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**Economic Strategies and Patent Governance of UK Software Firms: A Study on  
Financial Benefits, Reputation and Positioning**

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**ABSTRACT:**

Using a survey on UK software firms conducted under the EU 6<sup>th</sup> Framework Programme (U-KNOW), we analyse the operational aspects of the patent value creation processes in the patent market place. The analysis is on economic-related strategic benefits, such as financial reward, reputation, and positioning, and it also takes into account the factors that inhibit firms to achieve these economic benefits. The paper demonstrates the importance of patent governance structures for value creation processes. We find that there is a clear relationship between the type of benefit (financial reward, reputation, or positioning) that firms seek and the patent governance structures (buying or selling patents, simple or cross licensing, or pooling) they use. We also find a relationship between the obstacles (problems related to patent search, patent transparency, contract, enforcement, regulation or practice) firms experienced in the value creation processes and the patent governance structures they use. In contrast, there is no strong pattern between the benefit sought by firms and the obstacles experienced by them.

**KEY WORDS:**

Patent strategy; patent governance; UK software firms; financial gains (income, cost cutting and venture capital); reputation (recognition and signalling); market positioning.

## 1. INTRODUCTION

This paper identifies the particular strategic benefits UK software firms seek from their patent portfolio which is directly related to economic benefits. It also identifies the operational aspects (or patent governance forms) of their value creation processes through patent market place.

The economic strategic benefits which firms seek through value creation processes in patent marketplace and which are considered in this paper include (i) *financial* rewards which focus the monetary benefits that comes with patent (e.g. to cover R&D or profit), (ii) *reputation* which look into the informal part of gaining market and industry recognition like competitive signaling, and (iii) *positioning* which covers securing market protection as part of their formal way of building broader user base or gaining market share.

The economic strategic benefits are different from those we identify as the social benefits where firms manage their patent portfolio to build networks and corporate relationships (e.g. joint ventures, strategic alliances, etc) or to give something to the community. Social benefits also include patent portfolio management to enhance innovation processes where the aim is to be able to use the best inventions, innovations, creative expressions, or an innovation methodology for developing better technology, benefiting from user or supplier involvement (e.g. through learning and feedback ), for setting common standards or making or using compatible technology.

When investigating the operational aspects of patent value creation processes the paper turns to the role of the patent marketplace, and the quality of the patent market places. A proposition is that different governance structures are associated with different value seeking purpose (Andersen and Konzelmann, 2008). For example, a cross licensing agreement regarding patents may be due to strategic market positioning whereas selling a patent may be due to gaining one-off income.

Although the data does not permit us to assess how successful the corporate patent strategies have been in terms of reaching the economic market incentives, we do have data on the obstacles which UK software firms experience when seeking financial benefits, reputation

and positioning in patent markets. Thus, this paper is to investigate what factors inhibit or create obstacles in respect to the three broad strategic economic aims listed above. Obstacles faced in the IP market place which are addressed in this paper, can be divided into 5 groups (and they are analyzed in detail in terms of 15 different obstacles with the paper): (i) Market search problems, (ii) IP assessment problems, (iii) Contract and enforcement problems, (iv) Regulation and practices, and (iv) Other obstacles.

Several contributions arise from this paper. First, it deepens our understanding of the wide range of strategic benefits of patenting. Management and economics scholars have long recognise that some firms accumulate portfolios of patents for trading purposes (eg: Von Hippel, 1988; Grindley and Teece 1997). Indeed, one survey evidence by Teece 1986 suggests that the economic value of intellectual property is highly context specific, hinging on its use within a particular technological or competitive setting. This paper builds on this literature, while suggesting that strategic benefits of patents may vary considerably even within an industry and are driven by firm specificity and patent governance structures.

Secondly, the analysis presented in this paper also extends the existing literature by Andersen and Konzelmann, 2008 by focusing on value creation and value distribution from patent. It highlights the importance of governance structures towards strategic benefits that firms seek.

Thirdly, despite the existence of such research that points into strategic benefits of patent, the theoretical and empirical literatures have focused very little on the functioning and efficiency of the patent marketplace itself. That is why this paper also contributes new empirical evidence towards an emerging literature on problems in market for technology (ie: patents) and their implication for firms strategy (Arora et al, 2001). More specifically, we explore obstacles faced by firms when dealing with patent marketplace. Owning a patent is not enough. Understanding what firms do with it will tell whole other stories. Merges and Nelson highlights the difficulties underlies in patent related transactions, where it is difficult to value the patent and its blurry boundaries make it difficult to know the boundaries.

Overall, the results of the empirical analysis will shed new light on the relationship between the firms' objectives (in terms of value seeking) and the governance forms (embedded in

buying or selling patents, simple or cross licensing, or pooling). They also focus on the obstacles that prevent patent marketplace to function smoothly.

### *Why software firms*

There are three issues with respect to the dynamics of software firms that we want to discuss here because of their relevance towards IP marketplaces. Firstly, there is a growing use of software as a tool in this era. Thus, many firms want to make sure their inventions and products are protected. Secondly, the production of a software modules and components are really disintegrated that later combined into a more complex systems (Arora et al, 2001). Therefore, we hope to be able to see many patent transactions in the marketplace. Since the technology is also incremental, different things need to be combined to make a commercial product. Its short life-cycle of products and technology make it prone to involve in the marketplace for patent transaction since product innovation in the software industry is very closely tied to time. Thirdly, software firms have limited investment in downstream commercialisation capabilities, and usually choose to license to bigger software firms (Arora et al, 2001). All in all, it is less obvious that the benefits of patent outweigh the obstacles faced by firms. This is indeed a good thing for us to understand software firms' experiences in the patent marketplace.

