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ABSTRACT

Collaborative innovation literature shows that collaborating with clients enhances the innovation performance of firms particularly as regard the development of highly new products. In this setting, are highly new products the innovation category that drives the most firm's performance? This is a relevant research question in the innovation literature since it warns about the risks and limits of highly new products but has not considered the firm's performance implications of different categories of innovations developed by collaborating with clients. In this paper we consider different categories of innovation, product and process innovations new to the industry and new to the firm respectively, and develop original hypotheses about their implications over firm's performance. We develop and test our hypotheses on a sample of 99 Italian KIBS firms. We focus on KIBS firms since they are used to customize their services and collaborate with clients during the development of new services. Results support the idea that highly innovative product innovations are more strongly associated with a KIBS firm's growth, while weakly innovative process innovations are more strongly associated with a KIBS firm's productivity, but only in small firms. Theoretical and managerial implications for collaborative innovations settings are drawn.

INTRODUCTION

The study of innovation hardly needs justification as innovation is a primary source of growth and firms' competitive advantage (Damanpour, Walker and Avellaneda, 2009). The innovation literature has vastly analyzed the determinants of innovation and among them has emphasized the importance of collaborating with customers in the development of innovative products and services. This peculiar stream – named collaborative innovation literature – looks at how firms collaborate, the performance implications of collaboration with different partners, the categories of innovations that benefit the most from collaboration and also the potential drawbacks

of collaboration (Greer and Lei, 2012). Interestingly enough, while this literature has produced a number of contributes on the relationship between collaboration with customers and the firm's innovation performance by looking at the categories of innovations that benefit the most from that collaboration, it has almost neglected the study of a firm's economic performance implications of different categories of innovations generated by buyer-supplier collaboration.

Studies show a positive relationship between buyer-supplier collaboration and innovation performance measured as the ability to generate different categories of innovation (Vega-Jurado et al., 2008; Nieto and Santamaria, 2007; Ritala et al., 2015; Sieti, Smith and Park, 2001; Tether, 2002). However, the former studies do not discuss whether, ex-post, innovations generated through a more in-depth knowledge of clients generate superior economic performance for firms introducing such innovations (Li and Calantone, 1998; Tsai and Wang, 2009).

Therefore, despite the importance of clients' collaborations for innovation, we still lack a theory that disentangles the performance implications of different categories of innovation in a cooperative setting. The fact that collaborations positively affect the development of specific categories of innovation does not imply that a firm will be able to earn and grow thanks to these innovations. This is particularly the case of new to the industry innovations. On the one hand, firms collaborating with clients might experience lower environmental uncertainty, augment their innovative outputs and the abilities in marketing them, as well as their economic performances due to higher switching costs for buyers (Lieberman and Montgomery, 1988). On the other hand, however, in case of radical innovations, it might occur that the market does not easily accept these innovations and their effect over firm's overall economic performances are controversial (Suarez and Lanzolla, 2007).

In this paper we suggest that clients' collaborations may not only affect the ability to develop specific categories of innovations but could also affect the firm's ability to earn from the same innovations. In order to disentangle this topic, we posit this study within the collaborative innovation literature and investigate the relationship between different categories of innovation and

the associated firm's economic performances in a buyer-supplier collaborative setting by focusing on knowledge intensive business services (KIBS).

KIBS are enterprises whose primary value-added activities consist of the accumulation, creation, or dissemination of knowledge for the purpose of developing a customized service, including professional, design, communication and ICT firms (Bettencourt et al., 2002). KIBS services are often customized and the outcome of the collaboration of the service provider and the client via an intensive knowledge-sharing between the parties (Bettencourt et al. 2002; den Hertog, 2000; Landry, Amara and Doloreux, 2011). More specifically, research findings indicate that in KIBS services are often customized and in KIBS firms innovation processes are triggered by clients' requirements (Hipp and Grupp, 2005; Larsen, 2000; Päällysaho, 2008; Tether and Metcalfe, 2004). In other words, innovation in KIBS is fed by a client's needs and implemented through collaboration and recursive loops of client-supplier interaction, and knowledge and information sharing (den Hertog, van der Aa and de Jong, 2010). Therefore, the collaborative setting that characterizes KIBS represents an ideal research context for studying the effects of different categories of innovations on a firm's overall economic performances.

Building on the collaborative innovation and KIBS literature we distinguish between product/process innovations with different levels of novelty (Campagnolo and Cabigiosu, 2015; Sieti et al., 2001; Vega-Jurado et al., 2009; Santamaria et al., 2009) and we develop original hypotheses about their effect over KIBS firms' economic performance. We test our theoretical model on a sample of 99 Italian KIBS firms. Our results support the hypothesis that in a client-supplier collaborative setting, product innovations new to the industry more positively affect the growth of the service firm. Conversely, process innovations with a lower degree of novelty more positively affect KIBS firms' productivity.

Our results advance the collaborative innovation and KIBS literature by disentangling the performance implications of different categories of innovation in a setting characterized by collaborative innovation with clients. Particularly, we contribute to the collaborative innovation

literature by emphasizing how, despite the risks associated to more radical innovations, in this setting highly new products are those that drive the most the growth of firms. *Ex-ante* collaboration improves innovation performance as regard radical innovation and *ex-post* these are the most influent on the firm's growth. Nevertheless, we also show how these innovations have no effect on productivity, which is affected by process innovations new only to the firm. We also advance the KIBS literature by showing that KIBS firms gain a particular advantage in being first movers when they develop new services. We also show that KIBS firms increase their efficiency when they imitate existing process innovations. Hence, we contribute to explain the multifaceted relationship between innovation, timing of entry and a KIBS firm's performance.

Our study offers further managerial insights for practitioners. Since innovations have different effects on firms' performance and the nature of change associated with different types of innovations are different, our results imply that not all innovations are equally beneficial to a firm's performance. Thus, managers should carefully match their innovation efforts with the objective they determine to pursue when designing the innovation plans of their firms.

The paper is arranged as follows. In the next section we describe the theoretical grounds of our research question and develop the corresponding hypotheses. In the Data and Method section, we describe the research domain and sample; next, we illustrate how we operationalized the constructs. The results are then reported and discussed. In the last section, we summarize the most relevant findings and our conclusions, followed by comments on the study's limitations and future research directions.

THEORY DEVELOPMENT

In the next section we review the collaborative innovation literature to identify categories of innovation that are *ex-ante* more positively affected by buyer-supplier collaboration. This review shows that product innovations with a high degree of novelty are favored. Then we focus on the KIBS literature and show how innovation is *ex-ante* a byproduct of buyer-supplier collaboration

and innovation is expected, *ex-post*, to positively affect firm's performance. We then look at the studies about KIBS that try to account for the relationship between specific categories of innovation and performance. Finally, building on the collaborative, KIBS and first mover advantage (FMA) literature we present our hypotheses about performance implications of different categories of innovation in KIBS.

