
<td>0-100</td>
<td>19.20</td>
<td>28.93</td>
<td>n.a. (1)</td>
</tr>
<tr>
<td>Lead-time use</td>
<td>1-5</td>
<td>3.40</td>
<td>1.60</td>
<td>n.a. (1)</td>
</tr>
<tr>
<td>IPR availability</td>
<td>1-5</td>
<td>2.81</td>
<td>.80</td>
<td>.76 (7)</td>
</tr>
<tr>
<td>Goal: ST value</td>
<td>1-5</td>
<td>2.02</td>
<td>.84</td>
<td>.60 (3)</td>
</tr>
<tr>
<td>Goal: LT value</td>
<td>1-5</td>
<td>3.00</td>
<td>.87</td>
<td>.82 (7)</td>
</tr>
<tr>
<td>Goal: barrier</td>
<td>1-5</td>
<td>3.05</td>
<td>.94</td>
<td>.75 (5)</td>
</tr>
</tbody>
</table>

Before testing the hypotheses we considered the efficacy of different appropriability mechanisms in the light of previous studies. Earlier empirical research has shown that, in this respect, patents are thought to be weak compared to secrecy and lead-time (e.g., Levin et al. 1987, Cohen et al. 2000, Arundel 2001, Harabi 1995), but contracts, labor legislation and HRM were not included in these studies. Other research has emphasized managing human resources and found that even if it is important (e.g., Boxall 1998, Baughn et al. 1997), it is not without limitations. According to Rousseau and Wade-Benzoni (1994, p. 465), the “alignment of business and HR strategies is a key issue in implementing strategy, yet misalignment is common.” Furthermore, HRM has other, more essential functions than providing
protection, which could mean that it is not perceived to be as important as lead-time. As the differences in perceived importance may have an effect on the utilization of appropriability mechanisms, paired-sample t-tests were performed in order to assess the differences in perceived strength. Lead-time and technical means did not differ significantly, and were on average perceived as the strongest mechanisms, followed by tacitness and contracts on equal levels. The three weakest mechanisms in terms of strength were IPR, labor legislation and HRM, all of which differed significantly in efficacy.

As far as the other elements of appropriability were concerned, technical means were used to protect 40% of the new products on average, whereas IPRs were used only in 23%, and HRM in 19% of the products. The use of tacitness and lead-time are not directly comparable to the above-mentioned mechanisms, due to the different measurement scales, but in general the sample companies tended to enter the markets as fast as possible while not compromising product quality. Short-term-value creation was slightly less important as a goal of the appropriability strategy than long-term value or creating barriers to competition.

4.3 Analysis and results

The Pearson correlation coefficients of the variables of interest are presented in Appendix B. The correlations of the perceived strength variables are all positive, possibly reflecting general attitudes toward protection rather than the connection between the appropriability mechanisms: if a company considers protection important, it finds all of the mechanisms relevant. The use of the mechanisms generally correlates positively with perceived efficacy, but the use of each one is not related to the use of others (except the use of technical means with tacitness, IPRs and HRM). The goals of the appropriability strategy are positively associated with efficacy and use, and also with each other. This could imply that different strategies coexist for different products and processes (see Levin et al. 1987). The availability of IPRs correlates negatively with the goals, indicating that those for whom seeking value creation is more important find the availability of IPRs inadequate.

The hypotheses were tested using linear regression analysis. The first two hypotheses concerned the effects of perceived strength and goals on the use of the mechanisms. We ran five different linear regression models, one for the use of each mechanism. The standardized regression coefficients and model fit statistics are shown in Table 2. The R squares are all significant, varying from .12 for tacitness to
.26 for IPRs. In other words, up to one fourth of the variation in the use of appropriability mechanisms can be explained by the variation in strategic goals and perceived efficacy.

Table 2. The effects of perceived strength and goals on the use of appropriability mechanisms, regression results

