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**Intellectual Property Governance (IP) in ICT Firms: Strategic Value Seeking
through Proprietary and Non-proprietary IP Transactions**

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ABSTRACT:

This article investigates how firms exploit various forms of intellectual property (IP), often at the same time, in order to organize their strategic value seeking. The analysis is based upon confidential micro-data involving a survey of a set of 38 firms in the information and communication technology (ICT) sector in the United Kingdom. The article shows how three quarters of those firms exchange different types of proprietary (patents and copyright) and non-proprietary (open source and trade in non-patented technology) IP, in order to realize specific kinds of strategic value related to financial gain, competitive positioning, innovation and strategic alliances or relationships. The important role of alternative types of IP governance models (including various licensing forms, and other) associated with specific value seeking behaviours is also illustrated. The findings open up an important line of enquiry into the relative advantages conferred by different forms of IP markets and IP governance forms, and these insights in turn can provide useful indications to policymakers interested in promoting firms' ability to exploit their IP.

JEL: D02, D23, O31, O32, O34

Keywords: Intellectual property, IP transactions, IP governance, patents, copyright, open source, ICT sector.

1. Introduction

It is now recognized that firms do not patent or copyright primarily to recover R&D expenditures, as suggested by mainstream intellectual property rights theory, but that their incentives are related to various types of strategic value they can obtain through licensing markets or via buying and selling of such rights (Cohen, Nelson and Walsh, 2000; Levin et al., 1987; Mansfield, 1986). Nonetheless, not many studies are specifically aimed at shedding light on how firms use different forms of IP markets and IP governance forms for strategic purposes. The present article makes a contribution towards filling this analytical and evidence-based gap. In doing so, we address a range of limitations in existing research contributions. Mainly, such limitations concern: the range of IP mechanisms considered, which is usually limited to patents and other formally registered intellectual property rights such as trademarks and copyright; the level of detail at which such mechanisms are considered for strategic value seeking, which rarely extends to the micro-analysis of the specific IP governance forms applied in IP transactions; and the lack of investigations into the ‘types’ of strategic benefits that firms seek when using these mechanisms.

The information and communication technology (ICT) sector is interesting to research in this respect. This is because firms in this sector today utilize or experiment with a variety of IP protection mechanisms, including both proprietary IP (patents, copyrights) and non-proprietary IP (open source, IP with no formal protection)¹. The extent to which IP policy should embrace non-proprietary IP in the ICT sector, or it should instead mainly focus on extending laws and regulation for proprietary IP such as patents, has been intensively discussed for some time – for example, by the EU software hearing in the European Parliament in Brussels 2002-2005, IBM (2006), and by the current OECD Working Party for SME and Entrepreneurship (WPSMEE2) 2010-11. Understanding the extent to which firms exploit different forms of IP and the strategic objectives that underpin the choice to exploit each of these forms, is

¹ The terms ‘proprietary’ and ‘non-proprietary’ have become popular in relation to software. Proprietary software is software with restrictions on using, sharing, copying and modifying it, as enforced by the proprietor; such restrictions are achieved by either legal means (via patent and copyright law) and/or technical means (e.g. by releasing machine-readable binaries to users and withholding the human-readable source code). In non-proprietary software (e.g. open source software, freeware, shareware etc.) all or some of those restrictions are relaxed. The terms are also used more broadly to refer to protection modes applied to a variety of IP, not limited to software.

² WPSMEE is concerned with “SME Innovation and Management of Intellectual Assets in Creative Industries and Selected Manufacturing Industries”. The UK contribution involves ICT firms (software and hardware) and is based upon the same evidence (i.e. UKNOW data base) which informs this article.

crucial in order to inform policymaking in the context of a rapidly changing industry such as ICT.

There are also other arguments for researching strategic value seeking from IP in this sector more fully. First, this sector is very important to most economies, including the UK's. In general, ICT has been considered the key driver of economic growth since at least the 1980s (Freeman and Perez, 1988); recent data from the UK Innovation Survey (Robson and Haigh, 2008) confirm that a large component (more than 50%) of all UK firms' innovation activities consist in acquisition of products from the ICT sector such as software and computer hardware. Second, it is a sector where intellectual assets are particularly important components of firm value and where their acquisition is often crucial for innovation to take place (Cockburn, 2007). Third, the sector has seen an increase of activity in IP transactions (for example, see Grindley and Teece, 2008, on the increase of licensing and non-licensing agreements in the computer industry). One of the reasons for this perceived increase is due to the high level of disintegration of ICT modules in the production of products and components, especially software. Such activities in fact involve cumulative and incremental processes where different modules need to be combined into more complex systems (Arora, Fosfuri and Gambardella, 2001) to create commercially desirable products. The complex technologies underpinning the ICT industry and the challenge of short product life-cycles mean that firms are inclined to become involved in IP transactions, especially because product innovation in the ICT sector is very closely tied to time. Moreover, many ICT firms, especially software firms, have limited investment in downstream commercialisation capabilities, and usually choose to license to bigger software firms (Arora, Fosfuri and Gambardella, 2001): the use of IP gives them a platform to be more competitive.

Aim and evidence base

The particular aim of this article is to show how ICT firms based in the UK engage in various IP transactions within both proprietary (patent and copyright) and non-proprietary (open source and no protection) IP markets, in order to realize strategic corporate value, related to financial gain, competitive positioning, innovation and strategic alliances or relationships. The roles played, in this value seeking process, by different IP governance forms (such as various forms of licensing arrangements, etc.) are also investigated.

The article is based upon confidential micro data on a set of 38 UK-based firms in the ICT sector (comprising software³ and hardware firms), collected between October 2008 and March 2009. The firm evidence is drawn from the UKNOW database⁴ comprising data collected from a survey of German pharmaceutical firms, UK ICT firms and UK universities. Further details on the ICT sample entering this research paper is presented in Section 3.

The article is structured as follows. Section 2 sets the general analytical framework and describes the research questions. Section 3 introduces the data on which the analysis is based. In Section 4 we present the analysis and discuss the results. Section 5 concludes on the organization of strategic value seeking from proprietary and non-proprietary IP.

2. IP markets, IP governance and strategic value seeking

Andersen and Konzelmann (2008) outline several types of market platforms where IP can be exchanged, in relation to patents and copyright. They explain how these are embedded in various social relations as defined by different governance forms, ranging from simple arrangements (buying and selling, licensing in and out) to more complex ones such as cross-licensing and pooling of patents and copyright⁵. Such transactions are not expected to be exclusive; rather, most firms would presumably participate in several different forms.