### *Paper outline*

This paper examines the incentives of patenting in the economic point of view, and its obstacles. The focus is on two issues: The linkages between the benefits and the obstacles faced by firms and their linkages with patent governance structures. Section 1 covers the introduction and data information. Section 2 reviews some of the literatures on patent strategic economic incentives and its value creation through patent marketplace. It starts with section 2.1 - understanding the strategic benefits of patent, before moving into the importance of governance structure towards patent's value creation (section 2.2). It then covers the obstacles in the patent marketplace in section 2.3 These literature reviews will reinforce the importance of this paper for understanding the patent marketplace. Section 3 covers the analysis of the data gathered, with the analysis of strategic benefits in section 3.1, analysis for the value creation in section 3.2 and lastly the analysis of the obstacles in section 3.3.

## *Data*

We now turn to the empirical underpinning of the paper and the methods used for data in the analysis. The approach used was to survey the evidence reported by firm manager involved with IP strategy, asking about strategic benefits and obstacles experiences within IP marketplaces. Previous researchers that used the same approach (Mansfield, 1986; Levin et al., 1987; Cohen et al., 2002; Arundel, 2003) mostly focused on the benefits of patenting, and most of the literature needs updating as corporate strategies may change over time. Also, value creation as a process was only dealt with implicitly, or not at all, in the previous literature, whereas we take into account role of the patent market place where buyer or seller or licensee or licensor meet to jointly create value for all parties involved in the exchange or ownership or use rights. Here, we look into both the benefits and the obstacles which arise, and the value creation process through the patent marketplace.

The survey data that contribute towards the analysis of this paper are obtained through a questionnaire to UK software firms. This research is forming part of U-KNOW (Understanding the relationship between knowledge and competitiveness in the enlarging European Union: 2005-2009) which is an EU Specific Targeted Research Project (STRP) where Birgitte Andersen was a work package coordinator of "An IPR Regime in Support of a Knowledge Based Economy".

The questionnaire has been circulated to a sample of software firms in the UK. The list of software firms to be surveyed was drawn from the FAME database. FAME (Financial Analysis Made Easy) is a financial database that contains information of companies in the UK and Ireland. Firms has been extracted according to location of UK (ie: England, Wales, Scotland and Northern Ireland), with size of employees more than one person. The code used for the extraction is NACE code 7221 for software publishing, code 3002 for manufacturing of computers and other information processing equipment, code 322 for manufacture television and radio transmitters and apparatus for line only and line telegraphy, and code 323 for manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods. These codes identify companies producing software and hardware, which are likely to be dealing with software. For simplicity, we refer to the firms in this sample as ‘software firms’.

During the survey, it seems that many companies have gone out of business or are not involved with the software and hardware sectors. These companies already been eliminated from the survey population, together with firms that have double entry in the system and firms that cannot be contacted due to their non-existence as they cannot be contacted through telephone, email or post. The cleaning operation has allowed us to reduce the number of software companies from 1754 records to 980 records.

All firms were contacted by telephone, email and post. The questionnaire was offered to be carried out through online<sup>1</sup> or paper. The field work was carried out between October 2008 and April 2009.

The data of the survey covers various proprietary and non-proprietary marketplaces governing the exchanges of IP. It was also designed to collect data relating to different kind strategic benefits that firms seek through the IP marketplace; and the obstacles that able to hinder the performance of the marketplace. For each of the marketplace, the questions in the survey referred to different governance structures. However, in this paper, the focus will only be on patent governance which is detailed out in the following table.

*Table 1: Patent governance structures*

| <b>Patent marketplace</b>                                  | <b>Governance structures</b> |
|--|------------------------------|
| <b>Patents</b> as a tool for the protection of novel ideas | Selling patents              |
|  | Buying patents               |
|  | Out-licensing of patents     |
|  | In-licensing of patents      |
|  | Cross licensing of patents   |
|  | Participation in patent pool |

There are 980 firms altogether, but the number of responses obtained was only 38 firms, with the response rate of 3.87%. Of the 38 respondents, only 34% of the firms participate in the patent marketplace (13 firms).

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<sup>1</sup> Available at the following web address: <http://www.iwh-halle.de/ipr>

When we look at company size (measured according to number of employees) we find that SME firms (consist of firms with 250 employees and less) are more likely to engage in patent marketplace (66%). This is expected since big players under the TPDF (Trademark, Patent and Design Federation) of the UK, comprising about 30 of the largest firms dealing with software in the UK made a collective decision of not taking part with respect to providing information in relation to patents, and only one TPDF firm (but one of the world's largest) provided information on IP related to open source IP, non-patented technology and copyright.

Despite the low response rate, we believe that our results will give us a picture of the complexity of value creation from patents. Also, evidence based research in this area will always struggle considering how hard it is to get first hand data from software firms in the UK, since it requires firms to reveal their strategies in handling patent, which for most firms include something that should be remained hidden from others. In fact, we expected large firms to be more likely to respond to our survey, as they are more likely to have organised R&D and IP divisions. However, in this case, firms that have been particularly unwilling to answer the survey due to data sensitivity issues and to comply with company policy of confidentiality were on average much larger than those that did not answer the survey for other reasons. For example, as mentioned before, the TPDF (Trademark, Patent and Design Federation) of the UK made a collective decision of not taking part with respect to providing information in relation to patents. However, the information in hand from the rest of firms that answer the survey will be able to give us first-hand information of firms experience with value creation processes from patents.