<table>
<thead>
<tr>
<th></th>
<th>IPR use</th>
<th>Technical use</th>
<th>Tacitness use</th>
<th>HRM use</th>
<th>Lead-time use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical-means strength</td>
<td>-.012</td>
<td>.427**</td>
<td>.163*</td>
<td>.251**</td>
<td>.034</td>
</tr>
<tr>
<td>Labor-legislation strength</td>
<td>-.092</td>
<td>-.058</td>
<td>.077</td>
<td>-.084</td>
<td>.105</td>
</tr>
<tr>
<td>IPR strength</td>
<td>.410**</td>
<td>-.017</td>
<td>-.025</td>
<td>-.022</td>
<td>-.123</td>
</tr>
<tr>
<td>Contract strength</td>
<td>.096</td>
<td>.012</td>
<td>.127</td>
<td>.139*</td>
<td>-.156</td>
</tr>
<tr>
<td>Lead-time strength</td>
<td>.104</td>
<td>.057</td>
<td>-.035</td>
<td>-.038</td>
<td>.395**</td>
</tr>
<tr>
<td>Tacitness strength</td>
<td>.002</td>
<td>.130*</td>
<td>.080</td>
<td>.050</td>
<td>.018</td>
</tr>
<tr>
<td>HRM strength</td>
<td>-.133*</td>
<td>.065</td>
<td>-.020</td>
<td>.149*</td>
<td>-.029</td>
</tr>
<tr>
<td>Goal: ST value</td>
<td>.064</td>
<td>.032</td>
<td>.029</td>
<td>.001</td>
<td>.236*</td>
</tr>
<tr>
<td>Goal: barrier</td>
<td>.135*</td>
<td>-.089</td>
<td>-.154*</td>
<td>.098</td>
<td>.037</td>
</tr>
<tr>
<td>Goal: LT value</td>
<td>-.158*</td>
<td>.010</td>
<td>.152*</td>
<td>-.153*</td>
<td>-.036</td>
</tr>
<tr>
<td>R2</td>
<td>.261</td>
<td>.237</td>
<td>.123</td>
<td>.139</td>
<td>.213</td>
</tr>
</tbody>
</table>

**sig. < .01, *sig. < .05, "sig. < .10

The first hypothesis (H1) stated that the stronger an appropriability mechanism is perceived to be, the more it is used. According to the models of IPR use, technical-means use, HRM use, and lead-time use, perceived strength has a significant and positive effect. In all but HRM, it is also the single most important independent variable. The perceived strength of tacitness has no effect on its use, while the efficacy of the technical means does seem to explain it and also the use of HRM. In conclusion, H1 is supported, as four out of five possible hypothesized effects were significant.

The second hypothesis (H2) proposed a relationship between the strategic goals related to appropriability and the usage of appropriability mechanisms. The goal of short-term-value creation positively affects the use of lead-time, while barrier creation has a positive effect on IPR use that approaches significance (sig. < .10), and a negative effect on the use of tacitness. The goal of long-term-value creation has a significant negative effect on the use of IPRs, and two almost significant effects: positive on tacitness and negative on HRM. These findings suggest the following conclusions regarding the more specific subhypotheses:
H2a: The more the company seeks short-term value, the more it utilizes lead-time and IPRs as appropriability mechanisms → partly supported: the effect is significant only for lead-time.

H2b: The more the company seeks long-term value, the more it utilizes HRM and IPRs as appropriability mechanisms → not supported: the effect is significant for both, but of the opposite sign.

H2c: The more the company concentrates on creating barriers to imitation, the more it utilizes tacitness and practical/technical means to protect its knowledge → not supported: no effect on technical means, and the effect on tacitness is almost significant, but negative.

The third hypothesis (H3) stated that the relationship between the strength and usage of appropriability mechanisms is moderated by their availability. This was tested using the moderated-regression-analysis approach developed by Sharma et al. (1981), which incorporates a hierarchical set of regression models in which the first step takes in the main effects, and the second step the interaction term describing the combined effect of the predictor and moderator variables. Following the suggestion of Cohen et al. (2003), the independent and moderator variables were mean-centered in order to avoid multicollinearity problems. The regression results are presented in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th></th>
<th>Model 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>t</td>
<td>Beta</td>
<td>T</td>
</tr>
<tr>
<td>IPR strength</td>
<td>.460</td>
<td>8.531**</td>
<td>.459</td>
<td>8.568**</td>
</tr>
<tr>
<td>IPR availability</td>
<td>.159</td>
<td>.2945**</td>
<td>.183</td>
<td>3.341**</td>
</tr>
<tr>
<td>Availability x strength</td>
<td>.115</td>
<td>2.090*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fit statistics</td>
<td>$R^2 = .235$</td>
<td>$F=40.44**$</td>
<td>$R^2 = .248$</td>
<td>$F=28.76**$</td>
</tr>
<tr>
<td>Change statistics</td>
<td>$？R^2 = .013$</td>
<td>$？F=4.37*$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**sig. < .01, *sig. < .05

The main effects and the interaction term are all significant, which implies that availability is a quasi moderator (Sharma et al. 1981). In order to establish the nature of the interaction, we plotted the effects of strength for given values of availability, following the suggestions put forward in Cohen et al. (2003, p. 269). These high and low values were set at one standard deviation above and below the mean, respectively. We subsequently entered a range of values for strength, and computed the resulting values
for the dependent variable on the basis of the unstandardized regression coefficients. The plots are shown in Figure 4.

