

Capturing value from innovation in knowledge-intensive service firms: the role of competitive strategy

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Abstract

Building on a problem-solving perspective to value creation and capture, and on the business strategy literature, we argue that the actions that knowledge-intensive business service (KIBS) firms take to identify, select and solve client problems will affect their approach to capturing value from innovation. We apply regression analysis to data from an original survey involving a sample of 230 innovations introduced by 150 publicly-traded UK and US KIBS firms. Distinguishing between cost- and differentiation-oriented KIBS firms, we find that cost-oriented firms tend to place more importance on all appropriability mechanisms than do differentiation-oriented firms. Furthermore, the perceived importance of formal appropriability mechanisms, relative to that of all appropriability mechanisms, tends to be higher for cost-oriented than for differentiation-oriented firms. This association is stronger for the case of the introduction of process (rather than product) innovation. These findings contribute to the strategy and service innovation literatures, by showing that KIBS firms' competitive strategies influence value capture, over and above the role of the innovation-, industry-, and institutional-level factors examined in earlier studies.

Keywords: value capture; innovation; competitive strategy; knowledge-intensive business services

Introduction

The question of how firms create and capture value from developing new processes, products or services, is central to the strategy and innovation literatures (Bowman and Ambrosini, 2000; Ceccagnoli, 2009; Cohen et al., 2000; Teece, 1986; 2006). Innovating firms employ various formal (patents, trademarks, copyrights, design rights) and informal (secrecy, lead-time advantages, complexity, complementary assets) appropriability mechanisms to capture value from innovation. The choice and perceived importance of these mechanisms has been shown to depend on such factors as: the nature of the innovation (product versus process), the type of sector, the capacity of firms to afford the cost of obtaining legal intellectual property (IP) rights, the ability of competitors to “invent around” the innovation, and the efficacy of legal IP protection (e.g. Cohen et al., 2000; Mansfield, 1986; Teece 1986, 2006).

Most previous research focuses on the choice and perceived importance of appropriability mechanisms of manufacturing firms concerning their technological innovations (Hall et al., 2014; James et al. 2013). Much less attention has been paid to the question how service firms capture value from innovation. This can be attributed to the historically dominant role of manufacturing sectors in the global economy, and to a “supplier-driven view” of service firms, suggesting that their innovation is limited to adopting externally developed technologies that enable the offering of new or improved services (Pavitt, 1984). These perceptions, however, ignore recent trends. First, the structure of most developed economies has shifted away from manufacturing and towards service industries (BEA, 2016; BIS, 2016). Second, surveys have repeatedly shown certain types of service firms to be among the most innovative firms of the economy (Miles, 2005).

In this respect, knowledge-intensive business service (KIBS) firms are of special interest. These are firms “*whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service or product solution to satisfy the client’s needs*” (Bettencourt et al., 2002, pp. 100–101). KIBS firms include such activities

as accountancy and legal services, architecture and advertising, software, computer services and engineering, testing, and R&D services (Miles, 2011). The competitive advantage of these firms depends on their knowledge, creativity, and innovation (den Hertog, 2000; Grant, 1996; Kogut and Zander, 1992).

It may be expected that KIBS firms are less concerned about the protection of their IP from imitation (than manufacturing firms) because of their focus on working closely with customers to produce services addressing their specific problems (Bettencourt et al., 2012; den Hertog, 2000; Miles, 2008; Oliveira and von Hippel, 2011). In practice, however, the use of appropriability mechanisms by KIBS firms in the same sector differs widely. For instance, in management consulting, while there is no evidence of McKinsey's aggressive pursuit of IP rights, the case of Accenture is different. Accenture has sued a competitor management consultancy company for copying the 'look and feel' of their slogans (trademarks) (Lawson, 2013) and a competitor software company for patent infringement and misappropriation of trade secrets over their insurance claims management software (Hals, 2009).

This study set out to examine how KIBS firms capture value from innovation, by focusing on the role of competitive strategy. Indeed, the specific processes that firms have in place to identify and select customers and solve their problems depend on their established routines and ultimately on their broader competitive strategy (see Porter, 1980, 1985; Treacy and Wiersma, 1995; Skivington and Daft, 1991). Cost-oriented firms (hereafter: COFs) try to gain high market share so as to improve their bargaining power and exploit efficiency gains arising from economies of scale and scope. In contrast, differentiation-oriented firms (hereafter: DOFs) compete by offering unique or leading-edge service-products, or by tailoring their service offerings to meet the demands and secure the loyalty of a few highly valuable customers. As a result, cost-oriented KIBS firms, which compete on the basis of scale and efficiency, can be assumed to be more concerned about how to best protect their IP than DOFs, whose services might be less systematized, codified and imitable.

Our theoretical model proposes that firms adopting different competitive strategies treat their IP differently and emphasize different appropriability mechanisms. Taking a problem-solving perspective on value creation and capture (Nickerson et al., 2007; Nickerson and Zenger, 2004), we argue that the specific actions by COFs and DOFs to select and solve client problems affect their approach to capturing value. A further crucial mediating factor of the competitive strategy-value appropriation relationship is derived from Barras' (1986) "reverse product cycle" analysis of service innovation. This suggests that service providers move from process innovation, through improving the quantity and quality of services, to new or improved service-products. We predict that, since COFs systematize processes to gain market share and expand to new markets, they will have stronger incentives to protect their IP early in this "cycle".

To test our predictions, we apply regression analysis to data from an original survey, conducted for the purpose of this study. This provides a sample of 230 product and process innovations that were introduced by 150 publicly-traded UK and US KIBS firms. Three findings emerge from the analysis. First, COFs tend to place more importance on all appropriability mechanisms as means of capturing value from innovation than DOFs. Second, the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms tends to be higher for cost-oriented than for differentiation-oriented firms. Third, the positive association between adopting a cost-oriented strategy and the relative importance of formal appropriability mechanisms within all appropriability mechanisms tends to be greater when the innovations that firms are introducing concern their service-processes.

The contributions to the literature are twofold. First, we contribute to the literature exploring how firms profit from innovation (Arundel, 2001; Leiponen and Byma, 2009; Hall et al., 2014; James et al., 2013). We study the challenge of capturing value from innovation in the KIBS sector of the economy, a significant empirical context overlooked by previous studies. Our results demonstrate the existence of important linkages between competitive strategy and the perceived importance of different

appropriability mechanisms, over and above the influence of innovation-, industry-, and institutional-level factors that studies of manufacturing firms have examined. Second, we contribute to the literature on competitive strategy (Bowman and Ambrosini, 2000; Treacy and Wiersma, 1995; Porter, 1980, 1985). We find evidence supporting the argument that firms' approaches to "value capture" are closely associated with their broader competitive strategies. The differences in value appropriation between cost- and differentiation-oriented KIBS firms are consistent with the view that competitive advantage comes from the way that firms align the full set of their activities.

The next section of this paper describes the theoretical background of our research. Subsequently, we outline the methods used, the empirical results, and implications for research and management practice.