Value can also be generated through exchange of non-proprietary IP. Today, the most common non-proprietary model is the open source software development method. It can be compared to what used to be called the free software. Free Software and Open Source software are concerned with users' freedom to run, copy, distribute, study, change and improve the software⁶. The open source licensing strategy often

³ It is important to note software inventions are protected differently internationally: in Europe and Japan, a piece of software can be patent-protected if it reflects a technical advancement. In this sense, it is protected as computer programs (criteria: the software idea has to be new and inventive or novel and non-obvious). In the USA, a piece of software can be patent-protected as long as it is 'in the technological arts': that is, the software may not necessarily be of technical character, but it needs to be implemented via computers to get the protection. In this sense, it is protected as business methods. This meets UN's definition of technology: 'a combination of equipment and knowledge'. (Criteria: the software idea has to be useful, concrete and tangible results has to be provided)

⁴ The database was developed as part of Work Package 3.2: "An IPR Regime in Support of a Knowledge Based Economy" of the UKNOW (*Understanding the Relationship between Knowledge and Competitiveness in the Enlarged EU*) (2005-2009) project of the EU 6th Framework Programme.

⁵ Not all mentioned governance forms exist for copyright (see Table 1).

⁶ In this sense, the concept 'Free' or 'Open' may be associated with the concept of 'freedom' or liberty. It does not mean getting something for free in terms of zero price (<http://www.gnu.org/>). For a detailed

takes the form of ‘GNU General Public License (GPL)’. Whereas intellectual property rights law, in its current form, provides the right to exclude anyone from using, modifying and redistributing copies of an author’s work as well as a right to withhold the source-code, a GPL license transfers these rights to the commons in order to ensure access. This ensures that every person who receives a copy of a work has the same rights to study, use, modify, and also redistribute both the work, and derived versions of the work. Such licenses also require that the same license terms apply to all redistributed versions of the work. Therefore, open source changes the terms from ‘All Rights Reserved’ to ‘Some Rights Reserved’: the rights which are not reserved move into the ‘public domain’ or commons. Relaxing some of the restrictions of the intellectual property rights system is also becoming more common in other sectors than software, and it is usually linked to firms’ open innovation strategies. Examples include ‘Creative Commons’ in the creative industries; ‘Wikipedia’ and ‘Wiki’ in publishing; Open source in media (‘Open Source Journalism’ such as Weblogs, Messageboards, and Open Document; ‘Open Source Movie Production’; ‘Open Source Documentary’; ‘Open Source Filmmaking’); Open source in education and scientific research (e.g. Science Commons); and Open source health care and medicine, such as the Tropical Disease Initiative, and the not-for-profit “virtual pharmas” such as the Institute for One World Health and the Drugs for Neglected Diseases Initiative.

Many firms also exchange non-protected technology in the market. Thus, although many stakeholders (such as the Free Software and Open Source communities and the Foundation for Free Information Infrastructure) do not advocate putting non-protected technology into the public domain, because they believe that this would allow uncooperative individuals and firms to convert openly-developed inventions into proprietary technology, many firms still do. A reason could be that the patent system is too resource-demanding in terms of application costs, search costs in order to avoid duplication of invention, and enforcement costs regarding possible court cases. Or, the technological solution is not at the forefront from a technical point of view (so it does not satisfy the novelty criteria for patent protection), but it is still very productive for industry and therefore traded in the market. The reason could also be that the technology is difficult to understand and imitate, or that it is so client-

definition, see the website of the free Software Community: <http://www.gnu.org/philosophy/free-sw.html#exportcontrol>.

based that it has no wider interest of other firms. Finally, it could be due to the fact that the product life-cycle is so short that it makes sense to launch the unprotected technology on the market. The latter would indicate that it does not matter whether the technology is protected (that is, the inventor or innovator faces first-mover advantage), or simply that the patent system is too slow compared to the short product life-cycle that many firms face.

We shed further light on these issues in section 4 where we investigate which IP transactions firms engage into. We assess the relative importance of the different forms of IP (considering four types of IP: patents, open source, copyright, non-patented technology). We also investigate the various strategic reasons for firms to use different types of IP, and different governance forms when exchanging their IP, and we expect to find that certain IP markets are used to gain certain strategic benefits. This means that firms have a clear strategy when deciding on which IP markets to engage in.

Building upon the relevant literature on the use of patents (see points (i) to (iv) below), which captures the most widely debated reasons for firms to exchange IP, in section 4.1 we particularly explore four main categories of strategic benefits to be realized through participation in different types of IP markets (considering patents, copyright, open source and technology with no protection):

(i) *Benefits relating to innovation*, in that the trade of IP should facilitate innovation diffusion (see e.g. Arrow 1962; Rivera-Batiz and Romer 1991, Arora et al, 2001; Gans and Stern, 2000) and enhance innovation processes, often in a social process of interaction with other individuals and organizations, and thereby also enable the development of better technology or enable standardization and technological compatibility (see e.g. Merges and Nelson 1990, 1994; Winter 1993; Plant 1934). Arora et al (2001) suggest that IP exchange in the ICT sector has proved in many cases to be a powerful instrument for codifying knowledge and technologies. In fact, in order for IP to be transferred easily to other organisations, firms are encouraged to develop standard architectures and software components. This in turn will encourage more innovation from individuals or companies.

(ii) *Benefits relating to market positioning and competitiveness*, linked to the ability to gain or maintain market share due to the exclusive access to certain IP (see e.g. Rivette and Kline 2000; Cohen et al. 2000; Granstrand 1999).

(iii) *Benefits relating to financial gain* in terms of ability to derive income from transactions in IP markets, or conversely to cut costs by forsaking IP protection, or entering cross-licensing agreements, and even in terms of increased ability to raise capital thanks to the reporting of IP as strategic assets (see e.g. Coriat and Orsi 2002; Rivette and Kline 2000).

(iv) *Benefits relating to the building of strategic alliances or relationships* with or within industry (see e.g. Jaffe, Trajtenberg and Henderson 1993; Teece 1986).

Andersen and Konzelmann (2008) suggest that also the choice of the specific governance forms through which IP is transferred or acquired depends upon the type of financial and non-financial value that the stakeholders seek to realize: in other words, they suggest that there is a relationship between the choice of a certain IP governance form, for a specific type of IP, and the strategic benefits that firms seek to obtain from the transaction. For example, Mann (2005) highlighted in his research that some firms in the software industry obtain substantial amount of revenue through licensing, which confers direct income. Arora et al (2001) show that software firms have different competitive strategies, as many of them focus only on licensing their technology instead of investing into the business where their technologies are used. We expect ICT firms to seek to realize specific types of value from the choice of specific IP governance forms, and we investigate this by exploring (in section 4.2) whether there is a relationship between benefit-seeking and the choice of IP governance forms.