## **2: STRATEGIC ECONOMIC INCENTIVES, VALUE CRATION AND THE ROLE OF THE PATENT MARKET PLACE**

### ***2.1 Literature review: The economic strategic incentives from patent portfolio management***

The expansion of the usage of patent and the emergence of new ways of its exploitation have brought to the fore the issue of strategic value of patent, either in terms of its generation, dissemination, and appropriation. As it is known that the best patent will not generate revenue if the firm is not correctly positioned to exploit it (Brooking, 1996), firms nowadays try their best to find ways in which the patent system, as an institution, can help them with this

increasingly important practice. Definitely, positioning in the patent marketplace has become an explicit agenda for many firms.

Mansfield et. al. (1981) and Hall and Ziedonis (2001) suggest that certain characteristics of patent bring forth different kinds of impact on its value based on the intended utilisation of the patent. On top of that, Cohen et al. (2000) probe differences in motives of patenting across industries. Furthermore, Levin et. al. focus on patent effectiveness across industries in explaining variations in R&D productivity. Their survey shows that covering R&D expenditures is not the primary motivation for appropriation from patents, and that those motivations are related to strategic value from patents which can be obtained through licensing markets (i.e. the patent marketplace) (1987). However, their contributions can be extended further, by focusing on patent marketplace as an important theoretical position underpinning this research. Patent marketplace is an important platform for exchange, able to stress the institutional arrangements and social interactions, while the functionality of the marketplace creates more economic value. We will look into this in more detail in section 2.2.

Theories of benefit and cost of patent laid out by Mazzoleni and Nelson (1998) drive firms into associating patents with a competitive weapon and as a source of unexpected revenues. Firms used patent to appropriate initial cost of innovation (Taylor and Silberston, 1973), to cover R&D expenditure (Levin et al, 1987), or even used them as a tool to be part in the financial market, (Coriat and Orsi, 2002) and among others. However, the venture capital solution to the problem of financing innovation has its limits as it focus only on a few sectors at a time with minimum size of investment and also requires a thick market in small and new firm stock for exit strategy purposes (such as NASDAQ or EASDAQ) (Hall, 2002).

Apart from that, firms incentive to encourage growth of their industry, rather than their own immediate profitability, are able to reinforce their reputation in the market. Reputation, as explained by Ettenson and Knowles (2008), is a ‘companycentric’ concept that focuses on the credibility and respect that an organisation has.

Reputation based trading serves as asset that are able to reinforce the competitive advantage by increasing firms' access to external technologies (Gans and Stern, 2003), or by means of competitive signalling (Granstrand, 1999). Reputation management is an important factor in attracting partners and external funding. It is a precondition for others' willingness to do business with any firm. They show a clear indication that a corporate R&D well-managed reputation has a direct impact on the firm's brand value (Grassman, et al 2009). Unlike reputation, brand itself is a 'customercentric' concept that focuses on what a product, service or company has promised to its customers and what that commitment means to them (Ettenson and Knowles, 2008). In other words, with in-house R&D, firms able to inform their community through patent for reputational purposes. Indeed, reputation and brand are both recognised as valuable intangible assets that clearly contribute towards the success of company's operation.

In order to capture the full potential of the patent, firms are encourage to capture the market share as quickly as they can so that their products stand the chance to be the market standards. Patents are also used to support firms' branding effectiveness especially in trying to protect their own market share (Rivette and Kline, 2000).

Firms' diversification strategy could also lead to greater market share, although there is a limit of how much a firm can diversify (Markides, 1996). Benefit relating to market positioning is also related to firms' decision to buy patents that enable them to cut ties with other firms. This can be seen as an advantage for firms who want to commercialise their own products, whilst reducing the needs to do any licensing agreement. By removing the transactions from the market, firms gain more than just exclusive rights to the patents and the technologies. It allows the firms to enhance their competitiveness by controlling the overall production process and taking advantage of economy of scale (Reitzig, 2004).

Overall, the paper explores three main categories for strategic value to be realised through participating in patent marketplace, which lead to the following research question (denotes as RQ):

RQ1: What are the various types of economic benefits that firms seek when exchanging patent?

Table 2 below demonstrates the strategic incentives from patent portfolio management. It can be summarized in terms of (i) *financial* factors (which focus the monetary benefits that comes with patent), (ii) *reputation* factors (which look into the informal part of gaining market and industry recognition like competitive signaling) and (iii) a *positioning* factor (which covers securing market protection as part of their formal way of gaining market and industry recognition). The variables in our subsequent analysis is also listed.

*Table 2: The strategic benefits of patent according to the economic factors*

| <b>Economic factors*<br/>in the value of<br/>patents</b> | <b>Variables in the analysis</b>  |
|--|---|
| <b>Financial</b>   | Direct income from market transaction (e.g. to cover R&D or for profit)                 |
|  | Cost cutting (e.g. via savings on royalties or patent administration)                   |
|  | Increasing ability to raise venture capital (e.g. via the stock market)                 |
| <b>Reputation</b>  | Professional recognition or brand recognition   |
|  | Competitive signalling  |
| <b>Positioning</b>                                       | Increasing market share (e.g. building broader user base or securing market protection) |

\* *The economic factors are different from what we term the social factors which are related to patent-market-based innovation methodologies, business relationships, and networks.*

## **2.2 Literature review: Role of governance structure in Value creation**

Hall (2007) states that patents are valuable if they can be enforced legally with respect to infringement as it will show others its true merit. Bessen and Meurer (2005) also highlight the fact that litigated patents tend to be more valuable patents. Firm's willingness to pay the renewal fee in highlighting its value has also been emphasized (Schankerman and Pakes, 1986). In our approach in this paper, we are emphasising on the importance of the governance structure towards patent value creation.