Theoretical background

Determinants of value capture from innovation and KIBS firms

Innovating firms choose among different avenues to create value from novel ideas giving rise to improved processes and products. They can either exploit these ideas directly in the market for products, or indirectly by selling them through the market for ideas (Gans and Stern, 2007). No matter which avenue is selected, the innovator's share of the new value created tends to be smaller when appropriability is weak due to imitation by competitors (Teece, 1986, 2006).

Several studies have explored firm's choices among formal and informal appropriability mechanisms to capture value from innovation (see Hall et al. (2014) and James et al. (2013) for reviews). Formal appropriability mechanisms include patents, design rights, trademarks and copyrights. Informal appropriability mechanisms include the strategic exploitation of lead time, complexity in product design, the use of complementary production capabilities, and secrecy (Cohen et al., 2000; Teece, 1986, 2006). The literature has highlighted the role of institutional-, industry-, and innovation-level factors as determinants of IP protection decisions. We examine these in turn below.

In relation to institutional factors, differences in the strength of legal protection for IP rights across geographic regions imply some variance in the propensity to capture returns from innovation using formal appropriability mechanisms. In strong IP rights regimes, innovators with IP rights can resort to legal action in order to protect their interests against unlawful diminution of these rights (Hall et al., 2014; Hall and MacGarvie, 2010). Such strong regimes offer innovators incentives to employ formal appropriability mechanisms for exploiting their novel ideas by establishing licensing agreements or by translating them into valuable propositions for customers (Gans and Stern, 2003).

Concerning industry characteristics, there is agreement across innovation survey-based studies that patents confer rather weak IP protection in most industries. The exceptions are industries like pharmaceuticals, where a patented innovation tends to map into a commercializable product (Ceccagnoli, 2009; Cohen et al., 2000; Levin et al., 1987; Mansfield, 1986). In such discrete product industries, innovations have fewer patentable elements and it is easier for innovators to identify and defend against infringements. In complex product industries (e.g., computer equipment), in contrast, innovations are characterized by a large number of patentable elements. Innovators may find it difficult to develop a broad claim of novelty in a patent application, and to identify infringements. Other industry factors affecting the propensity to obtain formal IP protection include the ability of firms to “invent around” their competitors’ innovations (James et al., 2013).

Characteristics of the innovation in question also affect the importance of appropriability mechanisms. When the new knowledge related to an innovation cannot be easily articulated and codified (i.e., reduced to information by means of drawings, formulae, numbers or words), formal IP protection is impractical (Arora, 1997; Grant, 1996; Amara et al., 2008). The degree to which an innovation can be observed by individuals outside the innovating firm also matters. Unlike product innovation, which leads to the marketing of new or improved products, process innovations may involve proprietary elements of the value chain and be relatively less transparent to outsiders (Cohen et al., 2000; Levin et al., 1987). Often, formal appropriability mechanisms are more relevant to the

protection of product innovation, whereas informal appropriability mechanisms (especially secrecy) are more relevant to the protection of process innovation (Arundel, 2001; Harabi, 1995).

Fewer studies have examined the role of the innovator's own characteristics. There is some agreement that the propensity to patent rises with firm size and R&D intensity (Arundel, 2001; Hall et al., 2014; Leiponen and Byma, 2009). The explanation usually given is that smaller firms generally have fewer resources for obtaining and defending patents, for example, they are less likely to have in-house patent attorneys to help with the process of obtaining and enforcing formal IP rights (Graham et al., 2009; Somaya et al., 2007).

Most previous empirical work focuses on manufacturing firms and their technological innovations (Cohen et al., 2000; Hall et al., 2014; James et al. 2013), with less attention paid to capturing value from innovation specifically by service firms (e.g. Amara et al., 2008). The considerable heterogeneity of operations across services complicates the study of how service firms innovate and capture the resultant value. We focus on a particular set of services firms, KIBS, which span professional and technology-related services. Professional services include management consultancy, accountancy and legal services, banking and such services as architecture and advertising (von Nordenflycht, 2010). They typically have multiple touchpoints with clients, with relatively long contact time, and with much value-added in the "front office" where considerable judgement is applied concerning customer needs. Technology-related services are similar to professional services, but they are characterised by high use of scientific and technological knowledge and include such activities as software, computer services and engineering, testing and R&D services, where there is usually much technical back office work to accomplish (Miles, 2011).

In this study, we seek to improve our understanding of how firms capture value from innovation by considering the role of the characteristics of innovating KIBS firms. Taking a problem-solving perspective, we focus on the role of firms' competitive strategy.

Competition through a problem-solving perspective

The problem-solving perspective to how firms organise their activities provides a useful basis for a systematic examination of the links between strategy and value capture (Nickerson et al., 2007; Nickerson and Zenger, 2004). This perspective takes the problem identification process as the unit of analysis for exploring value creation, and uncovers the “strategic problems” that firms solve, whether embedded with clients, suppliers or their own organization. This perspective is appropriate for studying innovation by KIBS firms, which are knowledge-intensive organizations and whose innovation is often co-created with clients (Bettencourt et al., 2002; den Hertog, 2000; Miles, 2008; Oliveira and von Hippel, 2011). Although such firms are engaged in trying to solve numerous problems over their life-cycle, they tend to choose problems related to their existing knowledge assets (Nickerson and Zenger, 2004).

This perspective sees the roles of managers as: (a) identifying clients' problems - which, if solved, can yield new knowledge and improve their own organization's performance; (b) organizing ways of optimizing the likelihood, speed, and cost with which valuable solutions are discovered; and (c) ensuring the appropriation of a sufficient portion of the solution's value. As Nickerson and Zenger argue, “*valuable solutions deliver value to the firm, either through enhancement or development of a product or service or by reducing the cost of production delivery*” (p.619). Thus, the capacity of firms to identify and solve problems and capture (part of) the resultant value depends on their broader competitive strategy.

The competitive strategy literature has devoted considerable attention to the development of generic strategy types. Three of the most cited typologies emphasize different strategic components. Miles and Snow (1978) identify four patterns of organizational behaviour in adjusting to changing environments, classifying firms into defenders, prospectors, analyzers, and reactors. Porter (1980), emphasizing how firms create value for their customers, classifies firms depending on whether they pursue product/service differentiation, cost leadership and market focus. Treacy and Wiersema (1995) identify three “value disciplines” determining how firms achieve leadership, by delivering superior

customer value: operational excellence, product/service leadership, and customer intimacy. These strategy typologies, each with its own strengths and limitations (e.g. Hambrick, 1983), all contrast competitive strategies focusing on minimizing costs (and maximizing efficiency) with those focusing on offering differentiated products or services (Conner, 1991). They also all see strategy implementation as requiring consistency across the full system of value-creating activities (e.g., Gonzalez-Benito and Suarez-Gonzalez, 2010).