The interaction is synergistic, meaning that the higher the availability, the higher is the regression coefficient of strength. The conclusions for the more specific subhypotheses are thus:

H3a: when IPR availability is low, the usage is low regardless of the strength → supported;

H3b: when IPR availability is high, the level of usage depends on the strength → supported.

5. Discussion

In accordance with previous studies, we started our analysis with a comparison of the perceived importance of different appropriability mechanisms. Lead-time and practical concealment/technical means were, on average, perceived as the strongest mechanisms, followed by tacitness and contracts, while the three weakest were IPRs, labor legislation and HRM. These findings are in line with those of previous studies, providing us with an encouraging starting point. The role of HRM and labor legislation could be a fruitful topic for further research, however. The fact that it was not only the perceived importance of HRM, but also its usage that received lower values than other appropriability mechanisms makes it worth studying, especially given previous findings related to the central role of HRM (e.g., Baughn et al. 1997).
The reasons for the weakness of HRM and labor legislation might be related to the fact that the wrong kind of HRM kills innovativeness or harms the image of the company (Hannah 2005). Moreover, as an appropriability mechanism it may be so difficult to manage (the mobility of personnel is very challenging to monitor and control, for example) that its availability in this sense decreases its utilization. However, our data did not allow for the study of these issues.

Another topic for future research is to be found in the correlations related to the strength and utilization of appropriability mechanisms. A more detailed study might uncover linkages between appropriability mechanisms: using other protection mechanisms combined with some individual forms of protection could augment – and otherwise affect – the control provided by individual mechanisms. For example, in our investigation of Hypothesis 1 we found that the efficacy of practical/technical means of protection seems to explain the use of both tacitness and HRM, implying that some kind of interconnections exist.

As for the other results of the hypothesis testing, the first hypothesis covering the relationship between the strength and utilization of appropriability mechanisms was supported, as expected. The strength of tacitness did not have an effect on its usage, however, which might be a sign of its special nature in terms of controllability: tacitness is either present or not, and the company has little say in terms of whether to use it or not. On the other hand, the finding could also reflect the difficulties in evaluating tacitness, and the inadequacy of our measure. Testing this part of our hypothesis with data that is more concentrated on tacitness issues might be fruitful. We also failed to measure the use of contracts, but found that they are perceived as relatively strong as a means of protection. Therefore, further research on the role and use of contracts as a part of appropriability strategy might be interesting.

The second hypothesis proposing a relationship between the strategic goals related to appropriability and the utilization of appropriability mechanisms revealed some unexpected issues. Different goals do have some effects on the usage of certain mechanisms, but these effects turned out to be different from those we anticipated. First, a positive relationship was found between pursuing short-term value and the use of lead-time, but IPRs did not seem to be used for this purpose (H2a). It may be, as mentioned above, that obtaining protection is too time-consuming. Still, as licensing revenues were included in short-term goals (see Appendix A), this finding is worth closer examination. The second

13 For instance, the disclosure requirements of IPRs may conflict with tacitness, and difficulties in using lead-time may emerge when tacit components dominate (see Tuppura et al. 2005, forthcoming).
subhypothesis (H2b) was not supported, but after examining the results we found some explanations. When we formulated our questions and measures, HRM was approached purely from the protection perspective. Thus, it is not likely that our HRM measure captured the effects of HRM on the image of a firm, for example, at least not the positive ones (cf. Hannah 2005). Similarly, IPRs may be controversial in long-term value creation: they may send out positive signals indicating value and ground-breaking innovative capabilities, but on the other hand, the signals may be negative given the disputes over patent issues, for instance. Slightly surprisingly, the use of tacitness seems to be related to seeking long-term value. Finding an explanation for this is somewhat challenging, especially considering the results of our testing of Hypothesis H2c: when trying to build barriers against imitation, companies do not seem to utilize tacitness. On the contrary, the more protection is sought, the less tacitness is used. This is relatively unexpected given the findings of previous studies related to the strength of different appropriability mechanisms in preventing imitation. What makes it even more interesting is that the use of IPRs seems to be positively related to preventing competition and imitation. One explanation may be that they are utilized because it is the prevailing practice of the industry: for example, it has been customary for some time now for ICT companies to build extensive patent portfolios. There may be a certain amount of self-regulation within business driving this phenomenon.