When investigating the use of patents to reach the above strategic economic aims, we need to take into account the different forms of patent governance structures in the market. Andersen and Konzelmann (2008) relate the different governance structures to represent different forms

of market platforms where patents can be exchanged. This is relevant because different market-platforms function differently and are enforced in different ways. Also, the institutional economics literature (Hodgson 1987, 1999) argues that there is not only one market (as the standard textbook theory claims) but that there are many different types of markets (for example auction markets, price tag markets, medieval type regional street markets, black or unauthorized markets), and that these markets are enforced by different norms and bargaining forms. Thus, an important theoretical position underpinning this research is that markets are *platforms of social relations*. We also need to recognize that conflicts embedded in these social relations, or market obstacles, which inhibit the effectiveness of the functioning of these markets (see section 2.3 below). Thus, IP markets cannot be reduced to simple supply and demand curves as within standard textbooks. This point is also emphasized by institutional economics (Hodgson 1987, 1999).

To emphasize the key roles played by social interactions and institutional arrangements in the functioning of markets for patents, this study operates with a notion of “marketplaces” (rather than “markets” as within standard economics). The word “marketplace” denotes the space, actual or metaphorical, in which a market operates, and hence emphasizes the web of social relationship and institutions that are required for processes of exchange to take place.

This is the list of the patent governance structures which are considered in this paper, and analyzed in relation to each strategic aim: Selling patents, buying patents, out-licensing of patents, in-licensing of patents, cross licensing of patents, and participation in patent pools. (See Table 1)

Building upon the information that value from a patent is realized via various governance forms of market exchanges of IP, Andersen and Konzelmann (2008) also suggest that the choice of a governance structure underpinning a patent marketplace is not random, but depends upon the most suitable contractual or informal agreements. In other words, it is suggested that there is a relationship between the choices of patent governance institution underpinning a specific marketplace, and the value or benefit firms seek to realize from their patents. Thus, we anticipate that the patent governance structure applied for each strategic aim is not random (and that software firms have some dominant patent governance structures for each strategic aim which they believe enable them to reach economic aims).

This lead us to the next research question, while suggesting that strategic benefits of patents may vary considerably even within an industry and are driven by patent governance structures and not firm specificity.

RQ2: Which strategic benefits firms seek according to the patent governance structure?

This allows us to investigate the reasons why firms engage in specific patent governance forms. Firms definitely know when and how to manoeuvre around patents thickets through institutional solutions such as patent pools or joint ventures (Merges 2001, Shapiro, 2001). For example, patent pool and cross-licensing agreements will arise to ‘bundling’ effect and able to reduce the collective transaction cost (Merges and Nelson, 1990, Merges, 2001, Shapiro, 2001). Firms commercialising technologies that draw upon a concentrated pool of inventions can safeguards their investments through ex ante mechanism, such as joint ventures and patent pools. However, the cost and delays associated by ex ante contracting is an issue that somehow lead firms to approach ex post licensing transaction in more favour (Ziedonis, 2004). See section 3.2 for the results of the analysis.

### ***2.3 Literature review: Obstacles in the patent market place***

In this section we explore the obstacles faced by software firms in utilizing patent market places in reaching their aims for financial rewards, reputation and positioning.

To research this we need to consult the performance or efficiency of IP market places, in which strategic value is realized. As various IP market places are enforced by different norms and bargaining forms, Andersen and Konzelmann (2008) show how the performance or efficiency of IP markets depends on the nature of stakeholder interaction and other qualities. With respect to stakeholder interaction in the patent marketplace, institutional economics tend to focus on asymmetric relationships with respect to (i) bargaining power and (ii) information and knowledge. (iii) Trust is also an important factor in market interaction. (Hodgson 1987, 1999).

When we look into the criteria of granting a patent on an invention, the patent application’s details must be disclosed, which enable knowledge spill-over to others who are able to

improve the invention. However, sometimes, those who have the skill of the art to comprehend the technology also find it hard to digest the patent document (Bessen & Meurer, 2008).

Although patent application might have been previously regarded as a one-off event, the complexity of current technology and the current patent application system have combined to make it more cumulative and demanding process.

Lemley (2001) has argued that the cost of having higher quality patent may exceed its benefit. Low quality patent can create uncertainty among firms as investors, which raise the transaction costs for inventors obtaining access to it. Although some scholars like Shapiro (2001), have argued that large number of low quality patents may increase the fragmentation of property rights covering complementary technologies, recent experience suggest that it has the consequences of complicating the patent marketplace. It will be difficult for firms to access the degree of novelty and understand the economic value of patent with so many low quality patents around. Although firms who are specialised in their own technology might be able to differentiate between high and low quality patents, having bounded rationality, it is impossible for firms to include everything in a contract while maintaining the affordable transaction cost (Williamson, 1979). This may later lead to difficulties in reaching agreement due to high transaction costs. It is also very difficult to get away from opportunistic behaviour in business dealing by taking advantage when they can, although trust is an important factor in a successful market interaction (Bachmann, 2006).

Farrell and Shapiro (2008) shows that even weak patent whose validity is uncertain can be surprisingly effective in litigation. Thus, it is much safer for firms to engage in patent marketplace in order to reduce the uncertainty of litigation. Some legislation indeed imposes such a barrier to firms. However, Hall and Ziedonis (2001) found that after the creation of CAFC<sup>2</sup> and other changes in patent legislation in the US in 1982, firms in a semiconductor industry doubled its patenting. Thus, it is hard to say if legislation is indeed a problem or a catalyst for patenting activities.