COFs aim to exploit sources of cost advantage such as effective supply chain management for sourcing and utilizing low-cost inputs, improving efficiency of operations, and standardizing offerings (Porter, 1980, 1985, Treacy and Wiersma, 1995). Critical success factors for these firms include gaining high market shares, so as to improve bargaining power, and gain efficiency through economies of scale and scope (Porter, 1980; Skivington and Daft, 1991). When it comes to KIBS, evidence suggests that many COFs emphasize operational competences, with the objective of leading the industry in terms of price and convenience. For example, this is the case for many integrated solutions providers, whose organization and learning processes are often project-based (Brady and Davies, 2004). Among such integrated solutions providers are large IT services firms, which tend to rely upon transferring industry-specific knowledge of staff across multiple clients (Miozzo and Grimshaw, 2005; 2011). These IT services providers aim at establishing a large and diversified client base, developing and maintaining cost-effective management information systems, and adopting a lean supply chain. They are further likely to outsource activities to suppliers located in low-cost countries, and to make frequent changes of preferred suppliers (Massini and Miozzo, 2012; Mol, 2007).

In relation to problem-solving, COFs are likely to emphasize relatively more analytical problem-solving processes (Nickerson et al., 2007). Such processes involve a set of structured steps to identify problems that, if solved, tend to reduce cost (or enhance quality) incrementally through reduction of variance or waste in particular steps of the value chain. Thus, these firms focus on well-

defined metrics – for example, lower costs or fewer defects – as they are oriented to satisfying clients whose needs are familiar and clearly defined.

In contrast, DOFs emphasize output quality, and must find ways to provide an offering that customers perceive to have unique features, worth paying a premium price for (Porter, 1980, 1985; Treacy and Wiersema, 1995). Differentiation by service firms may involve offering leading-edge service-products to customers, but can also take other forms. Some firms focus on tailoring their service offerings to meet the demands of a few highly valuable customers, thus securing long-term loyalty. These firms tend to collaborate closely with high-end clients and to invest critical resources into idiosyncratic projects and relationships (Hansen et al., 1999; Suddaby et al., 2008).

In relation to problem-solving, DOFs tend to focus on synthetic problem-solving processes (Nickerson et al., 2007). These processes generate inductive, exploratory syntheses in identifying novel client problems and solving them through novel resource combinations and integration. These firms thrive on ambiguity or less structured environments to develop innovation.

Strategy as a determinant of value capture from innovation

The aforementioned differences between COFs and DOFs can be further reflected in the way they manage their IP assets (Bowman and Ambrosini, 2000). Since COFs tend to compete on the basis of efficiency and scale, they need to develop routines to transfer knowledge and replicate their best practices internally across time, space and business unit boundaries (Szulanski, 1996, Winter and Szulanski, 2001). Replication of best practices requires that the firms recreate complex (and partly tacit) routines and processes, which are embedded in individuals and in intra-organizational arrangements (Nelson and Winter, 1982; Kogut and Zander, 1992).

Thus, we can expect that, compared to DOFs, COFs (when they are largely engaged in replication of internal practices) will be more actively pursuing concerted action to protect their IP. One reason for this is that, in replicating their organizational practices, they may become more aware of sources of novelty, and put in place mechanisms to capture value from these, and to render them

more easily protectable by formal means. Furthermore, as they systematize and replicate their practices (Leiponen, 2006), imitation by competitors (which may be a result of staff leaving the firms and being employed by competitors) could become easier, so they will take measures to protect their IP rights (Roy and Suvakumar, 2011).

In contrast, the knowledge generated by DOFs is likely to be more client-specific, with limited opportunities for cross-fertilization across clients and projects. When client problems are highly complex or unusual, KIBS firms often craft solutions based on clients' problems by establishing a multifunctional team combining multiple individual experiences, knowledge and competencies (Love et al., 2011). This client-specific knowledge tends to be largely embedded in individuals or in collaborative social arrangements (Kogut and Zanger, 1992). Some of these firms may put in place formal organizational processes for addressing client needs in their projects (Miozzo et al., 2012). But, because they are harder to learn, systematize or for others to replicate, these organizational features tend to be difficult to copy (Zander and Kogut 1995). The resultant sources of competitive advantage will be better protected through resource scarcity, immobility and causal ambiguity (Ambrosini and Bowman, 2010; Barney, 1991; Peteraf, 1993).

In addition, COFs will have stronger economic incentives to prevent unintentional knowledge leakages and imitation by competitors, in order to protect anticipated returns from innovation. As a result of placing emphasis on analytical problem-solving processes, COFs will tend to produce new solutions generating positive, proximate and predictable returns (March, 1991). In contrast, DOFs, emphasising synthetic problem-solving processes to explore new alternatives, are likely to generate knowledge which is still at a "pre-paradigmatic" stage (Teece, 1986, 2006). Solving novel and complex problems often involves long trial-and-error processes and complex patterns of interactions with clients (Perks et al., 2012). During this experimentation phase, failure occurs more frequently than success (Thomke, 2013). This process generates returns which tend to be uncertain, distant and

often even negative (March, 1991), making value capture more challenging. Therefore we hypothesize that:

Hypothesis 1: The perceived importance of all appropriability mechanisms as means of capturing value from innovation will be higher for cost-oriented firms than for differentiation-oriented firms.

Our second prediction has to do with the perceived importance of formal mechanisms relative to that of all of the appropriability mechanisms that may be employed. As noted, COFs, which rely on the exploitation of sources of cost advantages and emphasize analytic problem-solving processes, are more likely to generate new knowledge which can be relatively easily codified for formal protection (Fey and Birkinshaw, 2005; Hall et al., 2014). Furthermore, the need to share knowledge within organizational boundaries, as COFs grow, suggests that they will tend to increasingly formalize and systematize organizational knowledge (Winter, 1987; Zollo and Winter, 2002). Even when these firms offer their customers what appear to be bespoke solutions, these services tend to be largely standardized and only partially customized (Love et al., 2011). They are more likely to generate incremental innovations within established paradigms. Finally, COFs may not to be able to maintain or raise barriers to imitation by relying, for example, on secrecy. Having large supplier and client bases is liable to raise costs for drafting, monitoring and enforcing IP-related contractual agreements (Williamson, 1981).

In contrast, DOFs face greater challenges in formalizing and systematizing new knowledge which is still at a “pre-paradigmatic” stage. Furthermore, since these service providers tend to be engaged in a close and often exploratory relationship with client firms, the ownership and division of IP rights can be unclear or subject to dispute (den Hertog, 2000; Hagedoorn and Heszen, 2007). With the organizational knowledge and skills that are critical to solution generation being socially embedded and closely intertwined with individual expertise (Johnson and Foss, 2011), innovation taking place in DOFs may be better protected using informal mechanisms. Finally, when successful in innovation,

DOFs, emphasizing synthetic problem-solving processes, will tend to generate more significant innovations by combining diverse sets of resources. Anton and Yao (2004) show that radical (cf. incremental) innovations are less likely to be protected through formal mechanisms, because the costs of information disclosure are very high. We summarize the hypothesized higher relative salience of formal mechanisms in the set of appropriability mechanisms as follows:

Hypothesis 2: The perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms will be higher for cost-oriented firms than for differentiation-oriented firms.

