

KIBS and technological innovation of service firms

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Some services firms are classified as Knowledge Intensive Business Firms (KIBS). According to the literature, KIBS function as interfaces of the generic knowledge available in the economy, and the tacit knowledge of the firms. The study explored microdata from a survey of Brazilian firms (Paep 2001), to investigate empirically if it is possible to state that KIBS contribute to the technological innovation of their clients of the service sector. The results indicate that the services for which this statement is true are: legal, internet solutions, business communications, advertisement and business management.

Keywords: knowledge intensive business services; innovation; services.

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1. Introduction

The service sector historically has been marginalized in the economic literature. However, some factors contribute to a change in this scenario. First, there is an increasing importance of the service sector in developed and developing economies. For the Organization for Economic Co-Operation and Development – OECD (2005a), the increase of productivity and employment are highly dependent of the success of service firms, which are important agents of the recent economic growth in many OECD countries.

The literature regarding innovation in services is very convergent in its main proposals. The main authors defend that the service sector is innovative, despite the fact that its innovations have a less technological character, when compared to the industry sector. Specialists in the field defend the importance of organizational innovations, and point to the deficiency of industry based surveys in apprehending the specificities of services. There is not yet a conceptual model that is largely accepted as an explanation of the phenomenon. The literature defends that the study of innovation in services may contribute to the understanding of the innovation in the industry sector, even because the industry firms perform a series of service activities.

An increasing part of the literature is interested in investigating the role of the Knowledge Intensive Business Services (KIBS) as inductors of innovation of firms of other sectors (NÄHLINDER 2002, BILDERBEEK *et al.*, 1998, KOX, 2002, HERTOOG, 2000 and ANTONELLI, 1998). According to these authors, KIBS act as facilitators of the innovation process in the economy. For Antonelli (1998), Katsoulacos e Tsounis (2000) and Tomlinson (2000), KIBS contribute to the increase in the productivity of economies.

According to Lööf (2000), the modern processes of innovation are characterized by an increasing complexity and interdependence between the different actors, which combine

several types of knowledge. Several problems in the search for innovation may be overcome by a process where the firm realizes a scrutiny of its own capacities and weaknesses, and later identifies potential partners – which include clients and suppliers – in an increasing importance of informal networks that are characterized by free distribution of knowledge.

This study used microdata of the Survey of the Economic Activity in São Paulo (Paep) 2001, of *Fundação Sistema Estadual de Análise de Dados* (SEADE) to investigate if there is a contribution of the KIBS for the innovation of its service clients. The paper is organized as follows. In section 2, the theoretical aspects of innovation in services and the contribution of KIBS to the innovative process is presented. In section 3, the methodology is presented. In section 4, the results are presented. Section 5 brings the conclusions of the study.

2. Innovation in services and the contribution of KIBS to the innovation process

The theme of innovation in services gains increasing attention in the literature, specially in the European Union countries. An example of this effort is the project Services in Innovation, Innovation in Services (SI4S), of the European Community. Other example is the project Enhancing the Performance of the Service Sector, of the OECD.

In opposition to what occurs in Brazil, the Community Innovation Surveys (CIS) have incorporated the service sector for years, what allows for a series of national analysis, as well as international comparisons (TETHER *et al.*, 2002; HIPP *et al.*, 2000; TETHER and MILES, 2000; SUNDBO and GALLOUJ, 1998). Notwithstanding the criticism regarding the deficiencies of these surveys in apprehending the subtleness of the service sector (DJELLAL and GALLOUJ, 2000, NÄHLINDER, 2002, MILES, 2000, BILDERBEEK *et al.*, 1998), it is an enormous advantage when compared to the Brazilian case, where only very recently the National Innovation Survey incorporated a few service sectors: telecommunications,

information technology, and research and development. In this scenario, the Survey of the Economic Activity in São Paulo (Paep) 2001 deserves special attention, as it analyses the technological innovation of the service firms of São Paulo, Brazil's richest and most populated State.

Sundbo and Gallouj (1998) define innovation as a change in business by the addition of a new element, or by the combination of old elements in a Schumpeterian sense. Innovation must be a phenomenon of some dimension to be considered. This means that the change must be reproducible and realized more than once.