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<sup>2</sup> Court of Appeals for the Federal Circuit

Kingston (2001) on the other hand recommends that a lower cost of patent dispute in complex technology can be achieved through shared-risk compulsory licensing. However, Heller and Eisenberg (1998) argued that licensing solution may fail with a very high transaction cost when a large number of patent holders are involved. Since software firms usually involve with a complex technology (cumulative innovation), there is a possibility that software firms fall into this proposition.

However, a recent industry report (Innovation Outlook Report, IP marketplace, IBM 2006) focused on other aspects of markets as platforms of social relations, which could also affect the sustainability of IP systems. This study was especially in relation to the market exchange of patent rights. The obstacles which were discussed in this report in an open online debate can be summarized within a few themes, as such (i) inflexibility (impossibility to bargain a deal), (ii) no transparency (difficulty to identify the owner, uncertainly as to what the right price is, impossibility to make sense of text and diagrams in patent documents), (iii) no integrity (poor behaviour and unjust court cases), and (iv) low quality (too many similar patents with no inventive step), and other obstacles.

Given that firms seek different benefits according for each governance forms we are now highlighting the final question of this paper.

RQ3: What are the obstacles that firms encounter in their value creation process, when seeking economic-related strategic benefits (financial benefits, reputation and positioning)?

In particular, we look into

- whether the obstacles are related to the benefits that firms seek, and
- whether they are adherence towards the governance structures.

In table 3 is a list of the obstacles which are addressed in this paper, sorted into four broad groups.

Table 3: Obstacles in patent marketplace

| Broad groups                              | Obstacles  |
|---|--|
| Search problems                           | Difficulty in locating the owners of a patent/patents                            |
|   | Difficulty in locating the users of a patent/patents                             |
|   | Difficulty in finding the best   |
| Patent assessment / transparency problems | Difficulty in assessing the degree of novelty/originality of the patent/patents  |
|   | The description or drawing in the patent document is not clear                   |
|   | Difficulty in assessing the economic value of the                                |
| Contract and enforcement problems         | Difficulty in negotiating a price for the patent/patents                         |
|   | Difficulty in negotiating the terms (not related to price) of the contract       |
|   | Excessive cost of enforcing the contract   |
|   | Problems (not related to cost) with enforcing the contract                       |
|   | Trust issues (e.g. opportunistic behaviour, free-riding, or similar)             |
| Regulation and practices                  | Regulations allow too exclusive rights   |
|   | International patent regulations do not fit the needs of different local markets |
|   | Differences in practices of firms  |

For each governance structure (see table 5), we expect to find a relationship with the obstacles they face (i.e., it is not random). That is, some market obstacles may be more significant in reaching certain types of obstacles than others. The reason we expect such a relationship, is because software firms participate in the same governance structures. Hence, they are all embedded in the same institutional structures of social relationships (enforced by types of bargaining processes, norms etc.). Put in other words, the patent governance structure has some inherit features which may inhibit most software firms in the same way, with respect to reaching their particular strategic aims for financial gains.

### 3. ANALYSIS

This section highlights the result of the analyses done on the available data. Section 3.1 look at the results for strategic benefits, section 3.2 highlights the role of governance forms in value creation process, whilst section 3.3 look at the obstacles.

### 3.1 Analysis: strategic benefits

In trying to answer RQ1 [What are the various types of economic benefits that firms seek when exchanging patent?] Table 4 lists the overall strategic benefits firms have reported. This is an overview of share respondents that choose at least one benefit in the corresponding category, averaged across governance forms, taking care to avoid double-counting.

Table 4. Benefits from participation in Patent marketplace

| Economic factors* in the value of patents | Variables in the analysis   | Percentage <sup>3</sup> |
|---|---|-------------------------|
| <b>Financial</b>                          | Direct income from market transaction (e.g. to cover R&D or for profit)                 | 10%                     |
|   | Cost cutting (e.g. via savings on royalties or patent administration)                   | 10%                     |
|   | Increasing ability to raise venture capital (e.g. via the stock market)                 | 2%                      |
| <b>Reputation</b>                         | Professional recognition or brand recognition   | 6%                      |
|   | Competitive signalling  | 8%                      |
| <b>Positioning</b>                        | Increasing market share (e.g. building broader user base or securing market protection) | 16%                     |

\* The economic factors are different from what we term the social factors which are related to patent-market-based innovation methodologies, business relationships, and networks.

The main economic related benefits that firms seek when engaging with the patent marketplace relates to firm's positioning in the market by increasing their market share (16%).

With respect to financial benefit, patent allow firms to obtain direct income from market transaction, to focus on cost cutting measures and also to raise venture capital. It seems that, cost cutting measures and direct income (both 10% respectively) are the most important financial benefit whilst raising venture capital is the least (2%). This seems to be different from the Silicon Valley practice in terms of connection between patent and venture capital financing, whereby venture capital is seen as an important benefits gained from patenting (Merges, 2003). On the other hand, benefits under the economic factor of reputation only take up 6% for professional and brand recognition, and 8% for competitive signalling.

<sup>3</sup> The percentage does not sum to 100% as this paper only focuses on economic benefits and does not include social benefits.

We now move on to analyse the role of governance structure in the value seeking process in patent marketplace. This will be able to deepen our understanding of the relationship between the use of governance structures in patent marketplace and the seeking of benefits.

### *3.2 Analysis: Role of governance forms in value creation*

We know that firms seek all kinds of benefits in patent marketplace with different intensity. Thus, in answering questions in relation to RQ2 [Which strategic benefits firms seek according to the patent governance structure?], we have listed the most important benefits reported by firms in accordance to the patent governance forms, and whether the benefits firms seek are associated with the governance forms (see Table 5). The latter is done by the ‘Revealed Governance Advantage’ (RGA) index.