We further argue that the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms for COFs will depend on the type of innovation. Previous studies of manufacturing firms suggest that patents are most important for capturing value from product innovation, whereas secrecy is most important for process innovations (Hall et al., 2014; Harabi, 1995; Arundel, 2001). However, fuller understanding of the challenge of capturing value from innovation in KIBS requires a service-oriented approach which emphasises the specificities of innovation in services (Tether, 2005; von Nordenflycht, 2010).

Barras (1986, 1990), building on the traditional product life-cycle model used in manufacturing (Abernathy and Utterback, 1978), proposed a “reverse product-cycle” model for services innovation. His model was originally based on examination of information-intensive industries such as financial services and real estate, but he generalised it to cases of service industries being transformed through the use of new Information Technology (IT). Thus, the model has applicability to services who are first adopting IT to support their own processes, and ultimately learn that this can be the basis for offering improved service quality and new services (Gallouj, 1998, 2002). Specifically, Barras argues that service providers start with back-office process improvements to increase the efficiency of existing services (e.g., computerization of bank transaction records). Later, process innovation is intended to improve the quantity and quality of services (e.g., extended access to bank services by use of ATMs,

more frequent bank statements). Finally, new or improved service-products (e.g., online and home banking, new types of bank account and related services) are introduced, aiming to open up service provision to new markets. Barras' account has been criticised as mainly describing developments in the era in which service industries were first being transformed through new IT (Uchupalanan, 2000). However, the likelihood that some KIBS firms will move from adopting new processes to save costs, gain efficiency and improve quality, to realising new products enabled by these processes, make this approach relevant and worth considering (Gallouj, 1998; Gallouj and Savona, 2008; Nightingale, 2003).

Even if the three posited phases do not follow a rigid pattern, we suggest that, as COFs formalize and systematize processes to gain market share and expand to new markets, they will have incentives to obtain formal protection over their process innovation early in the “cycle”. Failing to do so, might mean that they will be unable to offer a new service later, when a competitor obtains formal protection of necessary process improvements (Ceccagnoli, 2009; Desyllas and Sako, 2012).

Finally, new services tend to emerge through crafting solutions based on clients' problems; some of these solutions may eventually lead to new service-products whose core is a replicable service (Love et al., 2011). Since the customer is a co-creator of value in services (e.g. Bettencourt et al., 2002), secrecy about processes may not be a viable option to protect new knowledge.

Thus, the association anticipated in Hypothesis 2, that the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms will be higher for COFs, can be predicted to apply more strongly for service-process innovations (which may eventually underpin new service-products) than for service-product innovations themselves. Accordingly, we introduce our final hypothesis:

Hypothesis 3: For cost-oriented firms the perceived importance of formal appropriability mechanisms, relative to that of all appropriability mechanisms, will be higher when process rather than product innovations are concerned.

Methods

Data sources and the model

The empirical analysis uses a sample of publicly-traded KIBS firms which are incorporated in the UK and the USA. Data are derived by matching two databases. The first of these, from an original survey, contains information on firms' innovation activity, perceived importance of appropriability mechanisms, competitive strategy, and other characteristics. The survey was administered through telephone interviews between September and December 2012. The second database is Thomson's Datastream, one of the most comprehensive data sources for economic and financial information for publicly-traded firms.

The sampling frame for the survey is a list of all the UK and the US publicly-traded KIBS firms in Datastream.¹ The initial list comprises 406 UK and 1892 US firms. The respondents were selected to ensure that they were top management team members and knowledgeable about their organization's competitive and IP strategy.² Respondents, on average, had about 7 years of experience in their organizations, had served the organization in two different posts, and had spent about 5 years in their last position within their organizations: a long enough period of time to build an in-depth understanding of their organizations. All were given an overview of the survey so that they could judge whether they had adequate knowledge around the subject matter of the survey. The questionnaire was piloted on a small sample of subjects to establish that the questions were sufficiently clear and provided useful information for the dependent and explanatory variables of the study. The survey resulted in 223 responses (92 UK and 131 US firms), an overall response rate of about 10%, comparable to several previous studies (e.g. Mina et al., 2014).

¹ These are firms operating in SIC 48 communications; 60 banks; 61 non-depository credit institutions; 62 security and commodity brokers, 63/64 insurance carriers and agents; 65 real estate; 67 investment offices; 73 business services; and 87 engineering, accounting, research and management services; 82 educational services.

² Respondents were in senior managerial positions, including CEO, CFO, president and vice president, head of marketing, head of communications, and head of business development.

We tested for non-response bias by comparing the characteristics of the respondents and the whole sample in terms of firm size, industry, and country of origin. The response rates are significantly different in the U.K. and the U.S. (23% and 7% respectively), and biased in favor of U.K. firms (X^2 test=94.5, $p<0.001$) and large firms (measured by number of employees) (t -test=-4.4, $p<0.001$). To adjust for non-response bias in firm size and country, we applied a weighting technique based on logistic regression modelling (David et al., 1983; Kalton and Flores-Cervantes, 2003). We regress whether each of the firms in our sampling frame responded to our survey on firm size and country of origin and we estimate each firm's propensity to respond to the survey. Then, we weight observations of the focal regressions by the reciprocal of each firm's estimated propensity to respond. We also tested early and late respondents, as the latter are often assumed to be more similar to non-respondents. We found no evidence suggesting that competitive strategy differs between 50 early and 50 late respondents (which had to be prompted several times to respond) (X^2 test=2.10, $p=0.15$) (Armstrong and Overton, 1977).

We acknowledge the possibility of common method bias affecting our regression analysis, since our dependent and independent variables are based on responses to the same survey instrument. It has been argued, however, that models assuming a nonlinear relation between the response and predictor variables (as in the case of our fractional logit regression) are less affected by common method bias (Chang et al., 2010; Siemsen et al., 2010). Nonetheless, we adopted a number of standard practices to minimize the risk that our results are subject to common method bias (Podsakoff et al., 2003). First, the questions related to our dependent and independent variables were placed in different sections of the survey. Second, the questionnaire included different types of responses, including Likert scales, yes/no answers, and questions requiring numbers. Third, we assured respondents that their identity and responses would remain anonymous and confidential. Fourth, our analysis combines variables constructed using subjective information from our survey with others constructed using information from Datastream. Finally, we formally tested whether the results suffer from common

method bias by assessing the effect of a single unmeasured latent method factor (Podsakoff et al., 2003). We found that the variance attributed to the single common method is less than 1%, suggesting that common method bias is not significant.

The empirical analysis is conducted using data from firms which introduced at least one innovation during the period 2009–2011. We adopted a two-stage cluster sampling design. The primary sampling units are firms, and the secondary sampling units are their portfolios of product or process innovations. The unit of analysis in the regressions is their portfolio of product or process innovations. To adjust for intra-firm correlation of observations within a firm, we use the Huber-White cluster-robust standard error estimator (Rogers, 1993; White, 1980; Williams, 2000).³ Due to missing observations in some of the explanatory variables, the final sample in the analysis comprises 230 product and process innovations, derived from 150 innovating firms.