The authors define four types of innovation in services: product, process, organizational and market. As an example of organizational innovation, total quality management can be cited. Process innovations are renovations of procedures to produce and deliver the service, and can be subdivided in two categories: back office and front office. Market innovations are new market behaviors, as, for instance, finding a new segment or entering a new industry. The authors suggest another type of innovation, called ad hoc, or the socially interactive construction for a particular problem proposed by the client. It is not totally reproducible, but indirectly so by means of codification and formalization of experience and competence. For Drejer (2004), ad hoc innovation cannot be considered, because it would equal to state that learning, competence development and knowledge codification are innovations.

Sundbo and Gallouj (1998) present some results of the national innovation surveys of services conducted in the SI4S project, which included the following countries: Denmark, France, Germany, Netherlands, Norway, Sweden and Great Britain. Major firms and firms that internationalize tend to be more innovative. Lack of qualified manpower, of financial resources and organizational skills tend to be the main bottlenecks for the innovative process. Innovations tend to be simpler and incremental, and are easily imitable by capable

competitors. This incremental character of innovation, in opposition to innovation in steps – more characteristic of industry firms – is developed by Tether (2004) and Gallouj and Weinstein (1997).

Formal research and development (R&D) and – in a broader sense – the technological character of innovation are not so important for the innovation process of services, as it is for industry companies (CAINELLI, EVANGELISTA and SAVONA, 2004, SUNDBO and GALLOUJ, 1998, LOPES and DODINHO, 2005, MILES, 2000, TETHER, 2004, GALLOUJ, 2002). On the other hand, organizational innovations are considered as very important by a great number of authors (MILES, 2000, SUNDBO and GALLOUJ, 1998, GALLOUJ, 2002, GALLOUJ and WEINSTEIN, 1997, TETHER, 2004, HIPP *et al.*, 2000, ARK, BROERSMA and HERTOOG, 2003, HERTOOG, BROERSMA and ARK, 2003, HERTOOG, 2000). The importance of the workforce and of the clients for innovation is also considered by several authors (SUNDBO and GALLOUJ, 1998, BILDERBEEK *et al.*, 1998, GALLOUJ and WEINSTEIN, 1997, GALLOUJ, 2002).

For OECD (2005b), innovation in services has the following characteristics: (i) it depends less on formal R&D investments, and more on the acquisition of knowledge through the buying of equipments and intellectual property, and also through collaboration; (ii) the development of human resources is particularly important for services, and lack of specialized manpower may be a bottleneck for innovation in most of OECD countries; (iii) smaller firms tend to be less innovative than its larger counterparts, but entrepreneurship is a factor that favors innovation; (iv) protection of intellectual property is a theme that deserves attention, specially in what regards to software and business methods.

According to Miles (2001), the literature of services has increased since the 1960's. By then, there was a predominant view of services as laggards in the technological aspect. According to Miles (2000), the efforts of the European

Community to study the service sector began with the Forecasting and Assessment of Science and Technology Programme (FAST). In that context, Miles (2001) highlights two British researchers: Jay Gershuny and Richard Barras.

Gershuny effectively accepted the view that services were largely non innovators. The researcher coined the expression “self-service economy”, a tendency of the consumers to produce their own services. Despite this negative view, Gershuny viewed the possibility that the information technology would improve the costs and quality of services.

Barras (1986), by its turn, focused on innovations in services based on information technology (IT). He introduced the theory of Reverse Product Cycle (RPC), elaborated from the observation of financial services in Great-Britain. RPC admits that services are innovative, specially through the use of IT.

Miles (2001) highlights this emphasis of technology in the Anglophone literature, in contrast to the Francophone authors (like Gallouj and Weinstein, 1997), specially those of the Lille University, which emphasized the interactive character of services. Some authors classify approaches like that of Lille as “demarcation”, defending that innovation in services has very particular characteristics, differing from those of the industry. The approach of “assimilation” considers innovation in services as fundamentally similar to that of the industry. And the approach of “synthesis” defends that innovation in services and in industry don’t follow totally different paths, and that studies that try to understand the innovation in services may contribute to the understanding of the innovation in the industry sector. The “synthesis” approach materialized in the last version of the Oslo Manual: “the scope of what is considered an innovation has now been expanded to include two new types: marketing and organizational innovation” (OECD, 2005b, p. 3).

The most consistent criticism to the RPC came from Uchupalanan (2000), which developed the Dynamic Interdependence of Innovation and Competition Framework.

According to the researcher, RPC has the following weaknesses: it considers only one source of innovation (IT), it presents a dichotomy between product and process, lack of a clear definition of what is a new service, firms are passive recipients of innovation of IT suppliers. The model ignores the scope for simultaneous improvement of efficiency, quality and introduction on new services.