Collaborative innovation, innovation categories and performance

Working with customers helps suppliers identifying new market opportunities and helps firms realizing new products, quickly identify new trends, and enhance new technology applications. Several studies show that understanding the customer greatly affects new product success or failure (Li and Calantone, 1998, Sethi et al., 2001; Vega-Jurado et al., 2008).

Li and Calantone (1998) show how the knowledge of the market generates a superior product performance that leads to a higher firm's performance. Ritala et al. (2015) find that knowledge sharing with clients is beneficial for firms' innovation performance as regard product, process, managerial and marketing innovation. Firms typically possess different/complementary stocks and types of knowledge that can be shared through collaboration improving their innovation performance.

Tether (2002) finds that collaboration is more frequent among firms pursuing higher level rather than incremental innovations. Amara and Landry (2005) find that firms introducing innovations with a greater degree of novelty are more likely to use a wider range of information sources to develop or improve their products. Nieto and Santamaria (2007) show that collaboration with clients has a positive effect on both radical and incremental innovation. Sieti et al. (2001) find that customer's influence positively affects product innovativeness, measured as clients' perception of product innovativeness, as compared to competitors, along multiple dimensions. Lettl et al. (2006) suggest that in-depth collaboration and knowledge of clients may favor radical innovation in surgical equipment. The benefits of collaboration with external partners are particularly important

for complex, radical innovation and systemic innovation (Pittaway et al. 2004). Love and Mansury (2007) focused on KIBS and find that customers involvement has a strong positive effect on product innovation.

The analysis of the above studies overall suggest that the impact of client collaboration on innovation performance has been mainly focused on the firm's ability to develop product innovations with high newness. But which type of innovation has the highest impact over the firm's performance in a collaborative setting? Collaboration with clients may not only affect the ability to develop specific categories of innovations but can also affect the firm's ability to earn from these innovations. Looking at the model presented in figure 1 we have plenty of evidence about the positive relationship between buyer-supplier collaboration and innovation performance with studies that also distinguish between different categories of innovation (Vega-Jurado et al., 2008; Nieto and Santamaria, 2007; Ritala et al., 2015; Sieti, Smith and Park, 2001; Tether, 2002). But we still need to understand if the in-depth knowledge of clients generates superior performance associated to a specific category of innovation, the right side of the model (Li and Calantone, 1998; Tsai and Wang, 2009).

Insert Figure 1 about here

This is a relevant research question because knowing that collaboration positively affects the development of specific categories of innovation does not ensure that the firm will be able to earn and growth thanks to these innovations. Suppliers may face resistance from buyers when they search to overturn established products or interaction/delivery processes (Christensen, 1997). There may be resistance also to ideas that have been developed in collaboration with customers. For example, Lilien et al. (2002) identify tensions between buyers and suppliers during the development and implementation of the commonly generated ideas. Customer resistance may bias their

involvement in NPD activities toward incremental innovation that is usually perceived as less risky and expensive (van der Panne et al. 2003).

The strategic literature warns that results about performance implications of first mover advantage (FMA) are inconclusive and that scholars as well as managers need an in-depth understanding of the setting under analysis when discussing FMA. Coherently, FMA literature has identified and debated macro and firm-level variables that amplify or hinder the first mover advantage (Suarez and Lanzolla, 2007). Interestingly, buyer-supplier collaboration may favor the firm's ability to earn from innovations introduced as first movers because buyers are less likely to switch to other suppliers (Lieberman and Montgomery, 1988).

Innovation and performance in KIBS

Innovation in KIBS firms has been studied from various perspectives, one of which (and the most often studied) is how KIBS firms produce and circulate knowledge, and foster innovation processes at client level (Strambach, 2001). Attention has also been devoted to the innovation process within a KIBS firm (Amara, Landry & Doloreux, 2009; Corrocher, Cusmano & Morrison, 2009). Along this line of research, scholars have tried to shed light on the particular characteristics of the innovation process within KIBS firms and have debated whether they distinguish KIBS firms from manufacturing companies (Tether, 2005), and from traditional business service firms (Barras, 1986; Bryson & Monnoyer, 2002; Freel, 2006). Research findings indicate that innovation processes in KIBS are triggered by their clients' requirements (Hipp and Grupp, 2005; Larsen, 2000; Päällysaho, 2008; Tether and Metcalfe, 2004) and fed by a client's needs (den Hertog, van der Aa and de Jong, 2010). KIBS firms are problem solvers that are asked to develop customized solutions to answer to clients' need. KIBS co-develop their services with clients because they need to understand clients needs in order to define the content and characteristics of their services. Also, KIBS firms need to have an in-depth understanding of how their services have to be integrated into

the client's processes as well as the characteristics of client's industry and competitive setting[1]. All these information and knowledge have to be transferred from the clients to the KIBS firms at the beginning of the service development (Bettencourt e al., 2002; Stambach, 2001). This way KIBS can effectively act as problem solvers and deliver customized service solutions. The customization/collaboration loop feeds innovation in KIBS (Campagnolo and Cabigiosu, 2015; Muller and Zenker, 2001, Den Hertdog, 2000). As Greer and Lei (2012) and Etgar (2008) pointed out, firms may use customization and clients' collaboration to shape product ideas and reduce development risks. The ability to offer precise customization at the level of the individual customer is also linked with stronger bonding and customer lock-in (Vandermerwe 2000), which is particularly relevant in a business-to-business context.

Overall innovation capabilities are crucial for KIBS firms to accomplish clients' need and for their competitive advantage. Building on these arguments, scholars have focused on the effect that innovations have on KIBSs' performance and specifically focused on growth and productivity with somehow contrasting results. Cainelli et al. (2004; 2006) analyze an Italian region, the Lombardy, and found that innovative KIBS firms grow more and are more productive than non-innovative KIBS (Cainelli et al., 2004; 2006). Love et al. (2011) analyze UK KIBS firms and find a positive relationship between innovation and sales growth. Similarly, Evangelista and Savona (2003) find that those service firms that invest more in innovation are more likely to grow. Mansury and Love (2008), analyzing a sample of business-to-business US service firms, find a positive relationship between innovation and growth but not between innovation and productivity. The authors suggest that new services may disrupt pre-existing procedures thus reducing productivity in the short term. Alternatively, newly introduced products may initially be produced through scarcely efficient

[1] Clients are expert about their inner functioning and their industry setting and they transfer these information and knowledge to KIBS firms. Sometimes clients can also be expert about the KIBS service itself thus increasing their contribute to the service development. Nevertheless, clients that are expert of the acquired service constitute a somehow special case (Cabigiosu et al., 2015).

production processes, which negatively impact on productivity. Later on, once the production process is settled, process innovations are likely to positively affect efficiency.