The dependent variables for hypothesis testing are measured on a self-reported 1-5 Likert scale (respondents were asked to score the significance of various appropriability mechanisms in capturing value from their innovation). As with other surveys, the quality of responses reflects the suitability of the informants and is subject to biases arising from personal perceptions. In order to minimize the impact of this possible source of bias, we focused our attention on whether respondents assigned low (scores 1-3) versus high (scores 4-5) importance to each of the appropriability mechanisms (similar to Laursen and Salter, 2014). We then created a measure of the perceived importance of all eight appropriability mechanisms' by adding up the transformed scores (as we explain later, our results are not sensitive to this transformation). Since this measure takes non-negative integer values (as they are counts of scores), Poisson or negative binomial regression models could be appropriate. However, because the dependent variable is restricted by an upper bound (8 is the maximum score), the assumption that the conditional distribution of the dependent variable comes from an exponential family is not fulfilled and such models are not appropriate. Following previous studies (Laursen and

³ This heteroscedasticity-consistent estimator also takes account of the presence of heteroscedasticity of unknown form.

Salter, 2014), we use a fractional logit model (Papke and Wooldridge, 1996) to examine the relation between firm's competitive strategy and the perceived importance of appropriability mechanisms. This model is also particularly appealing for testing the hypotheses 2 and 3 regarding the relative importance of formal mechanisms (formality quotient). Furthermore, we carry out sensitivity analyses to check the robustness of our findings to the operationalization of our dependent variable and the estimation approach. In particular, we check the robustness of our findings regarding Hypothesis 1, using an alternative (untransformed) measure of our dependent variable and a negative binomial regression specification (see “sensitivity analysis” section).

Dependent variables

Hypothesis 1 concerns the perceived importance of all appropriability mechanisms. To design the survey questions concerning value appropriation (i.e. the wording of the questions for each mechanism and the options available to respondents), we drew on previous innovation surveys. We primarily followed the Community Innovation Survey (CIS) - which has been used in a number of studies (Arundel, 2001; Brouwer and Kleinknecht, 1999; Hall et al., 2014) - and the Yale/Carnegie Mellon survey (Cohen et al., 2000; James et al. 2013). Accordingly, for each portfolio of innovations (i.e., product or process innovations), we asked respondents to score from 1 to 5 how significant each of the following mechanisms have been in capturing value from their innovation: 1) patents, 2) business method patents, 3) copyrights, 4) trademarks, 5) design rights, 6) secrecy, 7) complexity of the service or service-process, and 8) complementary service development and delivery capabilities. Responses to this question are likely to be reflecting the perceived effectiveness of a mechanism in value appropriation and the frequency with which a mechanism is employed (Cohen et al., 2000).⁴

⁴ Since our measures are based on perceptual measures of the importance of appropriability mechanisms, we acknowledge that these measures might diverge from the extent to which sample firms actually rely on particular appropriability mechanisms. This can be particularly true since the importance of each appropriability mechanism is measured using a single item. In order to assess whether the “perceived importance” of, and “reliance” on, different appropriability measures are broadly consistent dimensions, we collected information from the Derwent patent database on the actual number of patents granted to our sample US firms and compared it with their recorded scores of perceived importance of patents as means of value appropriation. The average number of patent grants is actually monotonically increasing with the recorded

The ‘*all appropriability mechanisms’ importance*’ measure is constructed as follows. First, each of the eight appropriability mechanisms is coded as a binary variable, to indicate the significance of this appropriability mechanism in capturing value from innovation. Here, 0 indicates no or low perceived significance (original scores 1-3) and 1 indicates high perceived significance (original scores 4-5). This transformation makes scales less sensitive to respondent-specific perspectives. Second, the significance of all appropriability mechanisms is added up, running from 0 to 8. The scale formed from these items, as a proxy for the perceived significance of a firm’s overall appropriability mechanisms, has a high degree of internal consistency (Cronbach’s $\alpha = 0.851$; see Table 1). Third, in order to apply fractional logit regression, we divide the sum by 8 (the highest possible number of appropriability mechanisms seen as significant). The resulting variable takes values between 0 and 1. The greater the value, the higher level of the perceived importance of all appropriability mechanisms.⁵

[Insert Table 1]

Hypothesis 2 concerns the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms. The sets of items that have been defined as formal (items 1-5) appropriability mechanisms in the literature (Cohen et al., 2000; Hall et al., 2014; James et al. 2013) appear to have a good degree of internal consistency (Cronbach’s $\alpha = 0.882$).

We proxy for the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms using the variable ‘*formality quotient*’. For this purpose, we construct the variable ‘*formal appropriability mechanisms’ importance*’. Each of the five formal appropriability mechanisms is coded as a binary variable, as explained above. Then, the importance of the five formal appropriability mechanisms is summed (running from 0 to 5) and this score is divided

score of perceived patent importance. We therefore feel that there is a good degree of agreement between perceived importance and actual reliance on the various mechanisms. Results are available upon request.

⁵ We carried out several tests to check the sensitivity of our findings to the measurement of the dependent variables. For example, we found a highly positive and significant correlation coefficient between the “all appropriability mechanisms’ importance” variable when it is constructed using the dichotomized and the original scores of respondents’ perceived importance (0.896, $p < 0.01$). In addition, our findings continued to hold when we replicated the regression analysis with the variable calculated using the original scores. Results are available upon request.

by 5 (the highest possible number of formal appropriability mechanisms seen as important). Similarly, we calculate the variable '*informal appropriability mechanisms' importance*'. Each of the three informal appropriability mechanisms is coded as a binary variable. Then, the importance of the informal appropriability mechanisms is summed (running from 0 to 3) and this score is divided by 3 (the highest possible number of informal appropriability mechanisms seen as important). Finally, we construct the variable '*formality quotient*' by calculating the ratio between '*formal appropriability mechanisms' importance*' and the sum of '*formal appropriability mechanisms' importance*' and '*informal appropriability mechanisms' importance*'. The resulting variable can take values between 0 and 1. The greater the value of the variable, the higher the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms.

Independent variables

Our hypotheses revolve around the fundamental distinction between COFs and DOFs. We adopt a dual approach to capture competitive strategy types through our survey by combining deductive and inductive approaches (Hinkin, 1995). A deductive approach was based on a review of the literature on strategy typologies. Given that the empirical context of the study is KIBS firms, our attempt was to design questions that would better enable respondents to identify and select the most appropriate competitive strategy type. Treacy and Wiersema's (1995) strategy typology, emphasising three "value disciplines" (operational excellence, service leadership, and customer intimacy), has been found appropriate in previous studies focusing on service firms (e.g. Potgieter and Roodt, 2004). We complemented this approach, by adopting an inductive method, examining annual reports of 50 UK KIBS firms in 2012 and interviewing managers of six UK KIBS companies. Table A1 (in the Appendix) provides example quotations from company annual reports, reflecting each strategy type. This approach revealed an additional way whereby KIBS firms differentiate their offerings, apart from "service leadership" and "customer intimacy". These are cases where KIBS firms create value by offering a unique perspective on their clients' problems, and rely on a combination of unique

professional knowledge and skills to address these client problems. In order to allow for this possible strategy approach in our survey instrument, we adopted a KIBS-specific extension of Treacy and Wiersema's strategy typology as developed by Miozzo et al. (2012).