Basically, we build an index which measures the extent to which a certain governance form (in which firms participate) ‘specialize’ in seeking a certain economic benefit, compared with all governance forms overall. Because this index is constructed exactly as the widely used Revealed Technological Advantage index, we refer to it as the index of ‘Revealed Governance Advantage’ (RGA).

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  $\sum_i \sum_j x_{ij}$  measures 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:

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

This index only assumes positive values: a value that is smaller than 1 indicates that benefit  $i$  is relatively under-specialized in governance form  $j$ , while a value greater than 1 indicates that governance form  $i$  is relatively over-specialized in that benefit.

Table 5: Index of Revealed Governance Advantage for strategic benefits

| Economic factors in the value of patents | Benefits                                      | Selling      | Buying      | Licensing -out | Licensing -in | Cross-patenting | Patent -pool* |
|--|---|--------------|-------------|----------------|---------------|-----------------|---------------|
| <b>Financial</b>                         | Direct income                                 | <b>11.67</b> | 0.00        | <b>3.59</b>    | 0.00          | 0.00            | 0.00          |
|  | Cost cutting                                  | 0.00         | 0.71        | 0.77           | 0.42          | <b>2.67</b>     | 0.00          |
|  | to raise venture capital                      | 0.00         | 0.00        | 0.00           | <b>2.92</b>   | 0.00            | 0.00          |
| <b>Reputation</b>                        | Professional recognition or brand recognition | 0.00         | 0.00        | <b>3.59</b>    | 0.97          | 0.00            | 0.00          |
|  | Competitive signalling                        | 0.00         | <b>2.50</b> | <b>1.35</b>    | 0.73          | 0.00            | 0.00          |
| <b>Positioning</b>                       | Increasing market share                       | 0.00         | <b>1.82</b> | 0.49           | <b>1.06</b>   | 0.85            | 0.00          |

*\*Data shows that firms that involve in patent pool do not seek any economic benefits. Since this paper only focuses on economic related benefits, the patent pool column remains zero for all highlighted benefits.*

The research question that we are trying to answer emphasise that strategic benefits are highly specific to governance forms in patent marketplace, and this is supported by the value of the RGA index shown above.

In the patent marketplace, we find that firms particularly focus on getting a direct income when involving with selling and out-licensing their patent. This is predicted since both governance structures are the most conventional way to gain some monetary compensation from patent. With a limited sample, Mann (2005) highlights that some firms in the software industry obtain substantial amount of revenue through licensing. Such benefit is not important at all for the rest of the governance structure.

On the other hand, firms particularly seek the cost cutting measure when they engage in cross patenting. Merges and Nelson, 1990 highlight the fact that cross-licensing has its own social value of sharing and exchanging, which is actually the best way to cut cost. Firms that seek

the benefit of raising venture capital seem to be only engaging in in-licensing. In-licensing patents allow firms to raise capital by signalling that they master a high degree of intellectual capital which is able to give investors confidence to put their money at risk (Coriat and Orsi, 2002).

On the benefit of gaining professional and brand recognition, firms only associate them with out-licensing. Out licensing patent may also signal that a particular firm owns a lot of useful patents which are at demand. This can indicate the strength of the firm's R&D too as it highlight the credibility and respect of the organisation (Ettenson and Knowles, 2008). With respect to competitive signalling, it gives a great deal of importance for firms that deal with buying and licensing out their patent, with buying patent as the most important governance. Firms particularly seek to increase their market share when they are buying patent, and to a lesser extent when they are licensing in. By acquiring patents, firms are encouraged to capture the market share as quickly as they can so that their products stand the chance to be the market standards. Patents are also used to support firms' branding effectiveness especially in trying to protect their own market share (Rivette and Kline, 2000).

As a summary, we can say that firms sell patents in order to get direct income from it. Firms buy patents in an attempt to show competitive signalling to other firms and also when trying to increase their market share. The benefits relating to market positioning, relates to the ability to gain or maintain market share due to the exclusive access to certain patent (see Rivette and Kline, 2000; Cohen et all 2000; Granstrand 1999). Licensing out has the most benefits specialised within the governance form. When licensing out, firms try to obtained direct income and also gain professional recognition whilst giving out signals to others. When licensing in patent, firm focuses on raising venture capital and also to increase the market share. Finally, cross-patenting is only associated with the benefit of cost cutting.

In order to quantify the extent to which a 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 governance forms ( $\sigma_{RGA}/\mu_{RGA} * 100\%$ ). The higher the coefficient of variation, the more a certain benefit is specific to one or few governance forms or to a marketplace, so the stronger is the revealed advantage.

Table 6. Coefficients of variation across governance forms for RGAs

| <b>Economic factors in the value of patents</b> | <b>Economic benefits</b>                      | <b>Index of governance specialization (patent marketplace): <math>\sigma_{RGA}/\mu_{RGA} * 100\%</math></b> |
|---|---|---|
| <b>Financial</b>                                | Direct income                                 | 185%  |
|   | Cost cutting                                  | 130%  |
|   | to raise venture capital                      | 245%  |
| <b>Reputation</b>                               | Professional recognition or brand recognition | 189%  |
|   | Competitive signalling                        | 133%  |
| <b>Positioning</b>                              | Increasing market share                       | 99%   |

It can be seen from the table above that all the values of the coefficient of variation have a very high percentage, with all of them above 100% except the benefit of increasing of market share. These results show that in patent marketplace, the benefits stated above are very specific to certain governance structures.

### 3.3 Analysis: obstacles experienced in the value creation process

Firms may encounter obstacles when trying to seek benefits from patent marketplace. Apart from highlighting the obstacles itself, this section will also cover the nature of these obstacles, in response to RQ 3 [What are the obstacles that firms encounter in their value creation process, when seeking economic-related strategic benefits (financial benefits, reputation and positioning)?]. We will try to uncover whether the obstacles are somehow are inherent to specific governance forms, and also to the benefits.