Overall, the mainstream KIBS literature does support the existence of a positive relationship between service innovation and growth. Again, most of the empirical contributes show a positive effect of service innovation on productivity.

Taking for granted that innovation increases KIBS firms' performance, which innovations better explain firms' growth and productivity in this setting characterised by collaborative innovation with clients? The concept of service innovation is broad and needs further development. Articles differ greatly regarding what service innovation is and how it is used (Wittel et al. 2015; Toivonen, M., & Tuominen, 2009) and in the approach used to define innovation (Coombs and Miles, 2000).

As the aim of this paper is building a theory about performance implications of different categories of innovation in the KIBS setting, we looked at how previous contributes about innovation and performance in KIBS have defined innovation. The above analysis suggests that contributes tried to account for the heterogeneity of KIBS firms' innovative effort mainly distinguishing on the basis of market-based novelty of innovations (innovations new to the firm vs innovations new to the industry) and on the basis of the types of innovations (product vs process innovations). These are also the categories usually analysed by the collaborative innovation literature discussed above.

Market-based novelty of innovation and performance in KIBS

As far as the market-based novelty of innovations is concerned, the distinction between service innovations new to the industry and new to the firm disentangles innovations on the basis of firms' timing of entry. Often new to the industry innovations are also labelled radical but in this setting radical does not mean competence destroying but refers to firms' timing of entry (Therrien et al., 2011). First-to-market, or 'first mover' means that the KIBS is among the first few firms to bring an innovative product to the market while innovations new the industry means innovations

introduced by the firm for the first time but not new to the market (Mansury and Love, 2008; Love and Mansury, 2007).

The strategic management literature has widely debated the advantage of first movers. First, or early, mover advantage may lead to superior performance thanks to the firm's technological leadership, the pre-emption of scarce resources, and the buyer switching costs (Roberts and Amit, 2003; Lieberman and Montgomery, 1988). But the literature also warned about the risks that first movers face (substantial investment for product development, undeveloped supply and distribution channels, immature enabling technologies and complements, uncertainty of customer requirements. Results of studies that specifically looked at the impact of being first mover on innovation sales are mixed (Song, Zhao and Di Benedetto, 2013; Suarez and Lanzolla, 2005).

This literature provides inconclusive results about FMA and tried to identify FMA enablers at the macro and micro level as well as isolating mechanisms that protect first mover advantage in the long run (Suarez and Lanzolla, 2007). As Porter in 1985 argued several industry characteristics may affect the performance of first movers, such as the market uncertainty or the pace of technological change. Interestingly enough, as Lieberman and Montgomery claim (1988), FMA may rise when suppliers have an in-depth knowledge of buyers and buyers have high switching costs and tight relationships with suppliers.

Coherently, focusing on KIBS we observe a positive relationship between FMA and firm's sales growth even if we still miss a theory that looks at FMA in this context. Therrien et al. (2011) debate the existing empirical evidence about FMA and performance in manufacturing and service firms and show how results are still inconclusive. The authors then look at the relationship between FMA and performance in several Canadian KIBS industries and find that new to the industry services guarantee the highest increase in sales, no matter how much original they are. Also Mansury and Love (2008), studying US business to business services and among them several KIBS, find that innovations new to the industry positively affect firms' growth. No effect on productivity is detected.

Overall, new to the industry innovations seem more performing in KIBS but, as we will in depth discuss in the next section, the distinction between product and process innovations can further enhance our understanding of KIBS firm's performance.

Product and process innovations and performance in KIBS

As far as the content of innovation is concerned, literature about innovation in the manufacturing industry converges on the idea that growth may be achieved by introducing both new products and new processes. A product innovation is a new product or service offered to customers to satisfy their needs. A process innovation is a new mode of production and delivery of the good or service introduced into an organization's production or service operations (Barras, 1986; Damanpour and Gopalakrishnan, 2001; Utterback and Abernathy, 1975). Product innovations have a market focus and are primarily customer driven, while process innovations have an internal focus and are primarily efficiency driven (Damanpour, Walker and Avellaneda, 2009; Utterback and Abernathy, 1975). New products provide firms the momentum for market share and hence sales growth by increasing the customer base in current markets or attracting new customers by opening new markets to the firm (Goedhuysa and Veugelersb, 2012; Wolf and Pett, 2006; Zahra and Nielsen 2002). Process innovation has a double effect. Process innovation mainly improves firms' productivity and their ability to benefit from the resources they possess. In the long run, process improvements can eventually foster firms' growth by increasing their margins and the competitiveness of their products (Wolf and Pett, 2006).

Differently from manufacturing, the service literature is more cautious in distinguishing between product and process innovations because they may be not clearly separable (Evangelista and Savona, 1998; Gallouj, 2002; Miles 1995; Tidd, Bessant and Pavitt, 2005). Nonetheless, some authors argue that drawing the distinction between product and process innovations in service firms as well as in KIBS firms is feasible and relevant (Damanpour et al. 2009; Hipp and Grupp, 2005; Sirilli and Evangelista, 1998). This literature has mostly emphasized that clients drive product innovations processes and that KIBS firms' ability to develop new services determines their growth

(Den Hertdog, 2000). Nevertheless, we still lack quantitative tests of this hypothesis. The limited empirical evidence on KIBS suggests that only process innovations improve firm's productivity while both product and process innovations may enhance firm's growth (Campagnolo and Cabigiosu, 2015). Table 1 synthesizes the main findings of contributes on the relationship between innovation categories and performance in KIBS.

Insert Table 1 about here

The next paragraphs discuss how market novelty of product and process innovations affects KIBS firm's growth and productivity and develop original hypotheses.

How market novelty of product and process innovations affects KIBS firm's performance

Following the mainstream manufacturing and service literature, product innovation is mainly aimed at increasing market share. Also the KIBS literature supports the view that product innovations increase a firm's market share in line with the characteristics of the innovation process in KIBS firms. In fact, KIBS firms develop new services when triggered by clients (Love and Mansury, 2007). KIBS are knowledge intensive and specialized firms expected to solve clients' issues eventually developing new solutions. A KIBS firm capable of introducing (product) innovations to serve specific clients' requirements is likely to experience positive returns on its market share because it gains reputation for being customer-oriented and flexible (Cabigiosu et al., 2015; Skjølsvik et al., 2007). KIBS firms often develop new services based on the knowledge they acquire by collaborating with clients during service development and delivery (den Hertog, van der Aa and de Jong, 2010; Hipp and Grupp, 2005; Larsen, 2000; Tether and Metcalfe, 2004). In order

to provide their services, KIBS firms need to go into the organizational and operational processes of their clients in depth, so it is essential for the KIBS firm to be able to interpret and adapt to a given client's requirements. When KIBS firms interact with customers, they have the chance to exchange significant amounts of data and information with clients about their needs and industries, thus detecting new business opportunities. Collaboration with clients drives a firm's ability to successfully innovate identifying new services to satisfy clients' requirements (Campagnolo and Cabigiosu, 2015). Hence, the characteristics of the innovation process in KIBS reduce the market uncertainty from the demand side: KIBS have tight relationships with clients and they have an in-depth understanding of their needs.