3. Data

The research is based upon structured (questionnaire-based) interviews with a set of 38 ICT firms in the UK. The firms have been extracted from the overall population of firms based in England, Wales, Scotland and Northern Ireland, with one or more employees, active in the ICT sector (their sector of activity was identified by NACE

codes⁷). According to the FAME (Financial Analysis Made Easy) database, the total number of firms operating under the selected NACE codes is 959⁸.

The subset of firms interviewed are representative of the overall population in terms of number of employees and turnover (the two variables are strongly correlated). The distribution of these variables is shown in Table 1. The median respondent (at 50% percentile) is a firm with 74 employees and latest turnover of 8,979,116 GBP, localized in England and active in the field of software publishing. If we consider the distribution of firms by code of economic activity, response rates are quite similar across groups (3.3% for firms active in software publishing, 4.1% for firms active in hardware production, and 5.8% for firms with other codes).

Table 1. Size distribution of population and respondents

<i>Category</i>	<i>Size</i>	<i>Population</i>	<i>Interviewed firms</i>
	n firms	959	38
	%		%
n. employees	less than 10	17.4	23.7
	between 11 and 50	30.9	13.2
	between 51 and 250	37.5	42.1
	more than 250	14.1	21.1
Latest turnover (GBP)	less than 1 million	15.3	26.3
	between 1 and 10 million	40.0	23.7
	between 10 and 50 million	25.9	28.9
	more than 50 million	12.7	15.8

The firms were contacted by telephone and post with the purpose to identify knowledgeable respondents (such as R&D manager, CEO, head of IP department, or others)⁹, who were then asked to fill in the questionnaire online. Field work was carried out in the period between October 2008 and April 2009.

Each question referred, separately, to two types of proprietary IP (patents and copyright) and two types of non-proprietary IP (open source and non-patented

⁷ These are: NACE rev. 1 codes 7221 - software publishing, 3002 - manufacturing of computers and other information processing equipment, 322 - manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy, 323 - manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods. These codes identify companies producing both software and hardware. For simplicity, we refer to the firms in this sample as 'ICT firms'.

⁸ We reached this number after removing double entries of companies that are no longer in business and of companies whose main activity is not ICT-related, for example, because FAME reported wrong or outdated NACE codes.

⁹ More precisely, the 38 interviews were conducted with 12 CEOs/Directors/Owners, 9 R&D Managers/Chief Technology Officers/Heads of Operations, 10 IP Managers and 7 people in other positions.

technology). For each type of IP, the respondents were asked to consider different governance forms, as detailed in Table 2.

Table 2. Types of IP and IP governance

Types of IP	IP Governance forms (variables)
<u>Patents</u> as a tool for the protection of novel ideas	Selling patents Buying patents Out-licensing patents In-licensing patents Cross licensing patents Participation in patent pools Buying university-owned patents Licensing university-owned patents
<u>Copyright</u> as a tool for the protection of original creative expressions	Selling copyright Buying copyright Out-licensing copyright In licensing copyright Buying university-owned copyright Licensing university-owned copyright
<u>Open source</u> IP as a tool for the protection of original ideas and creative expressions	Participating in open source software development Participating in open source pharmaceutical projects Participating in other open source communities
<u>Non patented</u> ideas	Releasing not patented product or process innovations to the public Releasing not patented product or process innovations to private firms Using not patented product or process innovations Collaborating with universities without patent restrictions

A first set of questions referred to the extent and intensity with which firms participate in each form of IP exchange and in each governance form. Firms were asked about their stock of patents owned and licensed, whether they engaged in each type of patent governance, and if so the number of transactions in the last two years. With respect to open source, non-patented technology and copyright, firms were asked whether they engaged in each governance form, and if so the number of transactions they realized in the last two years.

A second set of questions referred to the strategic benefits sought when trading IP. For each type of IP and each governance form, firms were asked to choose up to five strategic benefits that they considered important, selecting them from a list of 13 benefits, which can be divided into four broad categories, as listed in Table 3 (identified on the basis of a review of the patent literature, as discussed in section 2).

Table 3. Strategic benefits which firms seek from IP transactions

Category of benefits	Specific strategic benefits
Financial gain	<ul style="list-style-type: none"> • Direct income from market transactions

	<ul style="list-style-type: none"> • Cost cutting • Increasing ability to raise venture capital
Competitive positioning	<ul style="list-style-type: none"> • Increasing market share • Professional recognition or brand recognition • Competitive signalling
Innovation	<ul style="list-style-type: none"> • Using the best inventions, innovations, creative expressions • Making or using compatible technology or creative expressions • Developing better technology or creative expressions • Benefiting from user or supplier involvement as a development strategy
Strategic relationships	<ul style="list-style-type: none"> • Building informal relationships with industry networks • Increasing ability to enter collaborative agreements • Giving something to the community

Finally, firms were requested to provide some general information: geographic localization (derived from address), ownership (independent or subsidiary company), size (current number of employees, current yearly turnover), yearly expenditure in R&D, geographic extension of the firm's main market (domestic or international), and main field of activity. A few additional variables relating to firm characteristics were derived from the FAME database: company name, full address, telephone number, primary UK SIC (2003) code, director's name and position, e-mail, website, last turnover (in thousands of GBP), number of employees.

4. Analysis and results

4.1. Strategic value seeking from the exchange of IP

Of the 38 firms that were interviewed, we found that 28 firms (73.7%) exchange one or more of the IP considered for this analysis. (This does not mean that the remaining 10 are not active in generating and protecting IP, but simply that they do not engage in IP transactions in these IP markets.) Among those 28 firms, 10 (35.7%) are involved in transactions around only one type of IP, while most (18 firms, that is 64.3%) are involved in transactions around two or more types of IP (more precisely: 10 firms engage in one type of IP, 12 firms engage in two types of IP, 3 firms engage in three, and 3 firms engage in all four types of IP). Furthermore, as shown in Figure 1, while 5 firms (17.9%) only exchange proprietary IP (patents and/or copyright) and 11 firms (39.3%) use a combination of proprietary and non-proprietary forms of protection of their IP, the greatest share of firms that exchange IP only exchange non-

proprietary forms (12 firms, or 42.9%). These results indicate that most of the firms exchange intellectual property that is not exclusively protected.

