

INNOVATION IN HOSPITAL SERVICES FROM A PERSPECTIVE OF TECHNICAL OPERATIONS: CASE STUDIES IN UNIVERSITY HOSPITALS

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Abstract

Aiming to an expanded analysis on the technical procedures that might be mobilized by multiple participants, the following paper approached, in the light of a neo-schumpeterian theory, the way particularities of the services industry influenced in the innovation processes in hospital service sector. In order to accomplish this goal, 44 innovation study cases have been analyzed in the four biggest university hospitals in Brazil. The results led to the fact that innovations are conceived through many participants, who mobilize and exchange experiences through operations set in different ways. The phases of such process have not been well defined; in a general sense, a process starting with a coordinator is conducted by many participants aiming to solve the problems of a defined population. The results showed the importance of knowledge exchange activities among the participants who are related to the many facets in which services are rendered in a hospital.

Key words: innovation in services, hospital innovation, technical operation perspective

Introduction

The innovation process involves activities surrounded by uncertainties, in which the participants gather different knowledge and competencies, with the objective of solving an organizational problem. Both in the services industry and in the primary sector, innovation enables hindrances overcoming, evolution, and maintenance of companies in the business. In the services industry, business widening before other economic sectors is performed through technological, social, and economic changes; all of that as a result of innovation processes. The attention of the researchers to the innovation processes in some service industries, however, does not have the same growth proportion as the increase and importance of the sector to the economy. In despite of being the main economic engine in the gross domestic product and job offers, some doubts remains according to the innovation capacity of services, when compared with the manufacturing sector.

This paper intends to better elucidate the process of innovation in services, using the literature advancements on services innovation based on an approach able to integrate the particularities of services in the light of the neo-schumpeterian theory. For such, case studies in university hospitals have been conducted with the objective of analyzing the characteristics of the innovation process in services.

The operations determining the necessary technical support to render the service have been identified from 44 cases of innovation in the 4 biggest Federal University Hospitals in Brazil, as well as the previous factors to the innovation processes through semi-structured surveys with the people in charge of the innovations.

Before the diversity of the customized and professional services (GADREY, 2002) developed in the hospitals, it is believed that they constitute a social and economic complex sector that enriches the proposed analysis.

The paper is organized into 4 sections, besides this introduction. In the first one, the focus is on the definition of the services product, starting point for the analysis of the innovation processes. Later, the second section briefly brings examinations on the main theoretical approaches on the process of innovation in services. The third section brings the analysis of the empirical results; followed by the final considerations.

1. The service product defined through technical procedures

The discussions on the forms of organization of the service industry have been deeper and portrayed the potentialities on the innovation processes. However, due to the particularities of

the sector, its innovations are hard to be identified, being underestimated. This is due to the analysis of the service sector based on the same indicators used in manufacturing. Such problem can not be separated from the difficulty to define the “product” of the service, considering its intangibility and the diversity of relations that surrounds its conception and consumption.

The problems concerning the definition of the “product” of the service result in myths that guide the sector and give the image of a fairly dynamic sector, with low capital intensity, deskilled jobs and badly paid, with low productivity increase, and no innovation (OCDE, 2001; GALLOUJ, 2002a).

The main characteristic that makes services different from goods is the inexistence of a palpable product. Concerning services, it is difficult to separate production from consumption, causing confusion with regard to what is product and what is process. Even being consumed in a short-term, its effects last for a long-term. Still, services involve a certain level of participation client/consumer, making them very singular and determining uncertainty in the final quality of the service (KON, 2004; GALLOUJ, 2002a; MIOZZO; SOETE, 2001; GADREY, 2000).

The difficulty in dissociating product and process in services indicates the necessity of being analyzed the relations regarding this dynamics. Since the result of a service hardly will be dissociated of its process, the link client/user within the process can not be neglected. This integration between provider and client/user might happen in two ways: through the *service relation*, “informational and verbal interactions, direct contact and interpersonal exchanges between the providers and the beneficiaries of the services” (GADREY, 2001); and/or by the *co-production* that requires some types of cognitive interaction among complementary competencies, regarding a more complex knowledge (DE BANDT; DIBIAGGIO, 2002). The main difference between these two forms of interaction is that the services relationship considers both the operational relations (co-production) and the social ones. Thus, it is characterized as a mode of coordination among the participants (GADREY, 2000). The product of services is, then, the result from the combination of characteristics of different capacities and the many participants involved.