Differently from Therrien et al. (2011), who point out that new to the industry innovations are often more disruptive than new to the firm innovations and may generate controversial performance effects, we also claim that in KIBS first movers have a competitive advantage over late movers. When services are customized and the output of long-lasting cooperative relationships, clients are less prone to change suppliers. Also, in uncertain and dynamic environments, buyers may evaluate positively suppliers that have a good reputation as providers of quality services. In this context suppliers with such characteristics are less likely to suffer from drawbacks of entering the first and will be advantaged as first movers. First movers can benefit from reputational effects, which increase perceived value and customer search costs (Lilien and Yoon, 1990 and Schmalensee, 1982). *Ex-ante* suppliers can rely on loyal clients that favor the innovation development stage reducing the demand and marketing uncertainty and *ex-post* favor the innovation adoption process. Hence KIBS specificities as regard buyer-supplier relationships may foster FMA when these firms develop new products.

As a matter of fact, innovating KIBS do not face all the risks and uncertainty that typically hinder first-movers advantage. First, KIBS firms have a better understanding of clients' needs and of their market since they collaborate with clients and they provide customized solutions. KIBS firms come in the organizational and operational processes of their clients, and their services are

frequently the outcome of an intense knowledge and information sharing between the parties (den Hertog, 2000). Highly original innovations are more likely to face the ‘‘market inertia’’ effect because customers may not respond enthusiastically to radical new products. This market risk is reduced when suppliers have in-depth knowledge of clients that may be useful both to develop highly new products in line with clients’ needs and to correctly communicate to clients the strengths and benefits of the new product and to market it. Second, we suggests that KIBS firms launching new products may benefit from being first movers and be recognized as market leaders. KIBS firms can potentially expand their market share both acquiring new clients and increasing the existing “share of the wallet” with loyal customers. Also followers may benefit from product innovations but comparatively less because they do not have the same ability and reputation of first mover innovators. Manufacturing firms that have new needs to satisfy, or require new solutions to satisfy their needs, will prefer KIBS firms that have the reputation of being able to explore new solutions and develop new services. Third, network externalities and clients switching costs may reinforce the advantage of first movers. Clients that have a positive experience of collaborations with suppliers that know their needs and how to satisfy them will be more prone to sustain suppliers that develop highly innovative products incorporating such needs. As suggested by the FMA literature, buyer-supplier collaboration increases buyer’s switching costs. In this context KIBS may face less risk of loosing clients due to eventual extra efforts required to use the new service or to the “market inertia” effect. Switching costs are an isolating mechanisms that constrains latecomers from catching up with the pioneers (Golder and Tellis, 1993).

Overall, drawing from the above discussion our first hypothesis follows:

H1. In KIBS firms, the positive relationship between innovation and sales’ growth is stronger for product innovations new to the industry.

The available evidence about the effect of collaboration with clients focuses on products. We overall miss empirical evidence supporting the existence of a positive relationship between buyer-supplier collaboration and the firm's ability to develop process innovations. In the KIBS literature we find evidence of how interaction with clients positively affects product innovation capabilities of KIBS but, at the same time, collaboration with clients seem having no relationship with the KIBS's ability to innovate inner procedures. Inner procedures are often black-boxes for clients that can not be of help in their innovation process (Cabigiosu et al., 2015). Hence, buyer-supplier collaboration is not expected to ex-ante positively affect the development of process innovations in KIBS.

Furthermore, while product innovations aim at increasing a firm's market share by offering new services, the primary focus of process innovations for KIBS firms is to be more competitive from the cost side by improving a firm's efficiency (Garcia and Calantone, 2002; Sirilli and Evangelista, 1998). Hence, process innovations are mainly inward looking and are aimed at fostering a KIBS firm's productivity.

In this context KIBS firms may opt for a "wait and see" strategy and introduce only those process innovations on which know how and experience have already been accumulated at the industry level. Other things being equal, when KIBS firms introduce new to the firm processes they can select those innovations that generate the highest savings. Relying on a wait and see strategy KIBS firms can imitate competitors by exploiting their prior experience. Process innovations new to the industry, by definitions, are activities never performed in their present operational mode, which suppliers and employees are not familiar with. In contrast, process innovations new to the firm benefit from higher learning effects[2]. For process innovations new to the firm, such as the introduction of a new software, KIBS may be willing to rely on existing expertise and services and may prefer process innovations new to the firm. Also Barras suggests (1986) that service firms typically innovate in the back-office by introducing process innovations new to the firm. Only when

[2] Market based novelty does not give information on how much different the new procedures/processes, and the related competences, are from pre-existing services. Thus, other things being equal, market based novelty can be considered as a proxy for the experience accumulated, at the industry level, on specific service processes and the related complements and enabling technologies.

service firms are familiar with an innovation they move it to the front-office. Process innovations that involve the delivery process have higher chances to be accepted by clients when they have already experienced similar procedures in the past collaborating with other suppliers or when new processes are consolidated and well working. Clients foster product innovations in KIBS but they may be less willing to "experiment" KIBS's process innovations.

Also, as explained by Love and Mansury (2007), in KIBS clients do not typically collaborate to process innovations and for KIBS it may become more complex to market, let accept and communicate such innovations. Furthermore, KIBS when introduce process new to the industry may not benefit from a reputation effect because clients are less aware of the newness and introduction of KIBS's inner process innovations.

Overall, when process innovations are concerned, a wait and see approach is likely to be more appropriate for KIBS firms. Hence our second hypothesis follows:

H2. In KIBS firms, the positive relationship between innovation and productivity is stronger for process innovations new to the firm.

DATA AND METHOD

Data and research method

We generated our dataset in two steps. First, we collected part of our dataset, namely independent variables, through a survey on KIBS firms. Second, we collected the remaining data, namely dependent variables, by consulting the AIDA database, which provides (among others) detailed accounts, indicators and trade descriptions of more than 1 million Italian companies. Overall, our dataset comprises the period 2006-2009 and specifically covers the period 2006-2008 for the independent variables and the period 2007-2009 for the dependent variables. Thus, we left 1 year time lag between independent and dependent variables to possibly mitigate the risk of endogeneity.