Figure 1. Forms of IP exchanged by ICT firms

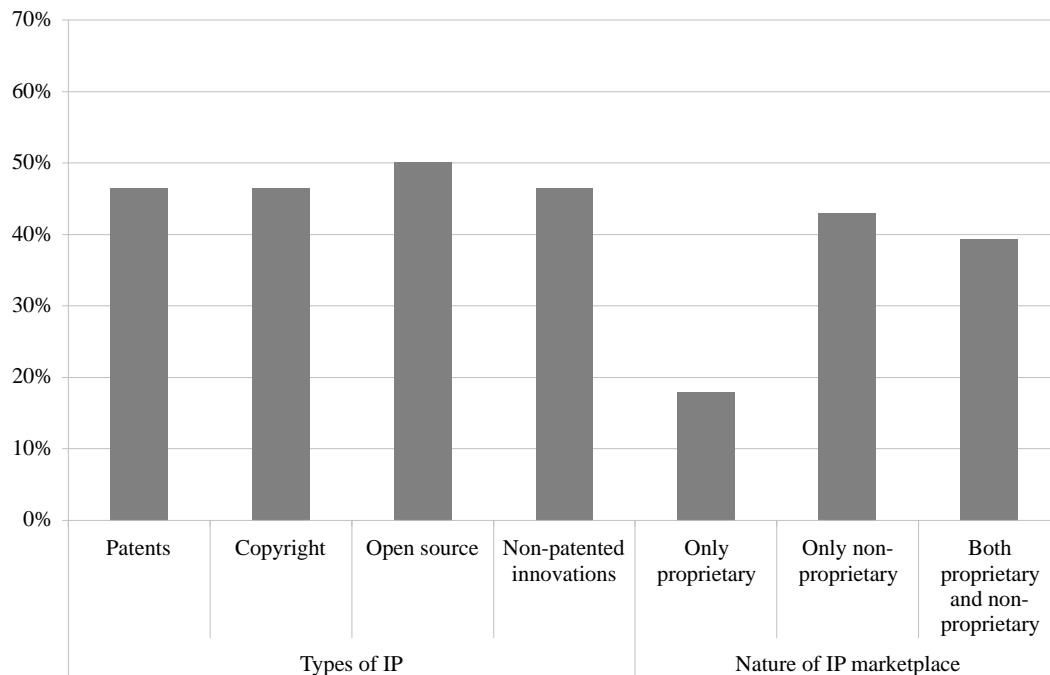


Table 4 summarizes the firms’ strategic reasons (in terms of value seeking) for the use of different types of IP markets. Percentages are computed with respect to the numbers of firms that exchange each type of IP (the columns do not sum to 100% since each firm could choose more than one category of benefits)¹⁰.

Table 4. Types of strategic benefits from exchange of different types of IP

	Patents	Copyright	Open source	Non-patented innovations
Number of firms.	13	9	14	19
Categories of strategic benefits:	% of firms involved in	% of firms involved in	% of firms involved in open	% of firms involved in non-

¹⁰ In order to construct the % shares presented in Table 4, the firms’ responses given with respect to each benefit and each governance form were aggregated into the four main categories (‘finance’, ‘innovation’, ‘strategic relationships’, ‘market/competitive positioning’) for each of the four forms of IP identified in table 2, taking care to avoid double-counting.

	<i>patents</i>	<i>copyright</i>	<i>source</i>	<i>patented innovation</i>
Financial gain	54	56	50	53
Competitive positioning	54	44	64	58
Innovation	69	44	93	89
Strategic relationships	54	22	64	58
No option chosen	23	33	7	5

Firms involved in proprietary (patent and copyright) and non proprietary (open source and technology with no protection) IP transactions seek all kinds of benefits from exchanging all forms of IP, but with different intensity. In most cases, the most important strategic benefits relate to improving innovation processes; the only exception is copyright, where innovation benefits are the second most important category after benefits relating to financial gain. The importance of innovation benefits for firms that exchange patent and copyright is in line with the view that IPR protection promotes innovation (see Dosi et al, 2006, for an overview of the debate on the relationship between patenting and innovation activity). However, fostering innovation is the most important benefit also for firms that engage in open source and non-patented technology. The fact that firms use non-proprietary IP to improve their innovation processes is also quite well known. The literature on open source has remarked that firms engage in open source in order to use and develop better innovations (Kuan, 2001), especially when user-driven (Bessen, 2002). The importance of standardization and compatibility, which allow firms to enlarge their user bases, has also been noticed (Wichmann, 2002a and 2002b).

Most firms that exchange patents also seek benefits relating to financial gain, competitive positioning, and the building of strategic relationships. In the case of copyright, financial gain is indeed the most important benefit sought, followed by innovation and competitive positioning. When exchanging the two non-proprietary forms of IP, the second most important categories of benefits, after innovation, concern the building of strategic relationships and competitive positioning.

Table 5 shows the firms' answers with respect to the specific benefits within each category (as listed in table 3). Also in this table, percentages are computed with respect to the numbers which include only firms that exchange a specific type of IP, and the columns do not sum to 100% since each firm could choose up to five strategic benefits.

Table 5. Specific benefits from exchange of different types of IP

		Patents	Copyright	Open source	Non-patented innovations
<i>Categories of strategic benefits</i>	Number of firms	13	9	14	19
	<i>Strategic benefits</i>	% of firms involved in patent markets	% of firms involved in copyright markets	% of firms involved in open source	% of firms involved in markets for non-patented innovations
Financial gain	Direct income from market transaction	23	44	-	32
	Cost cutting	38	11	50	26
	Increasing ability to raise venture capital	8	22	0	11
Competitive positioning	Increasing market share	62	33	43	26
	Professional recognition or brand recognition	23	22	29	26
	Competitive signalling	31	11	14	16
Innovation	Being able to use the best inventions, innovations, creative expressions	62	22	57	53
	Making or using compatible technology or creative expressions	23	0	71	58
	Developing better technology or creative expressions	31	44	57	53
	Benefiting from user or supplier involvement as a development strategy	8	22	21	16
Strategic relationships	Building informal relationships with industry networks	23	11	36	47
	Increasing ability to enter collaborative agreements	46	11	29	32
	Giving something to the community	0	0	36	11

With respect to financial benefits, the exchange of copyright takes place mainly because firms seek to derive income and the same goes for non-patented innovation, while cost cutting is the most important financial benefits that firms seek from open source.

62% of firms that exchange patents believe that patents allow them to use the best innovations, but similar shares of firms believe that they can use the best innovations by engaging in open source and by exchanging non-patented technology (57% and 53% respectively). Engagement in non-proprietary IP transactions allows firms to make or use compatible technology (71% of firms that use open source, 58% of those that exchange non-patented technology), whereas this is not an important reported reason when firms protect their technology through patents. Reliance on

open source (57%), non-patented technology (53%) and copyright (44%) is also regarded as having distinctive advantages in terms of allowing the development of better technology, which, in the former two cases, sometimes takes place through the involvement of users (22% and 21% respectively).