Based on this definition, Gallouj (2002a) considers that the service provision might be analyzed through four types of vectors, as it follows: the individual competencies of providers or of a group producing service [C]; the individual competencies, of a group or company consuming services [C*]; the intangible technical characteristics of the service [T] that might be activated by [C] and/or [C*]. The combination of these vectors will result in the characteristics of the service [Y]. Concerning the author, the innovations might be noticed in the given changes for any of these vectors.

In this dynamics, it is possible to observe that the mobilized competencies to provide a service are strictly linked to the technical [T] characteristics of this service. Thus, as described by Gallouj (2002a), these competencies are given by the technological support, or technical and knowledge operations.

Considering that service activities are composed by the interaction of many facets: tangible goods, codified information, knowledge, and the actors and their different mobilized competencies, as described by Djellal *et al* (2003), the interaction, or service provision, will happen from an operation mobilization, or the combination of operations for the support [T] in which it is conducted. According to Gallouj (2002a) they are:

- Logistical and material transformation operations (M): these are the operations that transport, transform, repair, and maintain the “tangible” objects (human or non-human);
- Logistical and information processing operations (I): enable the “codified” information to be produced, stored, transported, etc. It aims to reduce the costs in communication, establishment of nets, production of new information and new forms of using information;
- Methodological or cognitive operations (K): these operations concern knowledge processing through different methods (new or modified);
- Contactual or relational service operations (R): mainly related to the client, referring to a service direct to the client, frequently related to the other operations;
- Pure service operations (S): enable innovations in services without using any technical support (material or not material).

It is important to highlight the fact that even a service might gather different technical procedures, which will define the characteristics of the service, it means, of its function-production and product.

Djellal *et al* (2004) describe the analysis of a hospital service, object of this study, considering it a complex system consisted of many services using different technological support or operations, being described as it follows:

- The set of services going on in a hospital, denominated elementary services (Si): represented by the medical and health services and treatment, but also the services of catering, housekeeping, administrative or peripheral health services (not medical services, but related to patient's health care, such as laboratories, diagnosis services, outpatient therapy services, etc.);
- The service support, it means, the logics or functional operations (M, K, I, R) that compose the service (its internal composition);
- The competencies mobilized by the services providers (C), put into direct contact with the user, or indirectly through the aforementioned supports;
- The characteristics of the service or its use value (Y).

According to this representation, it is possible to consider many possibilities for the arrangement of a product's (good or service) final characteristics. It is due to the different individual competencies and the necessary technical characteristics combined to give support to the services operations. Then, it we question how the different participants involved in service activities combine and recombine competencies and operations with the objective of solving problems, it means, innovating. In order to better understand the way these dynamics become innovations, in the next section the particularities of the innovation process in the service industry will be explored.

2. Particularities of the innovation process in services

The service industry, like the other economic sectors, has innovation as the main goal for the evolution and survival of firms. Its innovation processes, however, are not clearly defined due to the particularities of service product. Such difficulties in defining and measuring services require a different perspective from the innovation theory.

It is perceived that the analysis on the product of the service as a result of many combinations of technical procedures expands the possibilities of differentiating products and services. This way, it is suggested that in situations of pressure, in which the firm needs to modify its products and services, the participants will apply modifications in the operations for the company maintenance in market.

Considering these different possibilities for the company innovation, it is suggested that the neo-schumpeterian approach for innovation is capable of integrating the different specificities of the services, being innovation understood as new combinations resulting of the introduction of new goods or a new production method, opening a new business market, or a new source of raw material, or the establishment of a new business in any industry (SCHUMPETER, 1985).

The author, however, sets that new combinations must follow the creation of value logic, which prevails over technology. As described by Zawislak (1995), innovation is determined by a new combination of knowledge for the generation of new products, processes, businesses, raw material, organizational forms, etc.; which are translated into value through problems solution.

The use of the neo-schumpeterian approach enables the analysis of the innovation process as the dynamics that considers not strictly technological innovations. It means expanding the concept of technology as a synonym of "technological object" (instruments, machinery, equipment, processes, etc.). But technology used as the technique of science, as said by Zawislak (1995).

In this analysis, the interactive nature of services induces the co-production character of its innovations, leading the service transactions and its innovations to something unique. As a result, the product of the *service relationship* does not have well defined limits (GALLOUJ, 1998; TETHER, 2002).