The third hypothesis was formulated to enable closer scrutiny of two dimensions of the appropriability regime – strength and availability– and their effects on the use of the mechanisms. We found that availability of appropriability mechanisms affects the possibilities of including them in the appropriability regime of a firm. Given the similarities between the mechanisms in terms of controllability, and the limitations of our data, we only tested IPRs, but we nevertheless feel that this was a useful starting point for further empirical study.

All in all, our findings suggest that the appropriability regime of a firm is dynamic by nature: the availability and strength of the mechanisms have an effect on their usage, and the strategy of a firm also guides the formation of the regime\textsuperscript{14}. The interfaces of the mechanisms do not seem to be without implications either. However, there are several issues that may have an effect on the formation of the regimes and strategies that have not been covered in this study. For instance, it seems from our findings

\textsuperscript{14} For instance, when IPRs are available, the strategy of the firm should determine whether they are utilized, and how. It may not be rational to acquire patents just because it is possible if they do not generate benefits and might even be harmful (Profit from innovation 1993, Cohen et al. 2000).
that parallel strategies exist within companies, but we could find out more about the time dimension in terms of using different appropriability mechanisms at different phases of product or process life cycles. Moreover, the field of business must have an effect on the availability and efficacy of these mechanisms, as well as on their effectiveness in creating profits (e.g., Cohen et al. 2000, Levin et al. 1987, Davis 2002, Mansfield 1986). The use of patent protection or other IPRs to secure innovation is not necessarily easy in knowledge-intensive fields such as the ICT sector because of legal restrictions (e.g., Rao and Klein 1994 on IPRs in the software industry) and furthermore, the high mobility of labor creates a high risk of losing key employees (Atkins 1998). Thus, secrecy, rapid development, and HRM should have more significant roles. On the other hand, more mature and established fields of business have longer traditions of using IPRs (see e.g., Teece 1986, Arundel and Kabla 1998), and because the registration of rights is time-consuming, their effectiveness may be higher in industries that are not developing as quickly as those in the ICT sector (e.g., Norman 2002, Davis 2002). Yet another example of factors having an effect on appropriability mechanisms and their use is related to the risks the company faces. The emergence of the open-innovation paradigm (see Chesbrough 2003, p. 37) shows that companies “can and should use external ideas in developing their technologies” (see also Inkpen 1998). Internal R&D is no longer enough. However, the risks of losing key personnel, and of other companies acting opportunistically, are present in collaborative relationships (e.g., Williamson 1999, Pisano 1990, Norman 2002, Neu 1991). In such situations companies can enhance appropriability by rotating contact persons frequently enough to prevent tacit knowledge from being transferred (Baughn et al. 1997, Kumar and Seth 1998). Similar risks may also emerge in relation to competing companies trying to imitate products and processes and to recruit skilled personnel, thus increasing the need to consider different appropriability mechanisms.

6. Conclusions

To overcome the appropriability problem that is prevalent in present-day business environments in which knowledge has an important role to play, labor mobility is high, and obtaining external ideas has great R&D potential, managers need to have a wide understanding of different appropriability mechanisms and of how to utilize them. Each of the means of preventing imitation has certain distinctive characteristics, and therefore may be more or less strong in protecting particular innovations. Furthermore, drawing lines between different appropriability mechanisms is challenging, because they interact and could be classified
in many different ways. Despite these challenges, it should be acknowledged that, without a conceptual
categorization, the role of individual means of protection is difficult to identify and examine. Managers
should benefit from sorting out elements of appropriability, since doing that enhances the readiness to
select proper means of protecting knowledge. It also helps in avoiding unexpected outcomes caused by
the fact that appropriability mechanisms may not only stand on their own, but may also be prerequisites or
derivatives of other mechanisms. Furthermore, the linkages often have more than two dimensions: one
mechanism may be enabling, enhancing, or preventive in terms of considering the use of others, and the
absence of an enabling factor may not have the same consequences as an existing preventive factor.
Consequently, building an appropriability regime and establishing an appropriability strategy for a firm
requires a lot from managers. With its empirical evidence this study provides one possible starting point
for future research on the dynamic nature and increased understanding of the appropriability regime.
Acknowledgements

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7. References


Appendix A.