Our data refer to KIBS firms of the Veneto region (North-east of Italy), which is one of the most highly-developed regions in Italy and Europe in terms of the employment rate and per capita GDP (Unioncamere, 2010). In 2009, 7,049 KIBS firms were based in the Veneto. We analyzed this sector by drawing from two sources: (a) the Business Register held by the Italian Chambers of Commerce; and (b) the records of the Association of Professional Accountants to obtain data on KIBS firms not registered in the Italian Chambers of Commerce. We randomly extracted 2,984 KIBS firms that were contacted by phone by a specialist survey company. We ultimately collected answers from 512 firms (with a response rate of about 17%), but only 238 companies returned fully-completed questionnaires.

The survey company collected the data by means of telephone interviews with the KIBS firms' entrepreneurs or managers. The interviews were based on a broadly-structured questionnaire designed to collect data for this and other research projects on KIBS firms. The questions, items, and scales in the questionnaire had been tested in previous, similar studies (Corrocher et al., 2009; Hipp et al., 2000; Muller and Zenker, 2001; Tether et al., 2004). The questionnaire contains sections on the firm's data, market strategies, entrepreneurship, organization, networking activities, service configurations and innovation. The items for the purpose of this study are described in the "Measures" section and the questions we asked are reported in Appendix 1. We specifically trained the survey company on how to interview the KIBS firms, spending a whole day with the interviewers on the questionnaire to ensure that all the questions were clear. We also assisted the interviewers during the first 5% of the interviews they conducted. We specifically asked them to interview the entrepreneur/owner or the most knowledgeable informant (e.g. a person on the top management team). Although multiple informants have been preferred in other surveys (Kumar, Stern, and Anderson, 1993), we used a single informant because questioning multiple informants when one in particular is the most knowledgeable can pose problems (Glick et al., 1990), particularly in the case of our KIBS firms because they were often very small. We did not explain the object of our research to respondents in order not to influence them ex-ante.

Once we matched our survey on KIBS firms with the data we obtained from the AIDA database, we remained with 99 observations. Although the number of valid observations largely reduced, the merge of two independent databases prevented from possible common method variance issues, perceptual biases and intentional distortions, since dependent and independent variables come from two distinct sources (Huber and Power, 1985; Podsakoff and Organ, 1986). Overall, we obtained complete information on 99 valid observations when the dependent variable is *Sales growth*, and 85 valid observations when the dependent variable is *Sales per employees growth*.

We then controlled if the KIBS firms in our sample rely on a collaborative approach with clients in developing new services. As the KIBS literature indicates, service customization is the main driver of clients' collaboration during development processes (Etgar, 2008; Greer and Lei, 2012). Hence we controlled if services in our sample are customized and use this variable as a proxy of collaboration with and of an in-depth knowledge of clients. We asked to our respondents the percentage of their services that are fully customized, standard, modular or personalized (i.e. standard with minor customization). In mean, the 73% services offered by our firms are either fully customized or personalized, with a sd of 39. The median level is 100%. We also controlled for the weight of these services over firms' revenues and we obtained similar results. Finally, no correlation higher than 0.10 and no significant correlation is detected between the variables customization and the various types of innovation pursued by KIBS firms.

Measures

Independent variables

The independent variables considered were: *Product innovations new to the firm, Product innovations new to the industry, Process innovations new to the firm, Process innovations new to the industry*.

We measured the variables *Product innovations new to the firm, Product innovations new to the industry, Process innovations new to the firm* and *Process innovations new to the industry* as, respectively, the number of each type of innovation introduced by the firm in the period 2006-2008 (Cainelli et al. 2006; Hipp et al., 2000; Tether et al., 2004; Mansury and Love, 2008; Therrien et al., 2011).

Dependent variables and controls

The dependent variable for H1 (growth) is *Sales growth* while the dependent variable for H2 (productivity) is *Sales per employees growth*. We measured these variables as the percentage of growth in the period 2007-2009.

Sales growth and *Sales per employees growth* might differ across firms for several reasons. Based on the KIBS literature, we tested our hypotheses with three control variables - i.e. *firm size* (measured as firm's revenue in millions of Euro), *firm age* (the difference between the year of the survey and the year in which the firm was established), *graduates* (the percentage of firm's employees with a university degree or higher education) and with three dummies *external collaborations* (a dummy variable equals to 1 whether the firm collaborates with other firms either for the development or delivery of services), *ICT* and *Professional,* representing two out of the three service typologies in our sample (ICT, professional and design firms)[3].

TESTS AND FINDINGS

Tables 2 and 3 respectively contain the descriptive statistics and the correlation matrix for all the variables. Table 2 also shows the number of firms in our sample belonging to Professional (49), ICT (40) and Design firms (10).

Insert Table 2 about here

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[3] The questionnaire is available upon request from the Authors.

Insert Table 3 about here

To begin with, we tested H1 using an ordinary least squares (OLS) model (with robust std errors) in which the dependent variable is *Sales growth* and the independent variables are *Product innovations new to the firm, Product innovations new to the industry, Process innovations new to the firm* and *Process innovations new to the industry*. The model also includes the three controls and the three dummies described in the previous sections (see Table 4).

Insert Table 4 about here

Product innovations new to the industry is the unique independent variable with a coefficient positive and significant thus supporting H1 (see Table 4, column 2).

Then, we performed an OLS model (with robust std errors) in which the dependent variable is *Sales per employee growth* and the main independent variables are *Product innovations new to the firm, Product innovations new to the industry, Process innovations new to the firm* and *Process innovations new to the industry.* No independent variable is significant and only the control *firm size* is positive and significant suggesting that the bigger the firm the higher the productivity increase (see Table 4 column 3). Interestingly, the managerial literature has analyzed the interplay between firm size, innovation and performance claiming that firm size may affect the relationship between innovation and growth. Some authors suggest that size has a positive effect on performance and also on innovation because the biggest firms usually have more resources to invest in innovation (Damanpour, 2010, 1992; Kimberly and Evanisko, 1981). Large firms may benefit more from investing in process innovations because a new process that reduces costs yields larger total savings to the company producing a large volume of output than to the firm whose output is smaller (Scherer, 1980; Cabagnols and Le Bas, 2002; Cohen and Klepper, 1996). Jiménez-Jiménez

and Sanz-Valle (2011) find that the relationship between innovation and performance is stronger when firms are bigger. However, they also suggest that small firms may benefit more from process innovation because they need to more carefully manage their resources.

Hence, we controlled if the effect of *Process innovations new to the firm* over *Sales per employee growth* was affected by *firm size.* We run our OLS model also including the interaction variables between *Process innovations new to the firm x firm size* and for completeness we also include the interaction effects *Process innovations new to the industry x firm size, Product innovations new to the industry x firm size* and *Product innovations new to the firm x firm size* (see Table 4 column 4). As the literature recommends, we centered the variables on their means before creating the interaction terms (e.g., Cronbach, 1987). Interestingly enough, introducing the interaction variables *Process innovations new to the firm* becomes positive and significant, the interaction *Process innovations new to the firm x firm size* is negative and significant while *firm size* is no more significant. These results suggest that *Process innovations new to the firm* is positively associated with a firm's productivity only for small firms.