Such specificities reassure the importance of the concepts and the different approaches of Schumpeter on the determinants of innovation. These models known as Schumpeter I and Schumpeter II (GALLOUJ, 1994), are related respectively with a model based on the entrepreneur and a model based on the departments of research and development (R&D), under a monopolistic capitalist system, can fit the reality of the services. On the other hand, refuse the "Linear Model of Innovation", in which innovation would be a process composed by four steady and sequential phases beginning with basic or applied research (product from research laboratories). Later, the development, production and commercialization of new products would happen. Kline and Rosenberg (1986) criticize the fact that this model does not

allow the alteration of the environmental aspects of the market through the production of facilities and knowledge, having a social impact.

Aiming to analyze the innovation processes in services considering the network that reassures the many phases of the process through the mobilization of different competencies and technical procedures, and on the attempt of supplanting the incoherencies linked to the technical character of approaches that consider technological innovations in services as coming from the primary industry, Gallouj (1994) reviews and classifies the literature on innovation in services into three fundamental approaches:

- Technical approach, which reduces the innovation in services to the introduction of new equipment and systems of information and communication. In this perspective, having as main subject the product reverse cycle, proposed by Barras (1986), innovations in services would be the consequences of process of innovation diffusion in the primary sector (GALLOUJ, 1997);
- Service based approach, which assures the amplitude of the Shumpeterian concept and develops a specific analysis of the services industry, considering its nature and organization. The main contribution of this approach lies on the proposition of the *ad hoc* innovation concept, it means, that innovation happens from the relationship service provider and user, which can only be partially reproduced (GALLOUJ, 1994; GADREY, GALLOUJ, WEINSTEIN, 1995);
- Integrative approach that supports that the innovation specificities in services should be incorporated, but it is not necessary a theory for the services (HAUKNES, 1998). Services and industry might be analyzed under the same analytical reference, being the central element for differentiation the intensity in services relationship.

Considering these approaches, Gallouj (2002a) suggests that the integrative approach is the one that best fits the services industry. It is due to the fact that it deals with the specificities and intensity of the relationship in services, in which providers and clients/users will search for better combinations of operations.

This combination and recombination of operations determine that the firm should be seen as a chain of interconnected competencies intrinsically related to the basis of knowledge and experience. The one referring to the knowledge storage related to the company activities, to be used in solving a problem. The basis of experiences refers to the competencies related to the use of theoretical knowledge, the competencies from performing tasks, organizational competencies and the ones related to information management (from the market), as described by Gallouj (2002a).

Based on such dynamics of the service products and the innovation processes, the author describes the following innovation models:

- Radical innovation: establishment of a new set of characteristics and competencies without changes in the characteristics of the service. Achieving: $\{[C^*], [C^*], [T^*]\}$, without modifying $[Y]$.
- Ameliorative innovation: Increases the quality of the characteristics from the learning process that follows any activity. For instance, there is no change in the system structure $\{[C'], [C], [T], [Y]\} \rightarrow \{[Cp'], [C], [T], [Y]\}$. The innovation results, however, in the increase of the value or weight of the services $[Y] \rightarrow [Yj]$. It is a continuous process and suggests that cumulative effort is demanded from the participants involved in the process.
- Incremental innovation model: involves the addition or elimination of technical characteristics $[T]$ and/or services $[Y]$. It is not a continuous process.
- *Ad hoc* innovation: results in the process of create a solution (innovative), $[Yi]$ for a client's problem through the production of new knowledge and competencies $[Ck]$ and changes in technical characteristics $[T]$. These new knowledge and competencies, when accumulated, must be codified and formalized as routines in order to be used in other circumstances. It is a process between provider and client/consumer and happens with no programming and in an emergent way.
- Recombinative innovation: creation of a new product through the combination of characteristics of two or more products or the division of the characteristics. For such, it is used knowledge on the individual components of the product, which is continuously produced, accumulated, and put into routine. Whenever a problem is found; more accessible knowledge, methods, and technologies are recombined.
- Formalization innovation: enable intangible innovations to become, to a certain extent, tangible. The service characteristics are specified, shaping and making them more concrete.

The innovation models are presented as a result of the different dynamics of the participants involved in providing the service, and mainly the operations supported by the competencies. This way, it is not possible to neglect all the situations in innovation process, both in the goods

production, and services production; using the most appropriate approach for each situation. Thus, the many models are capable to analyze the sector from a technical, service or integrative approach, allowing the innovation dynamics to be analyzed considering its evolution, eliminating the dichotomy view of goods and services in the innovation theory. In order to observe the way such characteristics and specificities in the innovation processes in services appear, the next section presents and discusses the results of the case studies analyzed in some university hospitals.