The table below demonstrates the obstacles that software firms encounter when engaging in patent marketplace. This is an overview of share respondents that choose at least one obstacle in the corresponding category, averaged across governance forms, taking care to avoid double-counting.

Table 7: Obstacles in Patent marketplace, sorted averaged across governance forms

| Broad categories                                 | Obstacles  | Percentage |
|--|--|------------|
| <b>Search problems</b>                           | Difficulty in locating the owners of a patent/patents                            | 5%         |
|  | Difficulty in locating the users of a patent/patents                             | 7%         |
|  | Difficulty in finding the best   | 7%         |
| <b>Patent assessment / transparency problems</b> | The description or drawing in the patent document is not clear                   | 7%         |
|  | Difficulty in assessing the degree of novelty/originality of the patent/patents  | 11%        |
|  | Difficulty in assessing the economic value of the patent                         | 14%        |
| <b>Contract and enforcement problems</b>         | Difficulty in negotiating a price for the patent/patents                         | 16%        |
|  | Difficulty in negotiating the terms (not related to price) of the contract       | 11%        |
|  | Excessive cost of enforcing the contract   | 11%        |
|  | Problems (not related to cost) with enforcing the contract                       | 5%         |
|  | Trust issues (e.g. opportunistic behaviour, free-riding, or similar)             | 2%         |
| <b>Regulation and practices</b>                  | Regulations allow too exclusive rights   | 2%         |
|  | International patent regulations do not fit the needs of different local markets | 2%         |
|  | Differences in practices of firms *  | 0%         |

\* No firms choose differences in practices of firms as one of their obstacles in patent marketplace

Based on the table above, it can be seen that the greatest shares of firms identify difficulty in negotiating a price of patent (16%) as the main obstacle. The least obstacle chosen by firm is in relation to issues on trust, patent regulations with too exclusive rights and also international patent regulations that do not fit the needs of local markets; where all of them only take 2% of the total obstacles respectively. It seems that differences in practices of firms is not a problem for firms that involve in the patent marketplace.

Since it is important to investigate whether these obstacles affect firms according to the governance structures, ‘Revealed Governance Obstacle’ (RGO) index is computed, exactly

like the one with benefits, only this time with respect to obstacles. This will enable us to understand the importance of the governance forms and the nature of the marketplace itself.

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

$$RGO = (x_{ij} / \sum_i x_{ij}) / (\sum_j x_{ij} / \sum_i \sum_j x_{ij})$$

This index only assumes positive values: a value that is smaller than 1 indicates that obstacle  $i$  is relatively under-specialized in governance form- $j$ , while a value greater than 1 indicates that governance form  $i$  is relatively over-specialized in that obstacle.

The research question that we are trying to answer emphasised that obstacles are highly specific to governance forms in patent marketplace, and this is supported by the value of the RGO index shown in table 8.

In patent marketplace, we find that firms are particularly has problem with locating the owner of the patent when they want to licensing-in the patent. On the other hand, firms find it difficult in locating the user of their patent when they want to sell and out-license their patent. Firms also find it difficult to search for the best patent available, especially when they want to buy and licensing in. These results are predicted since each of governance forms has their own search problem.

On patent assessment and transparency problems, firms find it difficult to understand the description or drawing in the patent document when they involve to in-licensing and cross-licensing of patents.

Table 8: Index of Revealed Governance Obstacle (RGO)

| Broad category                                   | Obstacles  | Selling     | Buying      | Out-Licensing | In-Licensing | Cross-patenting | Patent-pool* |
|--|--|-------------|-------------|---------------|--------------|-----------------|--------------|
| <b>Search problems</b>                           | Difficulty in locating the owners of a patent/patents                            | 0.00        | 0.00        | 0.00          | <b>2.62</b>  | 0.00            | NA           |
|  | Difficulty in locating the users of a patent/patents                             | <b>3.80</b> | 0.0         | <b>4.38</b>   | 0.00         | 0.00            | NA           |
|  | Difficulty in finding the best   | 0.00        | <b>1.90</b> | 0.00          | <b>1.57</b>  | 0.00            | NA           |
| <b>Patent assessment / transparency problems</b> | The description or drawing in the patent document is not clear                   | 0.00        | 0.00        | 0.00          | <b>1.97</b>  | <b>1.46</b>     | NA           |
|  | Difficulty in assessing the degree of novelty/originality of the patent/patents  | 0.00        | <b>1.58</b> | 0.65          | <b>1.16</b>  | 0.65            | NA           |
|  | Difficulty in assessing the economic value of the patent                         | <b>2.34</b> | <b>1.10</b> | 0.90          | 0.81         | 0.90            | NA           |
| <b>Contract and enforcement problems</b>         | Difficulty in negotiating a price for the patent/patents                         | <b>1.27</b> | <b>1.58</b> | 0.49          | 0.87         | 0.97            | NA           |
|  | Difficulty in negotiating the terms (not related to price) of the contract       | <b>1.52</b> | 0.95        | <b>1.17</b>   | 0.79         | <b>1.17</b>     | NA           |
|  | Excessive cost of enforcing the contract   | 0.00        | 0.59        | <b>1.46</b>   | 0.98         | <b>1.46</b>     | NA           |
|  | Problems (not related to cost) with enforcing the contract                       | 0.00        | 0.95        | <b>2.34</b>   | 0.00         | <b>2.34</b>     | NA           |
|  | Trust issues (e.g. opportunistic behaviour, free-riding, or similar)             | 0.00        | 0.00        | 0.00          | <b>2.62</b>  | 0.00            | NA           |
| <b>Regulation and practices</b>                  | Regulations allow too exclusive rights   | 0.00        | 0.00        | 0.00          | <b>1.31</b>  | <b>2.92</b>     | NA           |
|  | International patent regulations do not fit the needs of different local markets | 0.00        | 0.00        | 0.00          | <b>2.62</b>  | 0.00            | NA           |
|  | Differences in practices of firms **   | NA          | NA          | NA            | NA           | NA              | NA           |

\* Since no firms have tick any obstacles for patent pool, we did not include this governance form in our analysis, thus denotes as NA.