To gain further evidence we plot the interaction effect of *firm size* over the relationship between *Process innovations new to the firm* and *Sales per employee growth* (see Figure 1). Figure 1 shows that the effect of *Process innovations new to the firm* over *Sales per employee growth* changes its sign with the size of the firm. *Process innovations new to the firm* has a positive effect on *Sales per employee growth* in small KIBS firms, while the sign of the relationship turns negative in large KIBS firms.

Insert Figure 1 about here

Finally, we performed two OLS models, one for KIBS firms smaller than the median and one for firms bigger than the median (300,000 euros), in which the dependent variable is *Sales per employee growth* and the independent variables are *Product innovations new to the firm, Product*

innovations new to the industry, Process innovations new to the firm and *Process innovations new to the industry*. The results show that the only positive significant independent variable is *Process innovations new to the firm* for firms smaller than the median (see column 2). *Process innovations new to the firm* becomes negative and significant for firms bigger than the median (see column 3).

Insert Table 5 about here

In all regression models, the VIF test suggests that the models do not present multi-collinearity issues[4].

DISCUSSION

In this paper we aimed at investigating the relationship between different types of innovations and firm's performances in a setting, the KIBS industry, characterized by collaborative innovation with clients (Gallouj, 2002; Miles, 2005). While collaborative innovation literature has shown that ex-ante cooperation with clients enhances innovation performance and fosters the development of radical innovations (Vega-Jurado et al., 2008; Nieto and Santamaria, 2007; Ritala et al., 2015; Sieti, Smith and Park, 2001; Tether, 2002) we still do not know if ex-post, in a setting of collaboration with clients, innovations, and particularly radical innovations, positively affect firm's performance. As a matter of fact, this subject has not yet reached conclusive results and deserves further investigation because strategic management literature warns about the effects of radical innovations over firm's performance. Research has demonstrated that introducing disruptive innovations (i.e. innovations new to the industry) may be riskier than introducing innovations with a lower degree of novelty (i.e. innovations new to the firm) especially when the market is not yet ready or the new product destroys consolidated procedures and competences (Suarez and Lanzolla, 2006).

[4] VIF shows how much of the variance of the coefficient estimate is being inflated by multi-collinearity. A VIF greater than 10 is considered to signal harmful multi-collinearity (Greene, 2000). Our VIFs always show values lower than 3.74.

In our paper we argue that in KIBS firms domain, the role of clients as trigger of KIBS' product innovation processes and the tight knowledge transfer that usually occurs between the KIBS firm and its clients before, during and after the introduction of a new service, counter the risks associated with highly innovative services. Therefore, KIBS firms are likely to experience positive returns from the introduction of highly innovative services either because their innovations match market requests or because they gain a positive reputation that potentially increases their own market share.

Nevertheless, concerning process innovations, market-based novelty is likely to behave differently from the case of product innovations as process innovations are aimed at increasing a KIBS firm's productivity. Since process innovation concerns the production and delivery of services, in order to prevent possible disruptive effects at the client's operations level, KIBS firms are better off introducing innovations already in the market, i.e. innovations new to the firm. In so doing, they can leverage on the experience already accumulated in the market. Therefore, we hypothesized that process innovations new to the firm have a stronger relationship with a KIBS firm productivity than process innovations new to the industry.

Results confirm the general assumption of our work, i.e. that the relationship between service innovation and performance is complex and multifaceted. Generally affirming that innovation is positive for service firms is superficial and potentially misleading. Therefore a comprehensive theory on service innovation needs to deeply investigate all possible angles of service innovation to get conclusive results of its effect on a firm's performance. Specifically, not all combinations of innovation's contents (product and process innovations) and market-based novelty (new to the industry and new to the firm innovations) have a significant (positive) effect on a firm's performance.

Our hypotheses are substantially confirmed. In line with Therrien et al. (2011) we find that product innovations new to the industry are more strongly associated with a KIBS firm growth than product innovations new to the firm. Again, process innovations new to the firm are more strongly

associated with a KIBS firm productivity than process innovations new to the industry, even if this result holds only when introducing the moderating role of firm size. These results highlight that the distinction among innovations on the basis of their timing of entry (or market novelty) is relevant and that they behave partially different from innovations in other settings (Therrien et al, 2011). The introduction of new to the industry product innovations is beneficial for KIBS firm, while introducing product innovations only new to the firm would have no effect in terms of growth. Even if we cannot demonstrate that this positive effect is related to the relationship KIBS firms develop with clients, it is highly presumable. Indeed, KIBS firms gain several information on clients' needs and operations by working closely with them, which in turn can possibly translate into valuable market research information and, eventually, new products. In other words, KIBS firms that operate as first movers experience positive results on growth.

Collaborative innovation literature has shown that collaboration with clients *ex-ante* fosters radical innovations, in this paper we show that *ex-post* new to the industry innovations are those more strongly correlated with firms' growth.

As far as process innovations are concerned, it is worth underlying that the positive relationship of process innovations new to the firm with the growth of KIBS firms' productivity depends on firm's size, which negatively moderates the above relationship. This suggests that the smaller the firm, the stronger the relationship between process innovations new to the firm and productivity improvement. Conversely, for larger firms, the relationship turns negative since the coefficient of the moderating term is even larger than the coefficient of the direct relationship itself. This result is particularly interesting since it questions established literature that assumes that firm's size is more positively associated with process innovation than product innovations (Cohen and Levin, 1989; Fritsch and Meschede, 2001; Scherer, 1980 Jiménez-Jiménezand Sanz-Valle, 2011). Our results offer an alternative view where small KIBS firms, differently from large KIBS firms, are likely to benefit from productivity growth "coping" the process innovations that are already present in the market and that permit higher revenues per employees with lower investments. For

example, process innovations such as the introduction of ICT-based tools or software, increase the automation of service production and delivery, and in turn the efficiency of the firm. On the contrary, the larger the firm introducing new to the firm process innovations the lower the productivity enhancement it obtains. In fact, larger firms might be characterized by rigid structures and formal procedures where resistance to change and inertia are more frequent than in smaller firms. Moreover, when introducing innovations that already exist in the market, large (successful) firms could more easily suffer from a Not Invented Here (NIH) syndrome, which creates a less favourable environment for an outside-in approach to innovation. Thus, large firms might be forced to compromise with established routines, and could risk damaging the outcome of the entire process of change. Overall, even if large firms are usually equipped with more resources to devote to innovation compared to small firms, they might require higher investments in the short term, which in turn prevent from "immediate" productivity benefits.