3. Service innovations in university hospitals

The University Hospital (UH) in Brazil is submissive to the ministry of Health and Education, is accredited as an institution of assistance and participates in the formation of undergraduate and graduate students. It contributes for researching, scientific development, and health technology assessment, fully and permanently helping with education within the Brazilian Public Health System (*Sistema Único de Saúde - SUS*).

UHs gather a bigger diversity of services than the one in hospitals without teaching procedures, since besides the assistance services; it congregates the activities of teaching and researching, students and teachers. Thus, it constitutes a complex service, with a series of services that might require a higher or lower level of technology, knowledge, and relationship with the user (patient).

From an approach that considers the service provision as a system of vectors, the aim of this study was to identify in UHs the way different services combine the actors' competencies and the service operations that were mobilized, to create or modify the proposed service, it means, to innovate.

It is suggested that UHs are appropriate to the study of innovations due to the fact that they are associated to universities and because they have graduation and/or post-graduation programs forming health professionals and researchers. This way, gathering competencies that are more appropriate for R&D activities, and consequently, for innovation, because of the intense teaching, researching, and extension activity conducted in the departments of the hospital. The results presented here refer to 44 case studies of innovative or modified services conducted in the 4 biggest Federal UHs of High Complexity and General medical disciplines in Brazil.

In order to define the sample, the biggest federal university hospitals of high complexity have been chosen, considering the number of hospital beds. Lobo *et al* (2006) describe that high complexity hospitals are normally bigger and have more necessity for specialization, since they support more complex procedures. Due to the restrictions in financial and time resources to perform the study, the option was to choose 4 out of the 8 High Complexity hospitals to constitute the sample (MEC, 2006). The UHs of the research were: São Paulo Hospital of Federal University of São Paulo (HSP), Clinical Hospital of Porto Alegre (HCPA), of Federal University of Rio Grande do Sul, University Hospital of Federal University of Maranhão (HUUFMA) and Clinical Hospital of Federal University of Paraná (HCUFPR).

Firstly, the identification of the modified or new services in the hospitals has been made. The search of the cases was carried out between June and July, 2008; through electronic search at *Google* website, in order to identify news in newspapers, magazines, and electronic media linked to the UHs. As keywords it was used: "Name of the Hospital + year (2005 or 2006 or 2007) + word related to innovation (creates, created, modernizes, modernized, innovates, innovation, new, develops, developed opening, changes, changed, implements, implemented)". The option was to search for services created or modified between the years of 2005 and 2007, since this period seems to be enough to know if the new product was not only an invention, but useful and economically viable. Besides, the directors of the UHs were interviewed with the objective of reassuring the survey conducted and finding other innovations that have not been identified by the electronic search.

The first phase resulted in 44 innovative services. In the second phase of the research, a semi-structured interview was carried out with the 42 persons in charge of these innovative services analyzed. Two persons answered about the modification or creation of 2 services each, since they coordinate projects that originated the innovations.

It is important to highlight that the intent was to analyze any type of changes or new services in the hospital. It means, the analysis focus has been expanded by considering not only medical innovations represented by: biomedical and biopharmaceutical innovations, tangible or hard medical innovations, and intangible or soft medical innovations, represented by medical protocols and therapeutic strategies (DJELLAL; GALLOUJ, 2005). Thus, medical, housekeeping

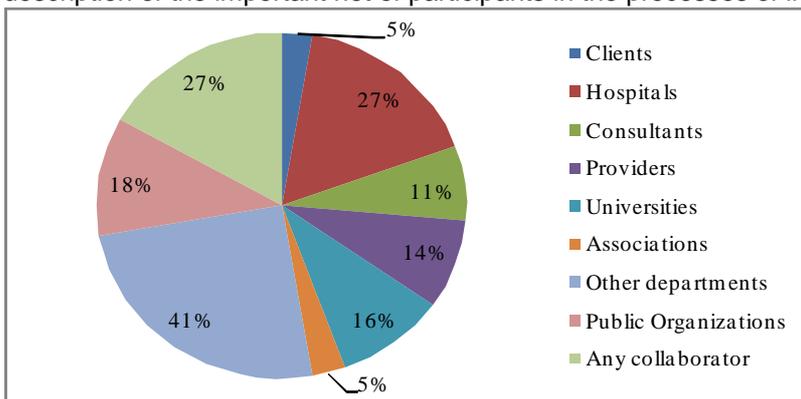
and catering services (which will be called general services, as they are usually called in hospitals), and managerial and administrative; as classified by Djellal e Gallouj (2005), were analyzed in order to gather the diversity of the subjects involved in rendering complex services, as in university hospitals.