Soete and Miozzo (2001) characterize service firms in three categories, in regard to their technological aspects. (i) Sectors dominated by suppliers, like education and personal services. These firms give only limited contributions to the technological process, and most of innovations come from the suppliers of equipments, materials and information. (ii) Sectors of scale intensive physical networks or information networks, like gas supply and banks. Technological innovations usually originate in the industry, but the nature of these innovations is strongly determined by their use in the service firms. (iii) Sectors that supply specialized technologies based on science, like software and laboratories. The main sources of technology are research, development and software activities of the firms of the sector.

According to Hertog (2000), KIBS form a category of service activities that are highly innovative, and besides that, contribute as facilitators of innovation in other economic sectors. They are characterized for being private organizations, specialized in certain technical expertise, and that supply products and services based on knowledge.

For Antonelli (1998), the process of technical change results from the manipulation of two kinds of knowledge: generic (technological codified knowledge with scientific content) and tacit (learning processes based on specific experiences of the innovator). Transforming knowledge localized in the firm in well succeeded innovation depends on the capacity of appropriating the results of research and development and internal learning, but also on the systematic absorption of knowledge available in the firm's environment. In this context, the network of relations of the firm with other agents gain importance, and KIBS, by supplying

the interface of the generic knowledge available in the system, and the tacit knowledge localized in the firm, may have a very important role. The diffusion of technologies of information and communication came to help in this process.

The relation of KIBS and their clients is classified as symbiotic by Bilderbeek *et al.* (1998). Professionals that work in KIBS gain as much with the interaction with the clients as the clients themselves. The experience obtained in certain project can be used to the development of new products, services and approaches, and valorizes the professionals involved in similar projects. Most of KIBS, by the nature of their operations, interact with varied clients, and several become important intermediates for the systems of innovation.

For Hertog (2000), KIBS develop three functions:

- a) Facilitators. KIBS act as facilitators if they support the client in its innovative process, in the case where they are not the generators of the innovation, and are not transferring this innovation from other firms to the client.
- b) Carriers. KIBS act as carriers when they transfer innovation of one firm or industry to the client, even when they are not the generators of the innovation.
- c) Sources. KIBS act as sources of innovation when they perform a fundamental role in the initiation and development of the innovation in the client, normally in an iterative process.

According to Nählinder (2002), there are several forms of classifying the KIBS. The use of industrial classifications presents the advantage of allowing comparisons over time. Her list of potential KIBS sectors, according to the industrial classification ISIC rev. 3 is shown below (Table 1):

Table 1 – Potential KIBS sectors according to the industrial classification ISIC rev. 3

Code	Description
721	Hardware consultancy
722	Software consultancy
723	Data processing
724	Data base activities
725	Maintenance and repair of office, accounting and computing machinery
729	Other computer related activities
731	Research and development
732	Research and experimental development on social sciences and humanities
741	Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy
742	Architectural, engineering and other technical activities
743	Advertising
749	Business activities (other)

Source: Adapted from Nählinder (2002), p. 18.

Modern approaches to innovation, developed by the European Union (Lengrand *et al.*, 2002) and later embraced by OECD (OECD, 2005c), emphasize the third generation policies, and reveal an important role for KIBS and innovation in services. The first generation of policies viewed innovation as a process that initiated in basic research, going to R&D until reaching the introduction in the market of a resulting product or technology. The second generation is identified with the concept of National Innovation System. This approach introduces the perspective that the analysis of processes of production, diffusion and use of science, technology and innovation must consider the simultaneous influence of organizational, institutional and economical aspects. The third generation calls for a more integrated action of innovation policies with other policies – like environmental, educational and health – what results in the difficult task of aligning the needs of different ministries.

In the core of the European approach is the concept of Knowledge Based Economy (KBE). KBE can be seen as an interpretation of recent socio-economical tendencies, as well as a vision of what Europe should become. Three characteristics of KBE have considerable impacts in the nature of innovation: (i) the emergence of services and intangibles; (ii) the fast

development of information and communication technologies and the Information Society;
(iii) the new roles of knowledge, organizational learning and human resources.