Ultimately, the theoretical contribution of our work is twofold. First, it sheds lights on the analysis of the relationship between innovation and performance in a setting characterized by collaborative innovation. Specifically it contributes to the KIBS, collaborative innovation and strategic management literature by showing that in this setting new to the industry innovations are more relevant for firm's growth, despite their risks. Particularly, the ex-ante collaboration with clients aimed at customizing services is useful to increase the knowledge of clients and their loyalty.

Second, we contribute to the KIBS and service innovation literature by showing that different types of innovations are relevant and that the combination of different types of innovation is a fundamental aspect to deal with to gain generalizable insights. Within the service innovation literature there is a growing debate around the concept of innovation and multiple categories of innovations have been identified, including product, process, radical, incremental, and many others (Wittel et al. 2015). Within the KIBS literature, authors have mainly focused their attention on the performance implications of innovations' degree of novelty and innovations' content. In these

contributes innovations typically range from innovations that are new to the entire industry (often labeled radical) and innovations that are new solely to the firm (often labeled incremental) (Mansury and Love, 2008; Therrien et al., 2011; Love and Mansury, 2007). As far as the content of innovation is concerned, innovations may involve the product, i.e., the content of a service, or the process, i.e., the way a service is designed and delivered (Campagnolo and Cabigiosu, 2015; Damanpour, Walker, and Avellaneda, 2009). Our paper confirms that it is useful to increase our understanding about the performance effect of different categories of innovation in services and that product *vs* process and new to the firm *vs* new to the industry innovations produce different performance outcome.

Our work has also clear managerial implications since results contribute to clarify the role of innovation towards better performances either in terms of growth or in terms of productivity. Investing in innovation is fundamental for KIBS firms but having a thorough understanding of their outcomes can better drive firms' choices regarding *where* and *when* innovating. A firm should consider simultaneously whether innovating the product or the process and whether being a *first mover* or a *follower* in terms of novelty. Indeed, our results suggest that these choices are not independent among each other as far as the relationship with KIBS firms performance is concerned. Again, managers should seriously consider the combination of product *innovation* and process *imitation* strategies in order to positively affect the overall performances of their firms.

CONCLUSIONS AND FUTURE DEVELOPMENTS

Even if this paper has the merit to extend existing knowledge about the complex relationships between innovation and performance in KIBS, it has also a number of limitations that represent opportunities for future research. First, the limited number of observations and the fact that observations refer to only a region of Italy. Extending the dataset would enhance the validity of our results. Second, our results highlight the controversial role of firm size on productivity. A deeper analysis comparing KIBS firms of different size is advisable. Third, the use of regression analysis

better highlighted the correlation that exists between each single dependent variable about innovation and KIBS firm performances, but further research could investigate more how different types of innovation interact among each other. Put differently, instead of assuming that product and process innovations are autonomous and each is motivated by a different set of drivers, future research is advised to examine the interrelationship between innovation types and the consequence of their concurrent generation or adoption. Finally, future studies may account for other types of innovation such as organizational or technological innovations.

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TABLE 1.

Innovation and performance in KIBS: the quantitative evidence available

	Effects on growth	*Effects on productivity*
Innovation	Positive (Cainelli et al., 2004; 2006; Evangelista and Savona, 2003; Mansury and Love, 2008; Love et al., 2011)	Positive (Cainelli et al., 2004 and 2006; Tacsir and Vargas, 2014)
Product innovation	Positive (Campagnolo and Cabigiosu, 2015)	None (Campagnolo and Cabigiosu, 2015)
Process innovation	Positive (Campagnolo and Cabigiosu, 2015)	Positive (Campagnolo and Cabigiosu, 2015)
Innovation new to the firm	Positive (Therrien et al., 2011; Mansury and Love, 2008)	None (Mansury and Love, 2008)
Innovation new to the industry	Positive (Therrien et al., 2011; Mansury and Love, 2008)	None (Mansury and Love, 2008)

TABLE 2
Descriptive statistics

	Variables	Mean	S.D.
1	*Sales growth*	0.04	0.75
2	*Sales per employee growth*	0.04	0.83
3	*Product innovations new to the firm*	1.30	3.48
4	*Product innovations new to the industry*	1.79	8.21
5	*Process innovation new to the firm*	0.81	1.79
6	*Process innovation new to the industry*	0.49	1.62
7	*Firm age*	8.48	7.89
8	*Graduates*	47.27	36.91
9	*Firm size*	577178.4	1050689
10	*External collaborations*	0.39	0.49
11	*ICT*	0.40	0.49
12	*Professional*	0.49	0.50
13	*Design*	0.10	0.30

TABLE 3
Correlations

	Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1	*Sales growth*	1.00												
2	*Sales per employee growth*	-0.83*	1.00											
3	*Product innovations new to the firm*	-0.11	0.10	1.00										
4	*Product innovations new to the industry*	-0.10	0.17	0.29*	1.00									
5	*Process innovation new to the firm*	-0.13	0.19*	0.48*	0.61*	1.00								
6	*Process innovation new to the industry*	-0.12	0.13	0.38*	0.69*	0.86*	1.00							
7	*Firm age*	-0.23*	0.24*	-0.03	0.12	0.02	-0.13	1.00						
8	*Graduates*	0.11	-0.20*	-0.11	0.20*	0.06	0.12	-0.10	1.00					
9	*Firm size*	-0.15	0.26*	0.06	0.07	0.02	-0.06	0.35*	0.00	1.00				
10	*External collaborations*	-0.07	0.13	-0.09	0.06	-0.03	0.01	0.12	-0.07	0.04	1.00			
11	*ICT*	-0.09	0.07	0.23*	-0.01	0.03	-0.00	0.05	-0.30*	0.21*	0.01	1.00		
12	*Professional*	0.11	-0.12	-0.16	0.07	0.02	0.04	-0.08	0.36*	0.15	-0.10	0.82*	1.00	
13	*Design*	-0.04	0.08	-0.10	-0.09	-0.08	-0.06	0.06	-0.11	-0.09	0.14	-0.28*	-0.33*	1.00

*$p \leq 0.1$

TABLE 4
OLS models results for all the hypotheses formulated (Robust standard errors in parentheses)