\*\* No firms chose differences in practices of firms as one of their obstacles in patent marketplace, calculation for the RGO also cannot be calculated, thus denote as NA.

It is interesting to note that firms find it difficult to negotiate the price of patents the most when they are buying and selling them. In terms of difficulty negotiating the terms of the contract that is not related to price, firms experience the problem more when selling, out-licensing and cross-patenting.

When we look into the cost problem of enforcing the contract, firms experience it more whilst licensing out the patent. It is also the same scenario for the problem of enforcing the contract that is not related to cost. Finally in the enforcement problem, trust only become an issue with cross-licensing.

On the problem of regulation and practices, the issue of regulations that allow too exclusive rights on patent only seems to be the problem with in-licensing and cross patenting. On the other hand, the issue of international patent regulations do not fit the needs of different local market deem to be a problem in licensing-in of patent. The differences practice of firms seems not to be a problem to any of UK firms that answered the survey.

As a summary, firms that involve in selling patents are likely to face difficulty in locating users of patent, assessing the economic value of patent and negotiating the terms of contract (related to price and non price). When firms buy patent, they are very likely to be involved in difficulty in finding the best patents. On top of that, they also find it difficult to assess the degree of novelty of the patent and assess the economic value of it. They also find it difficult to negotiate the price of the patent. Firms that licensing-out patent experience difficulty of finding the user of their patent. They also faced problem with enforcing the contract, find it difficult to negotiate the term with the contract that is not related to cost, and find the cost to enforce the contract a little bit excessive. It is also interesting to note that firms that licensing-in patents are the only ones that have a trust issues, and think that patents' regulations allow too exclusive rights and its international regulation do not fit the needs of different local markets. Apart from that, they also find it difficult in locating the best patents and its owners, find the description in patent document as not clear and find it difficult to access the novelty of the patent. Lastly, firms that involve with cross-patenting are likely to face difficulty in understanding the description of patents' documents and negotiating the terms of contract that is not related to price. They also think that the excessive cost of enforcing the contract, problem with enforcing the contract and too exclusive patents' rights as obstacles in patent marketplace.

The coefficient of variation of the RGO index allows us to access the extent to which obstacles are specific to certain governance structures or not.

*Table 9: Coefficients of variation across governance forms for RGOs*

| <b>Broad category</b>                            | <b>Obstacles</b>   | <b>Index of governance specialization (patent marketplace): <math>\sigma_{RGO}/\mu_{RGO}</math> *100%<sup>4</sup></b> |
|--|--|---|
| <b>Search problems</b>                           | Difficulty in locating the owners of a patent/patents                            | 224%  |
|  | Difficulty in locating the users of a patent/patents                             | 138%  |
|  | Difficulty in finding the best   | 138%  |
| <b>Patent assessment / transparency problems</b> | The description or drawing in the patent document is not clear                   | 139%  |
|  | Difficulty in assessing the degree of novelty/originality of the patent/patents  | 74%   |
|  | Difficulty in assessing the economic value of the patent                         | 53%   |
| <b>Contract and enforcement problems</b>         | Difficulty in negotiating a price for the patent/patents                         | 40%   |
|  | Difficulty in negotiating the terms (not related to price) of the contract       | 25%   |
|  | Excessive cost of enforcing the contract   | 69%   |
|  | Problems (not related to cost) with enforcing the contract                       | 104%  |
|  | Trust issues (e.g. opportunistic behaviour, free-riding, or similar)             | 224%  |
| <b>Regulation and practices</b>                  | Regulations allow too exclusive rights   | 153%  |
|  | International patent regulations do not fit the needs of different local markets | 224%  |
|  | Differences in practices of firms  | NA  |

Overall, these results suggest that firms experience obstacles are actually in response to specific governance structures. These results are consistent with the notion that benefits seek by firms are also in response to specific governance structures.

We also investigated the extent to which the obstacles that firms encounter across governance structures are correlated to the benefits they seek, but we did not find any strong patterns in this sense. This confirms that obstacles are more related to the nature of governance structures than to the firm's individual objectives.

<sup>4</sup> The calculation coefficient of variation for obstacle does not include the patent pool governance structure since the RGO index for it cannot be calculated.

## **SECTION 4: CONCLUSION**

This paper contributes that both economic benefits sought, and obstacles experienced in the value creation from patents, are specific to the choice of patent governance structures (buying or selling patents, simple or cross licensing, or pooling) used for value seeking. Results did not show a strong pattern between economic benefits firms seek with the obstacles they experience in their value creation process from patents, which confirms that obstacles are more related to the nature of patent governance forms than to the firms' individual objectives.

The implications of the results for policy and management are manifold. E.g. we see that firms are seeking a variety of economic value from their patents, and they use a variety of patent governance forms to reach this value, so there is no 'one size' policy or management for patents regarding supporting the value creation process. Also, value creation processes are not automatic, but policy makers and industrialists need to recognize the obstacles and conflicts experience by firms participating in such activities, and which may reduce the value they realize.

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