The exchange of open source and non-patented innovations is believed to allow firms to build relationships with industry networks (36% and 47% respectively) and to increase their ability to enter collaborative agreements (29% and 32%). 36% of firms engaging in open source also find motivation in ‘giving something to the community’. Firms have been known to contribute to open source projects out of individual intrinsic and social motivations (Bonaccorsi and Rossi, 2003) especially when the technology is not crucial to the firm’s competitive advantage (Henkel, 2002).

In terms of competitive positioning, 62% of firms that exchange patents do so in order to gain market share. Since competitive positioning is also sought by 43% of firms that engage in open source (and by 26% of firms that exchange non-patented innovations), this suggests that ICT firms do not attribute exclusive importance to the acquisition of patents as a means to prevent imitation and hence maintain market share: the importance of accessing a wider user base by developing compatible technologies probably plays an important role in market strategies. This is consistent with findings from the literature, which point to the importance to factors other than patent protection, such as lead time and secrecy, to improve market positioning (Levin et al, 1987). Engagement in non-proprietary IP also allows firms to gain professional or brand recognition.

In sum, three patterns stand out. First, while conventional economic theory suggests that proprietary IP protection is necessary to generate income from innovation and therefore to induce firms to invest in R&D (i.e. costly innovation processes) (Arrow, 1962), the responses from our set of ICT firms suggest that all forms of IP (not only proprietary ones) provide firms with benefits related to financial gains. Second, while it is often thought that IPRs are necessary in order to create markets for technology that can enter into other firms’ innovation processes, we find that greater shares of firms that seek innovation related benefits do so from engaging in the exchange of open source and non-patented technology (in line with the open innovation argument: Chesbrough 2003). Third, a fairly high share of firms exchanges non-proprietary IP (relative to proprietary IP) in order to increase their market share

or competitive positioning. Overall, the results point to the strategic importance of factors other than patent protection in some sectors (such as the ICT sector), and how the strategic use of non-proprietary IP needs to be acknowledged more fully in the mainstream literature.

4.2. The strategic advantages of different IP governance forms

We now move on to discuss the role of governance structures in the value seeking process through IP transactions.

In the three years previous to the survey, firms have engaged in a much higher number of IP transactions involving non-proprietary rather than proprietary IP. On average¹¹, firms have bought 0.75 patents, have sold zero patents, have in-licensed 1, have out-licensed 2.5 and have cross-licensed 1.2. No firms provided information about participation in patent pools. In the same period, they have engaged in 93.3 open source software transactions and in 51 transactions involving other open source IP, they have released 135 non-patented products to the public and 60.5 to private firms, they have used 50.37 non-patented products, and they have exchanged non-patented knowledge with 1.75 universities.

We find that the 28 ICT firms active in our selected IP markets are engaged in a variety of governance forms for IP transactions, often at the same time.

Of the 13 firms that exchange patents, most out-license (9 firms, or 69%) and in-license (10, or 77%) patents; 7 (54%) engage in cross-patenting and/or in buying patents, and 5 (39%) in selling patents. Only 3 (23%) participate in patent pools. 9 firms exchange copyright; of these, 5 (56%) buy copyright, 4 (44%) sell copyright, 3 (33%) out-license it and 2 (22%) in-license it. Only 3 firms in-license university patents (23%), 1 (8%) buys university patents, 1 (8%) buys and in-licenses university copyright. We thus find that patented university knowledge is not a key strategy to our set of ICT firms. This is consistent with the results of other investigations with respect to the software industry (see e.g. Cohen et al, 2002). Due to the particularly small number of firms that engage in the transaction of university IP, in the rest of the article we do not consider these governance forms.

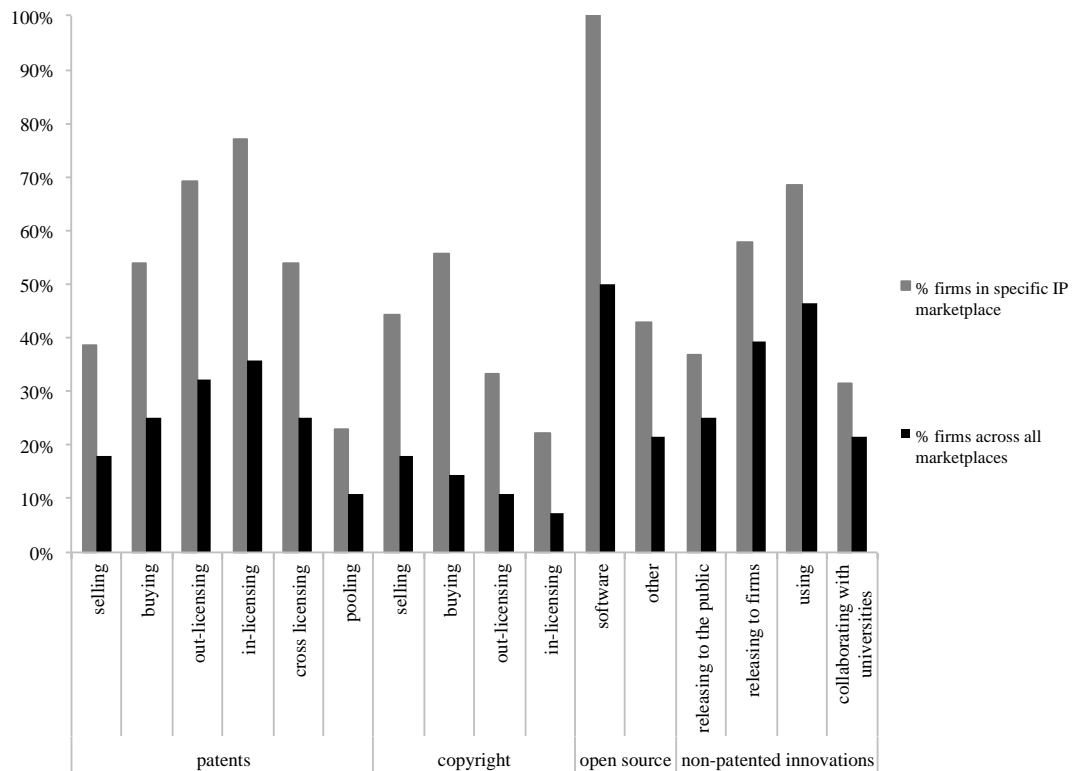
With respect to non-proprietary IP, all the 14 firms that engage in open source do so in software (100%), and 6 of them (43%) also participate in other open source

¹¹ Averages are computed with respect to the subset of firms that have provided this information, for each type of IP and each IP governance form.

communities. Of the 19 firms that exchange non-patented technology, 7 (37%) release technology to the public, 11 (58%) release non-patented technology to private firms, 13 (68%) use non-patented technology, and 6 (32%) collaborate with universities with no patent restrictions.