Based on such classification, it is pointed that most of the innovative services is connected to medical and complementary health services (55% of the cases). Regarding general services, 36% of the innovations, while managerial and administrative services represented 9% of the total innovative services analyzed. This general case analysis suggests the necessity of analyzing the hospital from an institutional (as an organization) and residual perspective (as a connection of net(s) service(s)), as suggested by Djellal *et al* (2004). Besides, it allows acknowledging the multiplicity of the innovation cases, developed in many departments of the hospital, and consequently related to different actors.

Such results seem to corroborate the capacity of the sector in incorporating new forms of innovation and new participants in the process, as said by Djellal and Gallouj (2005). Aiming to better understand who these different participants are, as well as the way these relationships are build up in the hospitals, three different aspects were analyzed: the types of participants in charge of creating ideas, the workers who participated in the innovation processes and the type of collaboration (formal or informal).

The identification of the person who had the idea that generated the innovation is especially interesting when analyzing hospital services. The discussion deals with the fact that doctors are traditionally coordinators or managers of great part of the services in the hospitals: medical, general, or administrative. As described by Garcia-Goñi, Maroto and Rubalcaba (2007), the doctors in general are in charge of coordinating all health subjects and, this way, are more involved with innovation processes in hospitals. The analyzed cases confirm the data from the authors: 52% of the innovative services created or modified began with doctors' ideas, 14% were from nurses, 14% from administrators and other 20% by professionals from many fields (engineers, nutritionists, physical therapists, etc.). The results showed a diversity of professionals who participated in rendering services in a hospital and are able to identify different possibilities of innovations. The fact that about 48% of the ideas did not come from doctors, displays a tendency of power decentralization. It is also suggested what Djellal *et al* (2004) call concentric expansion of innovation participants. In this type of expansion, there is interaction among the multiple participants, from many origins and not necessarily from directors, doctors, or people in charge of peripheral services.

Aiming to investigate how this interaction among the multiple participants resulted in innovation, the collaborators engaged in the processes of innovation were identified. At the same time, the types of collaboration were analyzed (formal or informal). Such analysis allows a better description of the important net of participants in the processes of innovation in hospital sector.



Graphic 1 – Actors in the processes of innovation in the UHs

Graphic 1 shows the diversity of participants who collaborated informally or formally in the definition of characteristics of the innovative services. The case of the restructuring of the Hospital Engineer Department of the HSP is an example that demanded information and knowledge exchange among many departments and even external participants. In order to set new service objectives, the coordinator went to clients to gather information about necessary changes. Other hospitals were visited to know different kinds of services. The ideas exchanged with professional associations, universities, and providers were also an important source of knowledge. The integration with other hospitals shows an interactive net, capable of exchanging fundamental knowledge for the innovation processes. The relationship with universities,

consultants, and professionals associations, according to Vargas (2006), is necessary to get together science and technique in rendering hospital services, what is especially more common in university hospitals, as the ones analyzed.

It is interesting to highlight, however, that those collaborations were developed mostly through informal relationships. Only 25% of the innovations depended on formal collaborators. Out of these, 3 refer to the consultants' engagement, which helped in generating knowledge. Consultants were hired to the structuring of the Department of Quality Management at the HUUFMA, for the restructuring of the Laboratory for Clinical Analysis of the HSP and for the implementation of the Electronic Auction in the Purchasing Service at the HCPA. Such relationships with consultants are normally formalized through services agreements. Other 4 collaborations were formalized because of loaning contracts between hospitals and public organizations. In a general sense, the collaboration relationships happened informally, confirming the fact that the sector innovates from the configuration of techno-economic nets in constant evolution according to the problems to be overcome (VARGAS, 2006).

After identifying the diversity of participants involved in the innovation processes in UHs, an analysis on the dynamics of combination and recombination of resources and knowledge in which these participants take part is made. As described by Gallouj (1998), from a Schumpeterian view, it is understood that the sector is capable to innovate, not only through technological alterations, but also economic, social, or institutional ones. This way, after considering the different institutional and social configuration of the participants, the technological and knowledge support is investigated, mobilized through competencies of such participants. This support is interesting to be analyzed because it is viewed as responsible for structuring the service operations and the innovation processes.