Following previous studies (e.g., Troilo et al., 2014; McDaniel and Kolari, 1987; Snow and Hambrick, 1980), we adopted a (so called) "self-typing" approach to capture strategy types.⁶ We asked respondents to select which competitive strategy best describes their company's competitive strategy: 1) operational excellence: the company's strategy emphasises efficiency, low cost and competitive prices relative to competitors, 2) service leadership: the company's strategy emphasises offering leading-edge services that enhance clients' businesses, 3) unique services: the company's strategy emphasises delivering a unique service using a particular mix of skills and technology resources that transform clients' businesses, and 4) customer intimacy: the company's strategy emphasises tailoring service offerings to match exactly the demands of key customers. Initial piloting of the questionnaire with nine companies confirmed that these questions were well understood by respondents, establishing face validity.

The four ideal strategy types can manifest themselves – to varying degrees – into multiple dimensions, including pricing, marketing communications, operating costs, resource utilisation, innovation inputs and outputs, and management systems and controls. Since these dimensions often vary across different parts of multidivisional organizations (Bowman and Daniels, 1995), and our sample consists of large and (often) multidivisional companies, we chose to focus on the organizations' overarching strategy orientations (in a way similar to the group-level consolidated information presented in annual reports) (MacKenzie et al., 2011).

⁶ Our study set out to explore associations between competitive strategy and capturing value from innovation. We are thus interested in capturing a firm's "intended" strategy as a broad description of a firm's desired position in the market place. Top management team members should be knowledgeable about their firms' broad strategic orientation as they should have been involved in strategy formulation and implementation (See Bowman and Ambrosini (1997) for a detailed discussion of the strengths and weaknesses of managerial perceptions).

Using this information, the dummy variable '*cost-oriented strategy*' is constructed using item 1 (coded 1). The rest of the items (2-4) representing the reference category (coded 0), are seen as indicative of a differentiation-oriented strategy. (In the sensitivity analysis which follows, we further explore the trends when DOFs are decomposed into three strategy sub-groups for service leadership, unique services, and customer intimacy).

Any survey of this kind might be subject to problems arising from single respondent perceptions (Bowman and Ambrosini, 1997) and functional expertise biases (Bowman and Daniels, 1995). To assess the extent to which these problems apply, the literature recommends considering multiple sources of information when evaluating a firm's strategy (Snow and Hambrick, 1980; Hambrick, 1983; Bowman and Ambrosini, 1997). We thus compared firms classified as either cost- or differentiation-oriented on the basis of questionnaire responses against an objective indicator. Previous studies suggest that DOFs tend to exhibit higher general, selling and administrative (GS&A) expenses than COFs (McAlister 2016; Higgins et al. 2015). Testing for corresponding trends for a subsample of 100 firms with data available from Datastream, we found that GS&A expenses per firm employee were economically and statistically significantly different between cost- and differentiation-oriented sample firms (mean=90.12 versus 167.06; p-value=0.045). This result increased our confidence in our strategy categorization and reduced concerns of possible common method bias arising from measures of the predictor and criterion variables from the same rater (Podsakoff et al., 2003).

Process innovation. We asked respondents whether they introduced any new and significantly improved service-processes or service-products during 2009-11: the dummy variable '*process innovation*' is equal to 1 for process innovation and zero otherwise. We adopt this variable, together with its interaction with the variable '*cost-oriented strategy*', to test Hypothesis 3.

Control variables

We include a number of control variables that have been shown to influence appropriability strategy (see Table 1 for details on measurement). We control for the ‘*number of innovations*’ introduced by the firm (measured by the natural logarithm of product and process innovations). Introducing several innovations simultaneously might compromise a firm’s capacity to manage them and capture the resultant value created (Van de Ven, 1986). The index ‘*R&D investments*’ is created using the survey question about whether a firm spent in a number of activities to support innovation. Prior literature finds that R&D performing firms are more likely to have patentable inventions (e.g. Hall et al., 2014). Firm size is proxied by the variable ‘*number of employees*’ (measured by the natural logarithm of the number of employees). Large firms tend to perceive patents as more important appropriability mechanisms (e.g. Leiponen and Byma, 2009; Arundel, 2001).

To further strengthen our analysis, we estimate an augmented specification with additional control variables. A dummy is employed to capture whether the firm has introduced a ‘*radical innovation*’, i.e., innovation new to the market (to avoid a sample reduction due to a few non-responses to the survey question about radical innovation, the dummy for radical innovation is set equal to zero when a respondent failed to respond, and we created a dummy variable that equals one in cases of a non-response, and zero otherwise⁷). There is evidence suggesting that firms prefer secrecy over patents for more radical innovation to avoid early public disclosure of their novel ideas (e.g. Anton and Yao, 2004). We control for the extent to which organizational knowledge is formalized, which may increase the likelihood of knowledge leakage (Cohendet and Steinmueller, 2000). The dummy variable ‘*formalized organizational knowledge*’ is constructed, taking a value of 1 when a firm takes systematic action to codify, document, share and exploit organizational knowledge (the dummy is set to zero, otherwise.) The index ‘*innovation collaboration*’ is constructed based on whether the firm collaborated for innovation with suppliers, clients, competitors, consultants and commercial laboratories, universities, and government or public research institutes. Previous work reports a

⁷ Regression results presented in Table 3 show that our findings are not sensitive to this normalization.

positive association between innovation collaboration and the perceived importance of formal mechanisms (e.g. Miozzo et al., 2016). The dummy variable ‘*manufacturing*’ is used to capture whether the firm is also active in the manufacturing sector (SIC 20-39). KIBS firms with some manufacturing activity can be relatively familiar with the use of formal appropriability mechanisms (Greenhalgh and Rogers, 2007). The variable ‘*cash holdings*’ (measured by the ratio of total cash and equivalent, to total assets) is used to account for the fact that formal IP protection can be prohibitively costly to obtain, especially for small firms (Graham et al., 2009). A dummy variable to control for firms incorporated in the USA. All regressions include seven industry dummies (2-digit SIC).

It is possible that the estimated associations can be inflated due to an endogeneity problem, i.e., the self-selection of competitive strategy and appropriability by “high-quality” firms. In the absence of instrumental variables that would fulfil both the relevance and strength requirements, proxies for firm quality should improve the robustness of our findings, even if they do not represent a perfect solution (Laursen and Salter, 2014). We thus employ three variables. The first, ‘*growth rate*’, is measured as the growth rate of the firms’ total assets. The second, *Tobin’s Q*, is measured by the ratio of the market value of a firm to its total assets (Gugler et al., 2004). Finally, we account for a firm’s ‘*human capital*’ which is measured by the proportion of staff with university degrees.