Figure 2 shows the shares of firms that engage in each governance form, both as a share of the firms that are active in that specific IP market, and as a share of all IP-active firms. Participation rates in each non-proprietary IP governance form range between 25% and 50% of all IP active firms, while participation rates in proprietary IP governance forms range between 7% and 36% of all IP active firms.

Figure 2. Participation in IP governance forms



Building upon Andersen and Konzelmann (2008), we hypothesized that, for each type of IP, there is a link between the governance form in which firms engage and the benefits that they seek. That is, benefits are not only specific to certain types of IP (as identified in section 4.1), but also to particular IP governance forms.

To address this issue, we build an index that measures the extent to which organizations that take part in a certain governance form ‘specialize’ in seeking a certain benefit, relative to the overall importance of this benefit. Because this index is constructed exactly as the widely used Revealed Technological Advantage index and Revealed Comparative Advantage index, we refer to it as the index of ‘Revealed Governance Advantage’ (RGA)¹².

Let x_{ij} be the number of times that benefit i is chosen in governance form j , and $\sum_i x_{ij}$ the number of times that all benefits are chosen in governance form j ; let $\sum_j x_{ij}$ be the number of times that benefit i is chosen in all governance forms, and $\sum_i \sum_j x_{ij}$ the total number of benefits chosen in all governance forms (that is, the index is the ratio between the share of benefit i in governance form j and the share of benefit i in all governance forms). Then, for a certain governance form, the revealed governance advantage index is:

$$(1) \quad RGA = (x_{ij}/\sum_i x_{ij})/(\sum_j x_{ij}/\sum_i \sum_j x_{ij})$$

This index allows us to compare the relative advantage of the various governance forms in allowing firms to reach certain benefits. It only assumes positive values: a value that is smaller than 1 indicates that governance form j is relatively under-specialized in benefit i , while a value greater than 1 indicates that governance form j is relatively over-specialized in that benefit.

The same index can be computed at the level of overall types of IP markets. The ‘Revealed IP Market Advantage’ index (which measures the extent to which organizations that engage in a certain type of IP markets ‘specialize’ in seeking a certain benefit, relative to the overall importance of this benefit) is computed as

$$(2) \quad \text{‘Revealed IP Market Advantage’ (RMA)} = (y_{ij}/\sum_i y_{ij})/(\sum_j y_{ij}/\sum_i \sum_j y_{ij})$$

where y_{ij} is the number of times that benefit i is chosen when exchanging IP j , $\sum_i y_{ij}$ the number of times that all benefits are chosen when exchanging IP j , $\sum_j y_{ij}$ is the number of times that benefit i is chosen when exchanging all types of IP, and $\sum_i \sum_j y_{ij}$ is the total number of benefits chosen when exchanging all types of IP (that is, the

¹² The RGA for a specific strategic benefit is constructed in a similar way to the Revealed Technological Advantages (RTA) index (first developed and used in patent statistics by Keith Pavitt and John Cantwell) and the Revealed Comparative Advantage (RCA) index, which is an index (first developed and used in international economics by Bela Balassa) for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flows.

index is the ratio between the share of benefit *i* for IP *j* and the share of benefit *i* for all types of IP).

This index allows us to compare the relative advantage of the various types of IP in allowing firms to reach certain benefits¹³.

Table 6. ‘Revealed governance advantage (RGA)’ and ‘revealed IP market advantage (RMA)’ for the various benefits – proprietary IP

Types of IP markets or IP governance forms	RMA index or RGA index			
	Financial gain	Innovation	Strategic relationships	Competitive positioning
Patents	1.02	0.95	0.94	1.12
• Selling patents	4.08	0.00	0.00	0.00
• Buying patents	0.37	1.27	0.54	1.61
• Out-licensing patents	1.81	0.62	0.65	0.98
• In-licensing patents	0.48	1.15	1.39	1.04
• Cross-licensing patents	1.25	0.86	1.36	0.68
• Patent pools	0.00	2.79	0.00	0.00
Copyright	1.38	0.90	0.75	1.00
• Selling copyright	1.11	0.83	1.67	0.83
• Buying copyright	0.48	1.43	1.43	0.71
• Out-licensing copyright	1.67	0.42	0.00	1.67
• In-licensing copyright	0.00	2.50	0.00	0.00
Open source	0.85	1.03	1.18	0.94
• Open source software	1.19	0.98	0.94	0.95
• Other open source communities	0.47	1.05	1.16	1.13
Non-patented innovations	1.00	1.04	0.97	0.97
• Releasing not patented innovations to the public	0.81	0.74	1.02	1.51
• Releasing not patented innovations to private firms	1.03	0.94	1.13	0.96
• Using not patented innovations	0.93	1.41	0.66	0.75
• Collaborating with universities without patents	1.40	0.77	1.32	0.75

We first consider proprietary IP. The values of the RGA index in Table 6 show that financial gains are particularly sought when selling, out-licensing and cross-licensing patents or copyright, probably since these transactions provide firms with direct income. This supports the results from Mann (2005), which highlight that some firms in the software industry obtain substantial amounts of revenue through licensing. Innovation benefits are particularly sought when buying and in-licensing

¹³ In order to compute the RGA and RMA indexes, the firms’ responses given with respect to each benefit were aggregated into the four main categories (‘financial gain’, ‘innovation’, ‘strategic relationships’, ‘competitive positioning’) for each type of IP, taking care to avoid double-counting.

patents and copyright, since these activities allow firms to use the best innovations. We find that firms improve their competitive position particularly by in-licensing and buying patents – which grants them exclusive access to certain technologies, and sometimes allows them to control the overall production process and take advantage of economies of scale (Reitzig, 2004) – or by out-licensing copyright - probably in order to create some technological dependency from their clients. This phenomenon is what Merges and Nelson (1990) described as ‘cumulative system technologies’, where the connectivity makes new technology more desirable than others.

When we consider non-proprietary IP, we find that releasing non-patented technology to the public allows firms to improve their market position, confirming the importance, in the ICT industry, to build a base of users. This shows the importance of other factors other than patent protection in improving market positioning (Levin et al, 1987).

Innovation benefits are mainly sought when using non-patented technology, which give firms access to the best innovations. Firms particularly use collaborations with universities in order to build strategic relationships and to gain financially, deriving income and saving on IP protection costs.

In the case of open source - apart from financial benefits which are particularly sought from open source software development - there is not much difference in the extent to which each benefit is sought by firms engaging in open source software and by those participating in other open source communities.

With respect to the IP markets, the values of the RMA index (also displayed in Table 6) show that firms particularly seek benefits relating to innovation and the building of strategic relationships when they engage in open source, financial gains when they engage in copyright, and competitive positioning benefits when they engage in patents.