1	2	3	4
Variables	*Sales growth*	*Sales per employee growth*	*Sales per employee growth*
Constant	0.13 (0.27)	0.10 (0.24)	0.12 (0.25)
Product innovations new to the firm	-0.01 (0.01)	0.06 (0.11)	-0.04 (0.04)
Product innovations new to the industry	0.01*** (0.00)	0.01 (0.14)	0.17 (0.10)
Process innovation new to the firm	0.04 (0.07)	-0.00 (0.01)	0.22** (0.12)
Process innovation new to the industry	-0.12 (0.07)	0.03 (0.10)	0.17 (0.10)
Firm age	-0.02** (0.01)	0.01 (0.01)	0.01 (0.01)
Graduates	0.00 (0.00)	-0.00 (0.00)	-0.04 (0.03)
Firm size	-6.25e-08 (5.88e-08)	1.68e-07** (6.85e-08)	1.59e-07 (2.05e-07)
External collaborations	-0.04 (0.15)	0.13 (0.17)	0.09 (0.17)
ICT	0.06 (0.27)	-0.25 (0.26)	-0.20 (0.26)
Professional	0.11 (0.26)	-0.19 (0.23)	-0.19 (0.25)
Process innovation new to the firm x firm size	-	-	-0.62** (0.25)
Process innovation new to the industry x firm size	-	-	0.23 (0.57)
Product innovation new to the firm x firm size			-0.39 (0.47)
Product innovation new to the industry x firm size			1.27 (2.06)
R^2	0.12	0.19	0.26
N	99	85	85

*p≤0.1; * p≤0.05; ** p≤0.01***

TABLE 5
OLS models results to test H2 for firms smaller and bigger than the median (Robust standard errors in parentheses)

1	2	3
	Firm size lower than the median	Firm size higher than the median
Variables	*Sales per employee growth*	*Sales per employee growth*
Constant	-1.16*** (0.40)	0.49 (0.54)
Product innovations new to the firm	-0.07 (0.07)	-0.00 (0.00)
Product innovations new to the industry	0.20 (0.17)	0.23 (0.17)
Process innovation new to the firm	0.33*** (0.11)	-0.15* (0.08)
Process innovation new to the industry	-0.20 (0.21)	-0.06 (0.14)
Firm age	0.04** (0.02)	-0.01 (0.02)
Graduates	-0.00 (0.00)	-0.01 (0.04)
Firm size	4.48e-06*** (1.40e-06)	1.74e-07** (7.57e-08)
External collaborations	0.31 (0.23)	-0.10 (0.27)
ICT	-0.10 (0.21)	-0.11 (0.51)
Professional	-0.22 (0.28)	0.30 (0.41)
R^2	0.61	0.25
N	37	38

*p≤0.1; * p≤0.05; ** p≤0.01***

Figure 1

Studies show the effect of buyer-supplier collaboration over innovation performance and identify the categories of innovations more positively affected (the left side of the model). In this paper we look at the firm's performance implication of these categories of innovation (right side of the model).

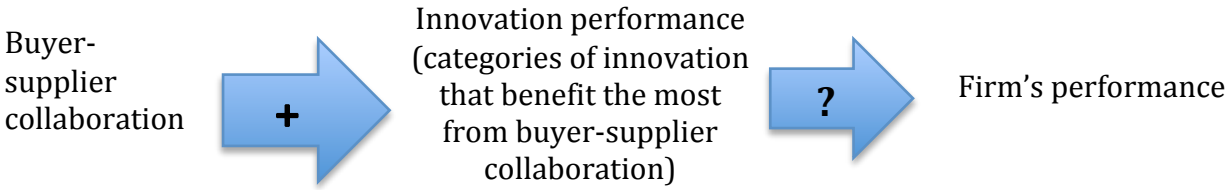
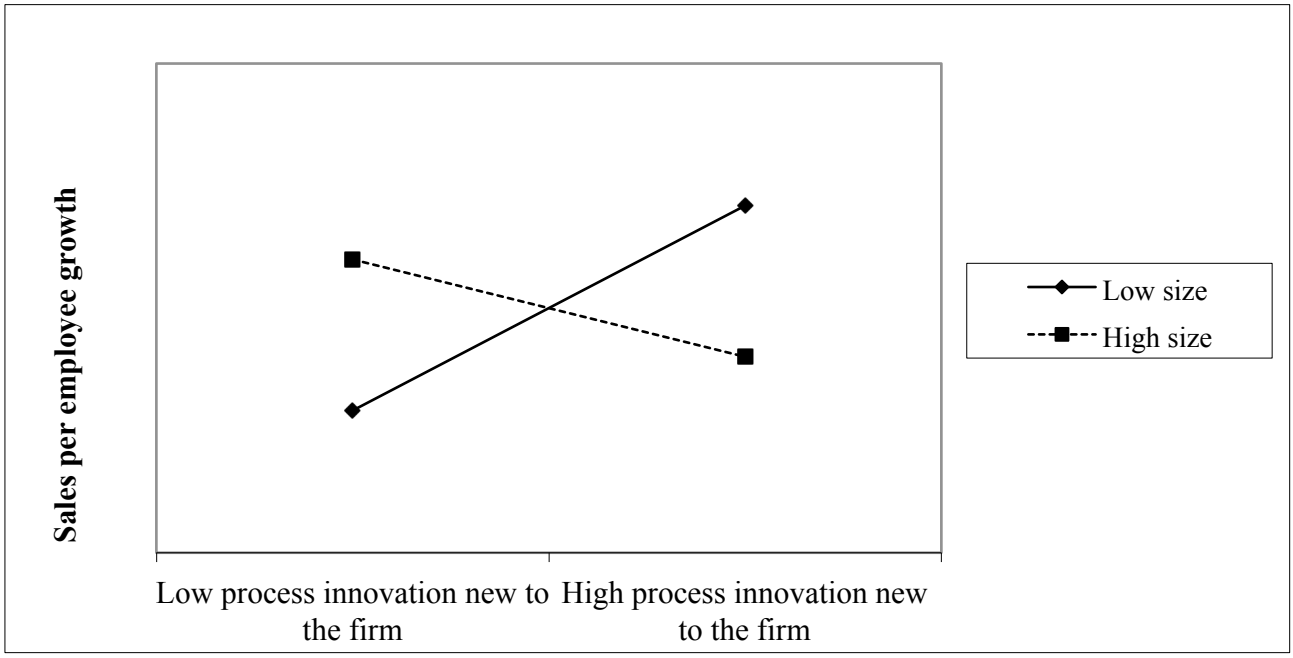


Figure 2

Plot of the interaction effect of *firm size* over the relationship between *Process innovation new to the firm* and *Sales per employee growth*



Appendix 1

List of the questions we asked to collect our independent variables

Product innovations new to the firm	How many product innovations new to the firm did you introduce in the last three years?
Product innovations new to the industry	How many product innovations new to the industry did you introduce in the last three years?
Process innovation new to the firm	How many process innovations new to the firm did you introduce in the last three years?
Process innovation new to the industry	How many process innovations new to the industry did you introduce in the last three years?
Firm age	In which year did you establish your firm?
Graduates	Which is the percentage of your employees that: has a PhD, a master or a bachelor degree?
Firm size	Which was your revenue?
External collaborations	Do you collaborate with consultants, ICT firms, design and communication firms, engineering firms, public institutions, universities, research centers, or other firms?