Results

The summary statistics and bivariate correlations of all of our variables are presented in Tables 1 and 2. Before turning to the multivariate analysis, a close look at our dependent variables is in order. Regarding the perceived importance of appropriability mechanisms, the importance of informal appropriability mechanisms outweighs that of formal appropriability mechanisms for our respondents (mean=0.473 versus 0.324, respectively). This result is in line with previous studies (e.g. James et al., 2013). The trends depicted in Figure 1, which shows mean values of perceived importance of different groups of appropriability mechanism by competitive strategy, are broadly consistent with our predictions.

[Insert Table 2 and Figure 1]

The main results of the fractional logit regressions are presented in Table 3. Models 1, 3 and 5 represent a parsimonious version of our model including only a subset of key control variables (to allow for a greater number of observations per parameter estimated), whereas Models 2, 4 and 6 include the full set of regressors. The results from Models 1 and 2 are consistent with Hypothesis 1, predicting that COFs perceive all appropriability mechanisms as being more important means of capturing value from innovation, compared with DOFs. The coefficient of the dummy for COFs from the full specification (Model 2) is positive and significant ($\beta=1.442$, $p<0.001$). Several of the control variables are statistically significant. Appropriability mechanism importance is positively associated with firm size, R&D investments, firm growth, the introduction of product innovations, having some manufacturing activity, and human capital. However, there is some evidence that introducing numerous innovations simultaneously might be compromising a firm's capacity to capture the resultant value created.

[Insert Table 3]

The results from Model 3 and 4 lend support for Hypothesis 2, according to which, the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms is higher for COFs than DOFs. The coefficient of the cost-oriented strategy dummy from the full specification (Model 4) is positive and significant ($\beta=1.003$, $p<0.05$). Again, a number of the control variables are significant. A higher perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms takes place for firms that are larger, are more active with innovation collaborations, and have higher human capital. Similar to findings from studies of manufacturing firms, service-process innovations have a lower likelihood of being protected effectively through formal appropriability mechanisms than product innovations. The fact that the positive link between cost-oriented strategy and formality quotient holds after controlling for

innovation type (product or process) supports the view that a given innovation may be protected differently depending on the strategy of the innovating firm.

Hypothesis 3 predicts that the association between adopting a cost-oriented strategy and the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms will be higher when these firms introduce process innovations. Models 5 and 6 augment the specification of Models 3 and 4 by adding an interaction term between cost-oriented strategy and process innovation. The coefficient of the interacted variables from the full specification (Model 6) is significantly positive ($\beta=0.802$, $p<0.05$). Since we estimate a non-linear model, additional checks are needed to confirm the statistical significance of the interaction effect (Ai and Norton, 2003; Berry et al., 2010; Bowen, 2012). We, thus, calculate the marginal probabilities for different combinations of the two dummies for cost-oriented strategy and process innovation and their differences, when all other covariates are set equal to their sample means. As can be seen from Panel B of Table 3, the effect of having a cost-oriented strategy on the probability of perceiving formal appropriability mechanisms as relatively more important among all mechanisms is greater when COFs introduce process innovations (i.e., $\Delta\text{Pr}(Y)_2=0.304$, $p<0.001$) than product innovations (i.e. $\Delta\text{Pr}(Y)_1=0.151$, statistically insignificant). Following Ai and Norton (2003), we compute the difference between the above two values to determine the interaction effect. The computed interaction effect is statistically significant (i.e. $\Delta\Delta\text{Pr}(Y)=0.153$, $p<0.1$). We further check the extent to which the interaction effect obtained above (i.e. the “total moderating effect”), is mainly driven by the inherent nonlinearity of the model (i.e. a “structural moderating effect”) (Berry et al., 2010; Bowen, 2012). We estimate a statistically significant negative and relatively small structural moderating effect (-0.032 , $p<0.05$). The direction and magnitude of the estimated structural moderating effect suggest that the estimated total moderating effect (0.153) actually arises from the inclusion of the interaction term. Taken together, these findings lend support for Hypothesis 3.

Finally, regarding national IP regime differences, results from Models 1, 3 and 5 offer some evidence that firms incorporated in the USA assign higher importance to all appropriability mechanisms and are characterised by a higher formality quotient compared with their UK counterparts. Given this study's empirical focus on KIBS firms, the prominent importance of formal appropriability mechanisms for US-based firms can be attributed to the greater potential to obtain formal protection for innovations relating to computer programmes and business methods in the USA. This potential arises from the judicial interpretation that the Patents Act includes "anything under the sun that is made by man" (Samuelson, 2008). However, the country effect becomes insignificant as more firm-level variables are accounted for in Models 2, 4 and 6.

Sensitivity analysis

To corroborate our results, we conducted several additional analyses. First, acknowledging the existence of possible differences within the group of DOFs, we replicate the analysis presented in Table 4, after discriminating among firms competing on the basis of service leadership, unique services, or customer intimacy. Service leadership firms become the reference category and we introduce two dummies for unique service and customer intimacy firms in the regressions presented in Table 4. The significantly positive coefficient of the strategy-oriented dummy in Model 1 continues to support Hypothesis 1 ($\beta=1.895$, $p<0.001$). Using a Wald-type test, we compare the magnitude of the estimated coefficients of COFs and customer intimacy-oriented firms. The test confirms that COFs are indeed more likely to perceive all appropriability mechanisms as important means of capturing value from innovation, than are customer intimacy-oriented firms ($X^2=5.71$, $p<0.05$). The significantly positive coefficient of the cost-oriented strategy dummy in Model 2 ($\beta=1.436$, $p<0.001$) provides further support to Hypothesis 2. The significant positive coefficient of the interaction effect between a cost-oriented strategy and process innovation in Model 3 ($\beta=0.800$, $p<0.05$) is consistent with the main regression results, reiterating support for Hypothesis 3. Furthermore, because differentiation-

oriented firms appear to be (insignificantly) more innovative than cost-oriented firms (ln number of innovations= 1.19 versus 0.69 respectively; $p=0.102$), we check the robustness of the results by replicating the analysis after excluding observations on the top 25% innovating firms in our sample. As can be seen from the results presented in Models 4-6, the aforementioned associations are confirmed.

[Insert Table 4]

Second, we check the sensitivity of our results to possible biases arising from idiosyncratic perceptions about firm strategy by our respondents. To minimize this possible source of bias, we repeat the analysis using a restricted sample, excluding respondents with less than three years of experience in their company at the time of the survey (as a result the sample size drops to 182 observations). The results reported in Models 1-3 of Table 5 suggest that the main relationships continue to hold.

Third, acknowledging that fact that our publicly-traded sample firms might be competing by adopting different strategies when they are active in multiple product markets, we replicate the analysis using a restricted sample of firms which operate in no more than three industrial segments (as a result the sample size drops to 161 observations). The results reported in Models 4-6 of Table 5 show that our findings continue to hold.