In order to quantify the strength of the results (i.e. the extent to which a certain benefit is specific to one or a few governance forms, or whether it is equally sought in different governance forms) we compute the coefficient of variation of the RGA index across the governance forms ($\sigma_{RGA}/\mu_{RGA} \cdot 100\%$). Similarly, we quantify the extent to which a benefit is specific to a certain type of IP markets by computing the coefficient of variation of the RMA index across types of IP markets ($\sigma_{RMA}/\mu_{RMA} \cdot 100\%$). The higher the coefficient of variation, the more a certain benefit is specific

to one or few governance forms, or to a certain type of IP market, so the stronger is the revealed advantage.

Table 7. Coefficients of variation across governance forms and types of IP markets

	Financial gain	Innovation	Strategic relationships	Competitive positioning
Index of governance specialization (patents): $\sigma_{RGA}/\mu_{RGA} * 100\%$	112.32	84.04	94.05	87.98
Index of governance specialization (copyright): $\sigma_{RGA}/\mu_{RGA} * 100\%$	89.55	69.87	116.15	85.00
Index of governance specialization (open source): $\sigma_{RGA}/\mu_{RGA} * 100\%$	61.25	4.46	14.63	12.08
Index of governance specialization (non-patented technology): $\sigma_{RGA}/\mu_{RGA} * 100\%$	24.38	32.03	26.88	36.51
Index of IP specialization: $\sigma_{RMA}/\mu_{RMA} * 100\%$	21.34	6.88	18.52	7.98

The results in Table 7 show that, in the case of proprietary IP, all benefits are very specific to certain governance forms (the standard deviation of the RGA index is greater than the mean by more than 20%) while in the case of open source and non-patented innovations, benefits are similarly sought across all governance forms (with the exception of financial benefits, which are very specific to open source software development). The coefficients of variation of the RMA indexes confirm that all kinds of benefits are sought across all forms of IP (although with differences in terms of relative shares, as shown in section 4.1).

5. Conclusions

The analysis of the intensity and the strategic reasons for which UK-based ICT firms exchange different types of IP sheds new light on the relationship between the firms' strategic objectives when creating value from IP and their choice of IP markets and IP governance in realizing this value.

ICT firms participate in a variety of proprietary and non-proprietary IP markets, to control and trade their IP assets. While mainstream analyses on value creation from IP focus on the exchange of patents, our results show that firms in the ICT industry that engage in non-proprietary IP at least as intensively as in proprietary ones (as evidenced by data such as the average numbers of IP transactions), and suggest that greater attention should be paid to them, especially by policymakers. Additionally, technology and science policies are usually based upon the assumption that firms

mostly value their IP in the form of patents, but if the pattern exhibited by our interviewed firms turns out to be general, then focusing only on proprietary IP exchange would ignore a large share of ICT companies' IP transactions. Thus, implementing policies in order to support only the enforcement of IP protection may have limited effect on corporate value creation, as the value-creation potential of other forms of IP is not fully exploited.

The finding that ICT firms gain a wide range of different strategic benefits (related to innovation, financial gain, competitive positioning, and strategic relationships) from participation in different IP markets (e.g. patent, open-source IP, non-patented technology) also suggests a counter-argument for the mainstream view that primarily proprietary or patent protection allows firms to develop significant value. For example, according to our firms, patent protection is not necessarily the only tool through which 'best' innovations can be protected, and patent protection is not always necessary to develop superior innovations. Further, patents are not always necessary in order to increase market share. Often technological compatibility achieved through participation in non-proprietary IP, and the professional recognition that these activities confer, are more important in order to improve market positioning. Also, financial gains are accrued when exchanging all forms of IP, not just proprietary ones. Moreover, the mainstream argument that patents are of primary importance for value creation from ideas, is put forward irrespectively of IP governance form. However, we find that the firms employ specific governance forms (e.g. simple licensing out or in, cross-licensing, patent-pooling, etc) in order to achieve specific strategic benefits.

Therefore, understanding strategic value seeking (related to innovation, financial gain, competitive positioning, and strategic relationships) through IP on the part of ICT firms requires that we take into account a greater variety forms of IP (both proprietary and non-proprietary) and the specific role played by various forms of IP governance (such as the role played by specific licensing forms, etc.). Such findings open up an important line of enquiry into the distinctive features of the exchange processes of different forms of IP, whose results provide useful indications to policymakers interested in promoting firms' ability to create value from their IP.

References

- Amara, N., Landry, R., and Traore, N. (2008). Managing the protection of innovations in knowledge-intensive business services. *Research Policy*, Vol. 37 (9), 1530-1547.
- Andersen, B. (2004) If intellectual property rights is the answer, what is the question? *Economics of Innovation and New Technology*, 13(5): 417–442.
- Andersen, B., Konzelmann, S. (2008) In Search of a Useful Theory of the Productive Potential of Intellectual Property Rights, *Research Policy*, 37, 12-28.
- Akerlof, G.A. (1970) The Market for “Lemons”: Quality Uncertainty and the Market Mechanism, *The Quarterly Journal of Economics*, 84 (3), pp. 488-500.
- Arora, A., Fosfuri, A., Gambardella, A. (2001) *Markets for Technology: Economics of Innovation and Corporate Strategy*, Cambridge, MA: MIT Press, December 2001
- Arrow, K. (1962) Economic Welfare and the Allocation of Resources for Invention. In R Nelson (ed.) *The Rate and Direction of Inventive Activity*, Princeton, NJ: Princeton University Press, 609-25.
- Arundel, A., and Kabla, I., (1998). What Percentage of Innovations are Patented? Empirical Estimates for European Firms. *Research Policy*, 27(2):127-141
- Bachmann, R. (2006) Trust, Power and Control in Trans-organizational Relations, in Bessen, J. (2002) *What Good is Free Software?* In Hahn (Ed.) *Government Policy toward F/OSS Software*. AEI Brooking Joint Center for Regulatory Studies, Washington D.C.
- Birecree, A., S. Konzelmann and F. Wilkinson (1997), Productive systems, competitive pressures, strategic choices and work organisation: an introduction, *International Contributions to Labour Studies* 7 (1), pp. 3–17.
- Blind, K., Edler, J., Schmoch, U., Andersend, B., Howell, J., Miles, I., Roberts J., Green, L., Evangelista, R., Hipp, C. and Herstatt, C. (2003) *Patents in the Service Industries*, Final Report. FhG-ISI, Karlsruhe.
- Bonaccorsi, A., Rossi, C. (2003) Contributing to common pool resources. A Comparison Between Individuals and Firms’, working paper, Sant’Anna School of Advanced Studies, available at: <http://opensource.mit.edu/papers/bnaccorsirossidevelopers.pdf>.
- Chesbrough, H (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Harvard Business School Press, Cambridge, MA.