Rotated Component Loadings: Goals of utilizing appropriability mechanisms

<table>
<thead>
<tr>
<th>Component</th>
<th>Long term value</th>
<th>Barrier to competition</th>
<th>Short term value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhancing and maintaining the company’s reputation regarding customers</td>
<td>.819</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increasing the value of the company (regarding investors, buyers)</td>
<td>.709</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating reputation regarding competitors (e.g., the company adheres to acquired rights and gained position)</td>
<td>.686</td>
<td>.382</td>
<td></td>
</tr>
<tr>
<td>Enabling collaboration</td>
<td>.681</td>
<td>.316</td>
<td></td>
</tr>
<tr>
<td>Maintaining its own freedom of operation</td>
<td>.581</td>
<td>.398</td>
<td>.348</td>
</tr>
<tr>
<td>Getting financing</td>
<td>.563</td>
<td>.327</td>
<td>.325</td>
</tr>
<tr>
<td>Developing/enhancing internationalization (e.g., operating abroad, collaborating with foreign companies)</td>
<td>.436</td>
<td>.327</td>
<td>.325</td>
</tr>
<tr>
<td>Preventing competitors from copying the product/process</td>
<td>.783</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preventing competitors from protecting similar or identical innovation(s) institutionally</td>
<td>.757</td>
<td>.405</td>
<td></td>
</tr>
<tr>
<td>Getting ahead of competitors</td>
<td>.427</td>
<td>.710</td>
<td>.412</td>
</tr>
<tr>
<td>Preventing competitors from expanding their protection or exclusive rights in some field of technology</td>
<td>.690</td>
<td>.412</td>
<td></td>
</tr>
<tr>
<td>The lack of protection has caused negative experiences earlier (e.g., knowledge leaks to competitors, lost bargaining asset)</td>
<td>.472</td>
<td>.369</td>
<td></td>
</tr>
<tr>
<td>Preventing accusation of infringement</td>
<td>.302</td>
<td>.417</td>
<td>.382</td>
</tr>
<tr>
<td>Receiving license revenues</td>
<td>.743</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enhancing bargaining position (e.g., cross-licensing)</td>
<td>.310</td>
<td>.265</td>
<td>.625</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>5.69</td>
<td>1.58</td>
<td>1.22</td>
</tr>
<tr>
<td>Percent of variance</td>
<td>37.9</td>
<td>10.6</td>
<td>8.2</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. KMO measure of sampling adequacy = .86
Appendix B

Correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>technical means strength</th>
<th>labor legislation strength</th>
<th>IPR strength</th>
<th>Contracts strength</th>
<th>lead-time strength</th>
<th>tacitness strength</th>
<th>HRM strength</th>
<th>technical use</th>
<th>tacitness use</th>
<th>IPR use</th>
<th>HRM use</th>
<th>lead-time use</th>
<th>Goal: short term value</th>
<th>Goal: barrier</th>
<th>Goal: long term value</th>
<th>IPR avail</th>
</tr>
</thead>
<tbody>
<tr>
<td>technical means strength</td>
<td>1.00</td>
<td>0.52**</td>
<td>0.42**</td>
<td>0.52**</td>
<td>0.31**</td>
<td>0.39**</td>
<td>0.31**</td>
<td>0.31**</td>
<td>0.31**</td>
<td>0.18**</td>
<td>0.31**</td>
<td>0.15</td>
<td>0.29**</td>
<td>0.45**</td>
<td>0.37**</td>
<td>-0.11</td>
</tr>
<tr>
<td>labor legislation strength</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>-0.16**</td>
</tr>
<tr>
<td>IPR strength</td>
<td>0.45**</td>
<td>0.50**</td>
<td>1.00</td>
<td>0.48**</td>
<td>0.41**</td>
<td>0.43**</td>
<td>0.41**</td>
<td>0.40**</td>
<td>0.43**</td>
<td>0.25**</td>
<td>0.41**</td>
<td>0.38</td>
<td>0.55**</td>
<td>0.52**</td>
<td>0.57**</td>
<td>-0.01</td>
</tr>
<tr>
<td>Contracts strength</td>
<td>0.55**</td>
<td>0.55**</td>
<td>1.00</td>
<td>0.55**</td>
<td>0.39**</td>
<td>0.39**</td>
<td>0.39**</td>
<td>0.39**</td>
<td>0.39**</td>
<td>0.14**</td>
<td>0.39**</td>
<td>0.37</td>
<td>0.57**</td>
<td>0.57**</td>
<td>0.57**</td>
<td>-1.12</td>
</tr>
<tr>
<td>lead-time strength</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
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<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.07</td>
<td>1.00</td>
<td>0.38**</td>
<td>1.00</td>
<td>-1.16**</td>
</tr>
<tr>
<td>tacitness strength</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
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<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>0.90</td>
<td>-0.10</td>
</tr>
<tr>
<td>HRM strength</td>
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**sig. < .01, *sig. < .05, *sig. < .10