[Insert Table 5]

Finally, we check the sensitivity of the results regarding Hypothesis 1. We replace the dependent variable, which was measured using the transformed perceived importance of all appropriability mechanisms (i.e. 'all appropriability mechanisms' importance'), with a raw measure: the significance assigned to each appropriability mechanism (running from 1 to 5) is added up across the eight appropriability mechanisms. Reflecting this change, we now employ a negative binomial regression specification (since the conditional variance exceeds the conditional mean of the perceived importance of all appropriability mechanisms). The results reported in Table A2 in the Appendix are

qualitatively similar with those of Models 1 and 2 of Table 3. Overall, these sensitivity checks lead us to conclude that our findings are rather robust.

Discussion and conclusions

This study advances our understanding of how KIBS firms capture value from innovation by exploring the role of these firms' competitive strategy. The study articulated a theoretical account of how firms adopting different competitive strategies will treat their IP rights differently, tending to emphasize different appropriability mechanisms. Taking a problem-solving perspective (Nickerson et al., 2007; Nickerson and Zenger, 2004) and considering two broad strategy types (Conner, 1991; Treacy and Wiersma, 1995; Porter, 1980, 1985), we argued that the different competitive actions that cost-oriented and differentiation-oriented firms take to identify, select, and solve client problems will affect their approach to capturing value from innovation.

We found evidence that COFs tend to perceive all appropriability mechanisms as being more important means of capturing value from innovation than DOFs. Furthermore, the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms tends to be higher for COFs than for DOFs. These findings are consistent with the view suggesting that there are important differences in the way innovation takes place in the two sets of companies. It fundamentally differs in terms of the type of markets targeted, the type of client problems addressed, the selected approaches to solving client problems, the realised returns to innovation and, ultimately, the innovators' capacity to capture the resultant value from innovation. Finally, the positive association between adopting a cost-oriented strategy and the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms is shown to be stronger when KIBS firms introduce process innovations.

Our study contributes to two literatures. First, we contribute to research exploring how firms profit from innovation (Arundel, 2001; Leiponen and Byma, 2009; Hall et al., 2014; James et al.,

2013). We further our understanding of how firms capture value from innovation in the KIBS sector of the economy, which has been overlooked by previous studies. We propose and find evidence for the existence of linkages between competitive strategy and IP rights protection. These linkages hold even after controlling for the effects of innovation-, industry-, and institutional-level factors that earlier research studied. Thus, consistent with the problem-solving perspective, there seem to be gains when firms align their approach to value capture with the type of clients they select to serve and the problems they chose to solve. We also show that the positive association between adopting a cost-oriented strategy and the perceived importance of formal appropriability mechanisms relative to that of all appropriability mechanisms is stronger when COFs introduce service-process innovations. This finding, which is broadly consistent with Barras' (1986) "reverse product cycle" analysis, suggests that as COFs systematize processes to gain market share and expand to new markets, they have strong incentives to protect their IP early in the "cycle" (otherwise, customers or competitors may exploit innovation-related knowledge). The heightened importance of formal protection for process innovation by cost-oriented KIBS firms hints at an additional source of possible differences in innovation by services firms relative to manufacturing firms (Mina et al., 2014; Miozzo and Soete, 2001; Tether, 2005).

Second, we contribute to the strategy literature (Bowman and Ambrosini, 2000; Miles and Snow, 1978; Porter, 1980, 1985; Treacy and Wiersma, 1995), by finding evidence which supports the argument that a firm's approach to value capture is closely associated with the firm's broader competitive strategy. Although previous work has studied the links between competitive strategies and overall firm performance (Dess and Davies, 1984; Kim et al., 2004; Zott and Amit, 2008), our study is the first (of which we are aware) to examine the influence of a firm's competitive strategy on the use of different appropriability mechanisms to capture value from innovation. The findings that COFs are more active in taking action to protect their innovation using various appropriability mechanisms, and favouring formal appropriability mechanisms (more than DOFs) are consistent with

the view that, because they compete on the basis of scale, scope and production efficiencies, they become more aware of the need to take action to capture value from innovation. As they systematize their knowledge to obtain scale, imitation by competitors becomes relatively easier. Also because they engage with a relatively large network of suppliers and clients, relying on contractual agreements with several parties may be prohibitively costly. In contrast, innovation by DOFs may generate client-specific innovations which are sufficiently protected through resource immobility, causal ambiguity, and/or competitors' lack of absorptive capacity. These differences between COFs and DOFs accord with the view that a firm's competitive advantage comes from the way that a firm's full set of activities are aligned with one another.

These findings have two implications for managers seeking to increase the effectiveness of their firm's appropriability strategy. First, managers need to be aware that IP rights management needs to be placed in the context of their organizations' broader competitive strategy. Value appropriation tactics should be decided only after accounting for a firm's broader strategic objectives. This requires cross-functional coordination for capturing value from innovation - i.e. engaging a firm's IP rights counsel or Chief Intellectual Property Officer in the strategy making process. The second implication is that the particular challenges experienced in service innovation (particularly service-process innovation) imply that an early (pre-emptive) use of IP rights may be a necessity for service firms competing on the basis of scale and efficiency. Otherwise, if a competitor obtains formal protection first, innovating firms may be blocked from developing new service offerings facilitated by these new methods of service production and delivery.

Our study is subject to limitations. First, our study is designed to uncover associations, rather than to establish casual relationships between the competitive strategy and value appropriation from innovation. It seems reasonable to assume that a firm's innovation and appropriability strategies tend to account for this firm's longer-term strategic objectives, i.e. its competitive strategy in a Chandlerian sense (Chandler, 1962). However, we acknowledge that it is also possible that the conjectured

potential to appropriate value from innovation will be influencing the competitive decisions of this firm. As a result, the relation between the two sets of variables is likely to be endogenous to a number of factors, including industry structure, the regulatory environment, professional standards, and demand trends. Assessment of the direction of causality would require further analysis using longitudinal panel data over multiple respondents. Furthermore, as already mentioned, it is possible that the estimated association between competitive strategy and value appropriation may be affected by a different endogeneity problem: the self-selection of value capture approaches and competitive strategy by “high-quality” firms. Despite our efforts to capture observable firm heterogeneity, our approach does not represent a perfect solution, particularly with respect to unobservable firm qualities.

Second, administering a parsimonious survey instrument (developed for time-constrained company executives), compromises our capacity to capture the complexity of a firm’s competitive strategy. The relatively small effective sample of firms which were included in our analysis further restricts our ability to perform an exhaustive analysis of the competitive strategy-value appropriation association, such as to examine possible differences within cost- and differentiation-oriented groups of firms, or the cases of firms which are “stuck in the middle”.

Finally, our proxies for the importance of different mechanisms for appropriating value from innovation are based on perceptual measures and single-source responses, which can be problematic. Future studies could assess whether the different appropriability mechanisms actually are successful in capturing value from innovation by using objective measures of innovation-induced performance (such as revenues from new service product and process innovations, or income from licensing fees).

Despite the exploratory nature of the study, our work enriches our understanding of the factors associated with the relation between competitive strategy and different approaches to value capture. By capturing information on competitive strategy, innovative activity and appropriability mechanisms, we shed new light on how - in the increasingly important context of knowledge-intensive services -

firms capture value from their innovation. This opens fertile territory for further research into capturing value by service firms, and innovators more generally.

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