- Cockburn, I. (2007) Is the Market for Technology Working? Obstacles to Licensing inventions, and Ways to Reduce Them. Paper prepared for the Conference on Economics of Technology Policy, Monte Verità, June.
- Cohen, W. Nelson, R., and Walsh, J. (2000). Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not). NBER Working Paper, No.w7552
- Cohen, W. Nelson, R., and Walsh, J. (2002). Links and Impacts: The Influence of Public Research on Industrial R&D. *Management Science*, 48(1), 1-23.
- Coriat, B. and Orsi, F. (2002) Establishing a New Intellectual Property Rights Regime in the United States. Origins, Content and Problems. *Research Policy*, 31, 1491–1507.
- Dosi, G., Marengo, L., Pasquali, G. (2006) How much should society fuel the greed of innovators? On the relations between appropriability, opportunities and rates of innovation, *Research Policy*, 35, 1110-1121.
- Freeman, C., Perez, C. (1988) Structural crises of adjustment, business cycles and investment behaviour, In Dosi et al, “Technical change and economic theory”, Pinter, pp. 38-66.
- Gans, J., Stern, S. (2000), Incumbency and R&D Incentives: Licensing the Gale of Creative Destruction, *Journal of Economics and Management Strategy*.
- Graham, S.J.H and Somaya, D. (2006) Vermeers and Rembrandts in the Same Attic: Complementarity between Copyright and Trademark Leveraging Strategies in Software. Georgia Institute of Technology TIGER Working Paper
- Granstrand, O. (1999) *Economics and Management of Intellectual Property*. Cheltenham: Edward Elgar.
- Griliches, Z. (1990) Patent Statistics as Economic Indicators: A survey, *Journal of Economic Literature*, 28(4), 1661-1707.
- Grindley, P., Teece, D. (2008) Managing Intellectual Capital: Licensing and Cross-licensing in Semiconductors and Electronics, in Teece, D. (ed) “Technological know-how, organisational capabilities and strategic management: business strategy and enterprise development in competitive environments”, Singapore: World Scientific Publishing
- Henkel, J. (2002) F/OSS Software from Commercial Firms: Tools, Complements, and Collective Invention, GEABA Discussion Paper 02-27.

- Hill, C. and Jones, G. (2001) Strategic Management, An Integrated Approach, fifth ed. Houghton Mifflin.
- IBM (2006) Building a New IP Marketplace: A Global Innovation Outlook 2.0, Innovation Outlook Report, IP marketplace
- Jaffe, A.B., Trajtenberg, M. and Henderson, R. (1993) Geographical Localisation of Knowledge Spillovers, as Evidenced by Patent Citations. *Quarterly Journal of Economics*, 58(3), 577–598.
- Katila, R., and Ahuja, G., (2002). Something Old, Something New: A longitudinal Study of Search Behaviour and new Product Introductions. *Academy of Management Journal*, 45:1183-1194
- Kuan, J. (2001) F/OSS Software as Consumer Integration into Production, Working Paper available at: www.papers.ssrn.com/paper.taf?abstract_id=259648.
- Levin, R., Klevorick, A., Nelson, R., Winter, S., Gilbert, R., and Griliches, Z. (1987). appropriating the returns from industrial research and development, *Brookings Papers on Economic Activity*, 3.
- Mann, Ronald J.,(2005) Do Patents Facilitate Financing in the Software Industry?., *Texas Law Review*, 83,961-1030
- Mansfield, E. (1986) Patents and innovation: An empirical study, *Management Science* 32, 173-181
- Mansfield, E. (1991) Academic research and industrial innovation, *Research Policy*, 20, 1-12.
- Mergers, R. and Nelson, R. (1990) On the complex economics of patent scope, *Columbia Law Review*, 90 (1), 839-961.
- Munari, F., Santoni, S. (2009) Exploiting complementarities in IPR mechanisms: the joint use of patents, trademarks and designs by SMEs, paper prepared for the 4th Annual Conference of the EPIP Association – 24-25 September 2009.
- Nelson, R.R. (1959) The simple economics of basic scientific research, *The Journal of Political Economy*, 67/3: 297-306.
- Nelson, R (1989) What Is Private and What Is Public About Technology? *Science, Technology & Human Values*, Vol. 14, No. 3, 229-241 (1989)
- Plant, A. (1934) The Economic Theory Concerning Patents for Inventions. *Economica*, 1, New Series, 30–51.

- Pitkethly, R. (2001) Intellectual property strategy in Japanese and UK companies: patent licensing decisions and leaning opportunities, *Research Policy*, Vol. 30, 425-442
- Porter, M. (1996) What is strategy? *Harvard Business Review*, November-December, 61-78
- Reitzig, M. (2004). Strategic management of Intellectual Property. *MIT Sloan Management Review*, 45(3):35-40
- Rivera-Batiz, L. and Romer, P. (1991). Economic integration and endogenous growth, *The Quarterly Journal of Economics*, May.
- Rivette, K. and Kline, D. (2000) *Rembrandts in the Attic: Unlocking the Hidden Value of Patents*. MA: Harvard Business School University Press.
- Robson, S., Haigh, G. (2008) First findings from the UK Innovation Survey 2007, *Economic & Labour Market Review*, Vol 2, No 4, April
- Teece, D. (1986) Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. *Research Policy*, 15, 285–305.
- Trajtenberg, M., Henderson, R., Jaffe, A. B. (1997), University versus corporate patents: A window on the basicness of inventions, *Economics of Innovation and New Technology*, 5 : 19–50.
- Wichmann, T. (2002a) Basics of F/OSS software markets and business models, *Free/Libre and F/OSS Software: Survey and Study*, FLOSS Final Report, International Institute of Infonomics, Berlecom Research GmbH.
- Wichmann, T. (2002b). Firms' F/OSS activities: motivations and policy implications, *Free/Libre and F/OSS Software: Survey and Study*, FLOSS Final Report, International Institute of Infonomics, Berlecom Research GmbH.
- Wilkinson, 1983 F. Wilkinson, Productive systems, *Cambridge Journal of Economics* 7 (1983), pp. 413–429.
- Wilkinson, 2002 F. Wilkinson, Productive systems and the structuring role of economic and social theories. In: J. Michie, Editor, *Systems of Production: Markets, Organisations and Performance*, Routledge, London (2002).
- Williamson, O., 1975. *Markets and Hierarchies: Analysis and Antitrust Application*. Free Press, New York.
- Williamson, O., 1998. Transaction cost economics: how it works; where it is headed. *De Economist* 146, 23–58

Winter, S. (1993) Patents and Welfare in an Evolutionary Model. *Industrial and Corporate Change*, 2, 211–231.