For Lengrand *et al.* (2002), innovation in a KBE is not only based in research, development and technology, but also in management skills and marketing, in organizational, social, economical and administrative knowledge. As the sources and types of knowledge required for major innovations become more diverse, there is greater emphasis in collaboration and there is a trend that innovations are produced by a network of actors, instead of autonomous individuals or organizations. As can be observed in the European and OECD discussion, the more incremental and less technological nature of innovation in services, and the increasing importance of interaction – and, therefore, KIBS – for innovation, are perfectly aligned with more recent developments of innovation policies in developed countries.

3. Methodology

3.1 Hypotheses

The present study has the aim of identifying if service firms that hire KIBS are more innovative than its counterparts that don't. Following, we present the main null hypothesis, as well as the auxiliary null hypotheses. Different KIBS considered in these hypotheses were selected upon availability in the Paep survey, and afterwards a check was made between these questions and the sectors considered by Nählinder (2002).

H_0 – Service firms that hire KIBS are not more innovative than service firms that don't.

$H_{0,1}$ – Service firms that hire legal advisory KIBS are not more innovative than service firms that don't.

$H_{0,2}$ – Service firms that hire accounting KIBS are not more innovative than service firms that don't.

$H_{0,3}$ – Service firms that hire software KIBS are not more innovative than service firms that don't.

H_{0,4} – Service firms that hire data processing KIBS are not more innovative than service firms that don't.

H_{0,5} – Service firms that hire internet site management KIBS are not more innovative than service firms that don't.

H_{0,6} – Service firms that hire internet solution KIBS are not more innovative than service firms that don't.

H_{0,7} – Service firms that hire computer maintenance KIBS are not more innovative than service firms that don't.

H_{0,8} – Service firms that hire business communications KIBS are not more innovative than service firms that don't.

H_{0,9} – Service firms that hire telemarketing KIBS are not more innovative than service firms that don't.

H_{0,10} – Service firms that hire advertisement KIBS are not more innovative than service firms that don't.

H_{0,11} – Service firms that hire management consultancy KIBS are not more innovative than service firms that don't.

3.2 Paep 2001 database

This study used microdata of the Survey of the Economic Activity in São Paulo (Paep) 2001, of *Fundação Sistema Estadual de Análise de Dados* (SEADE), a State owned organization. The survey studies the economic activities of the firms of the State of São Paulo, the richest and most populous (more than 40 million people) in Brazil. The State concentrates most of industrial and service firms of the country, and holds the largest financial center of Latin America. Paep considers the sectors of manufacturing, construction, services, commerce and banks. The complete survey – that considers the issue of technological innovation (according to the Oslo Manual) - was applied to firms of 20 or more employees, in the case of services. The population of service firms with 20 or more employees consists of 21 thousand firms. Paep also considers firms with headquarters in others states, which have at least one local unit in São Paulo, with more than 30 employees. These firms make part of the

take all stratum of the sample, along with firms with 100 and more employees. The other firms make the sample stratum of the survey.

Most of the firms that were studied in this paper – those that filled the complete form of the survey – are small, and classified as follows, according to the range of employees in December 31, 2001: from 20 to 29 employees: 10,253; from 30 to 99 employees: 8,080; from 100 to 499 employees: 2,136; 500 employees or more: 794; total: 21,262.

Notwithstanding the fact that the literature of innovation in services suggests the importance of organizational and non technological innovations, the current study will concentrate on technological innovations, because this is the focus of Paep: products and services that introduce new technologies. Paep doesn't consider management or organizational innovations, as well as superficial changes in the service delivery. The complexity of the innovations apprehended by the survey is varied, ranging from advertisements with the Flash technology to vaccines developed as a result of the Genome Project. However, it is important to remember that the survey covers the period from 1999 to 2001, when several technologies which are current today where still not very diffused. Results were obtained through consultations of the Paep database, in the access room of *Fundação Seade* in São Paulo.

The service sector is very heterogeneous, considering firms classified in hotels and restaurants, as well as large companies of the transportation and telecommunications industries. The level of technological innovation to the market is also varied, being more relevant in the sectors of information technology (30%), R&D (22%) and services related to forest exploitation (12%). For a more aggregated view, we used the classification available in the Paep database, which includes the following sectors: Telecom, Information technology, R&D, Technical services provided to firms; Audiovisual and Other services. It is possible to observe that the technological innovation is significant to all sectors (Table 2). However,

considering only technological innovation to the market, the firms of the Telecom, Information technology and R&D stand out:

Table 2 – Number and percentage of service firms that are innovative and innovative to the market, 1999 to 2001

Sector	Innovative				Innovative to the market			
	No	%	Yes	%	No	%	Yes	%
Telecom	93	75%	31	25%	105	85%	19	15%
Information technology	614	64%	352	36%	677	70%	287	30%
R&D	31	76%	10	24%	32	78%	9	22%
Technical services provided to firms	1514	84%	291	16%	1720	95%	86	5%
Audiovisual	435	84%	80	16%	503	98%	11	2%
Other services	15978	92%	1338	8%	16764	97%	518	3%

Source of data: Paep/SEADE 2001. Prepared by the author.

4. Results

To investigate the hypotheses presented in the previous section, we developed the following logit model of inputs to innovation:

$$\begin{aligned}
 Li = \ln \left\{ \frac{Pi(Y=1)}{1 - Pi(Y=1)} \right\} = & \alpha + \beta_1 \text{ LEG} + \beta_2 \text{ ACC} + \beta_3 \text{ SOFT} + \beta_4 \text{ DATA} + \beta_5 \text{ SITE} \\
 & + \beta_6 \text{ NET} + \beta_7 \text{ COMP} + \beta_8 \text{ COM} + \beta_9 \text{ TMKT} + \beta_{10} \text{ ADV} + \beta_{11} \text{ MANAG} + \beta_{12} \text{ TEST}_i + \beta_{13} \\
 & \ln(\text{EMP})_i + \beta_{14} \text{ SECTOR}_i + \mu_i \quad \text{Equation (1)}
 \end{aligned}$$

- $Pi(Y=1)$ – probability that the i -th observation is classified as innovative¹.
- LEG – *dummy* that indicates if the firm contracted – in total or partially – services of legal advisory (question EW001)².
- ACC – *dummy* that indicates if the firm contracted – in total or partially – services of accounting advisory (question EW003)².
- SOFT – *dummy* that indicates if the firm contracted – in total or partially – services of software development (question EW018)².

- DATA - *dummy* that indicates if the firm contracted – in total or partially – services of data processing (question EW019)².
- SITE - *dummy* that indicates if the firm contracted – in total or partially – services of internet site management (question EW022)².
- NET - *dummy* that indicates if the firm contracted – in total or partially – services of internet solutions (question EW023)².
- COMP - *dummy* that indicates if the firm contracted – in total or partially – services of computer maintenance (question EW025)².
- COM - *dummy* that indicates if the firm contracted – in total or partially – services of business communications (question EW037)².
- TMKT - *dummy* that indicates if the firm contracted – in total or partially – services of telemarketing (question EW042)².
- ADV - *dummy* that indicates if the firm contracted – in total or partially – services of advertisement (question EW044)².
- MANAG - *dummy* that indicates if the firm contracted – in total or partially – services of management consultancy (question EW045)².
- STUDY – average years of study of workforce (in years), a proxy for the qualification of the workforce. It is expected that firms with more qualified employees are more prone to innovate.
- Ln (EMP) – Ln of the number of employees, to control for the size of the firm (questions EH025 + EH 037 + EH038 + EH039).
- SECTOR – *dummy* that identifies the sector of the firm³. Introduction of this variable aims to control sector heterogeneity that may influence the innovation of the firms. Sector of reference is “Other services”.
- μ_i – symbol of the residuals of the regression.

The results of the model are shown below (Table 3):

Table 3 – Determinants of the probability of the service firm to innovate

Variables	Coefficient	Standard Error	Wald	p-value
Constant	-4.945	0.275	322.688	<0.001
LEG ^a	-0.870	0.092	88.814	<0.001
ACC ^a	-0.111	0.069	2.588	0.108
SOFT ^a	0.010	0.075	0.019	0.890
DATA ^a	0.327	0.083	15.620	<0.001
SITE ^a	-0.124	0.080	2.421	0.120
NET ^a	-0.403	0.078	26.526	<0.001
COMP ^a	0.419	0.079	28.080	<0.001
COM ^a	-0.154	0.087	3.144	0.076
TMKT ^a	-0.141	0.120	1.367	0.242
ADV ^a	-0.310	0.064	23.515	<0.001
MANAG ^a	-0.617	0.067	87.737	<0.001
STUDY	0.904	0.086	109.813	<0.001
Ln (EMP)	0.356	0.027	168.957	<0.001
SECTOR			363.939	<0.001
Telecom	0.406	0.292	1.926	<0.001
Information technology	1.796	0.097	345.172	0.020
P&D	0.948	0.406	5.450	<0.001
Technical services	0.657	0.098	44.782	<0.001
Audiovisual	0.897	0.169	28.238	<0.001

Number of observations – 20,767

- 2 log likelihood – 9,022.23

Qui-square of model – 1,430.07 (p-value <0.001)

Correctly classified – 90.5%

McFadden Pseudo R² – 0.137

Source of data: Paep/SEADE 2001. Prepared by the author.

Note^a: Coefficients refer to code “0”, don’t contract.

As most of the variables in Equation (1) are dummies, it is not recommended to work with typical cases. Therefore we will concentrate on the signs and significance of the coefficients. It is possible to observe that years of study (STUDY) and the size of the firm [Ln (EMP)] contribute positively to the propensity to innovate. Variable SECTOR is also

statistically significant, and all sectors shown in (Table 3) more innovative than “Other services”.

In what regards to the core variables of the study, KIBS for which it was possible to reject the null hypotheses – with a 0,10 level of statistical significance - were: legal, internet solutions, business communications, advertising and management consulting. It means that it is possible to reject partially the null hypothesis that service firms that contract KIBS are not more innovative than those that don't.

We conducted an Ordinary Least Squares regression to calculate the tolerance (the inverse of the variance inflation factor – VIF), as recommended by Menard (2002). The tolerance tests the collinearity of the model variables, and the threshold is a minimum value of 0.2. In our model, the minimum tolerance variable was 0.539, what shows that there is no problem of collinearity.

5. Conclusions

Modern approaches to innovation, developed by the European Union (Lengrand *et al.*, 2002) and later embraced by OECD (OECD, 2005c), emphasize the third generation policies, and reveal an important role for KIBS and innovation in services.

In the core of the European approach is the concept of Knowledge Based Economy (KBE). KBE can be seen as an interpretation of recent socio-economical tendencies, as well as a vision of what Europe should become. Three characteristics of KBE have considerable impacts in the nature of innovation: (i) the emergence of services and intangibles; (ii) the fast development of information and communication technologies and the Information Society; (iii) the new roles of knowledge, organizational learning and human resources.

For Lengrand *et al.* (2002), innovation in a KBE is not only based in research, development and technology, but also in management skills and marketing, in organizational, social, economical and administrative knowledge. As the sources and types of knowledge required for major innovations become more diverse, there is greater emphasis in collaboration and there is a trend that innovations are produced by a network of actors, instead of autonomous individuals or organizations. As can be observed in the European and OECD discussion, the more incremental and less technological nature of innovation in services, and the increasing importance of interaction – and, therefore, KIBS – for innovation, are perfectly aligned with more recent developments of innovation policies in developed countries.

The current study aimed to investigate empirically if the vision that KIBS contribute to technological innovation of product and/or process of their clients – in this case, in the service sector – has support in the data of the Survey of the Economic Activity in São Paulo (Paep) 2001, of *Fundação Sistema Estadual de Análise de Dados (SEADE)*.

Results indicate that KIBS for which it was possible to confirm this statement were: legal, internet solutions, business communications, advertising and management consulting. It means that it is possible to reject partially the null hypothesis that service firms that contract KIBS are not more innovative than those that don't. Adopting a more restrictive view of innovation – technological – it is necessary to qualify the notion that KIBS contribute to process and/or technological innovation of their clients. It is necessary to study case by case. It is possible that a similar study, conducted in a survey that contained also other types of innovations, like organizational or market, would result in more positive results for the KIBS. Unfortunately, this survey is still not available in Brazil.

Results also indicate that years of study (STUDY) and the size of the firm [Ln (EMP)] contribute positively to the propensity to innovate. Variable SECTOR is also statistically significant, being all sectors shown in (Table 3) more innovative than “Other services”.

Notes

1. The dependent variable was built from question EA003 of the survey: “The firm introduced in the market some technological new or significantly improved service, product and/or process between 1999 and 2001?”. Missing values were not considered.
2. Variable considered as “hire third parties” for firms that answered that contract totally or partially the correspondent service from suppliers. Missing values were inputed as “no”. Codified as 0=no and 1=yes.
3. This variable was built from the crossing of administrative data from the *Relação Anual de Informações Sociais* (Rais), of the Ministry of Work and Employment, and from *Pesquisa Anual de Amostra por Domicílios* (Pnad), of the Brazilian Institute of Geography and Statistics (IBGE), the national statistics agency.

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