The multiplicity of the subjects represented by the diversity of the innovations analyzed come from the mobilization of a series of technical procedures, necessary to improve the competencies. 12 types of operations or combinations of operations were found. The most frequent combination was (M, K, R), mobilized to develop 27% of the innovations. The establishment of the Project *Amicão* (Dog Friend) is an example of this type of combination. In this case, the service was proposed by two volunteers, who became capable to work with a dog in a hospital environment (representing operations M). At the same time, specific methods to work with children in a hospital environment were created (K). To be effective as a service, the project was submitted to the Commission for Hospital Infections Control. The viability of the project was proved by scientific papers and the process demanded relational competencies (R). Besides, the volunteers developed techniques for the dog performs its recreational function with the children, and another type of relational competence was developed.

The combination of operations (M, I, K, R) were mobilized by 14% of the innovations. The creation of the Commission for Environment Management at the HCPA is an example. The new service was set to aggregate other actions regarding environment, which were conducted with the Group of Waste Management. This way, besides developing competences concerning hospital waste, the coordinators widened the actions in order to better manage other resources (M) of the hospital (water, electricity, residues, etc). For such, a page at the intranet has been created for the logistic of information (I). It is used to inform the 4 thousand employees who benefit from training, information, and a "Talk to Us" service to clarify doubts. In order to the service fulfills its educational purpose, the commission developed methodological competencies (K) through meetings with about 25 employees, which has resulted in a change in the internal practices and environmental awareness of the employees. Since the Environmental Management is a matter that concerns to all knowledge areas, the commission developed relational competencies (R), which enabled the setting of a multidisciplinary team, where each professional and/or sector contributes with its knowledge.

Also, 14% of the innovations depended on the combination of operations (I, K, R), as we can illustrate by the case of the changes in the System for Goals Follow-up at HSP. This system provides services to the internal user of the hospital, enabling a better treatment of information (I) regarding the goals of each hospital department. The system enabled a new management model (K), allowing the management of goals every single month. The system allows all the coordinators to make a follow-up in the goals, which allows a better communication and relationship (R) among the areas.

9% of the innovations resulted in the mobilization of the operations (M,K), as the service of Environmental Management created at the HSP. Among the competencies related to the treatment of materials (M) developed for the implementation of the service, its coordinator cited: type of water treatment for hemodialysis, segregation and recycling of rubbish, gardening and

conservation of degraded areas, and the effective and efficient control of hospital problems. It was also cited a great effort in the adequacy of methodologies and knowledge (K) on Environmental Management for the hospital atmosphere, considering the fact that great part of literature and scientific events does not consider the specificities of the hospital sector.

Operations (I,K) were combined to develop 7% of the innovations. For instance, the establishment of the Optimization Program for Septic Shock, implemented at the HC of the UFPR. This program, already implemented in other countries, demanded Brazilian professionals to generate competencies for the treatment of information (I) concerning the signals of the patient, since his entrance in the hospital. The way this information is treated is especially important to the syndrome diagnostic process. Since the program approaches all the patients' health care since the service in the emergency room to the treatment at the Intensive Care Ward, all the departments concerned had to follow a program of 10 steps. Competencies related to this new method (R) were followed by these departments to diminish the patients' death rate.

Also, 7% of the innovations combined operations (K,R). For instance, the use of a surgical technique called Arthroscopic Sinovectomy at the HC of the UFPR. In this case, the doctor had already been conducting another type of treatment for the bleeding in the hemophilic patient's joints, but the costs were high and there were side effects. However, after being in touch with the new technique, the doctor mobilized a net of actors to perform the surgery at the hospital. After mobilizing competencies related to the new surgical method (K), in hospitals in Cuiabá (a city in Brazil) and Mexico, the doctor made contacts to obtain the radioactive isotope used in the technique for free by providers abroad. He also made contacts with radioactive doctors from Sao Paulo to prepare the isotope. Besides, he got, through other doctors, complementary examinations to be freely made for the patients. This multidisciplinary team, set for the implementation of the technique, the only one in a public hospital in Brazil, might be represented by the mobilization of relational competencies (R).

Other operational combinations were less frequent, like the combinations (M,I,K), (I,R), (I) and (R), which were mobilized by 2 innovations each. 1 innovation mobilized only the operations (M,I) and another one only (M).

As seen in great part of the innovative services investigated, the diversity of relationships developed informally. It is suggested that the informality within innovation service is related to the intangibility of the services product, an important characteristic of the sector, already canonized in the literature. The specificities of the sector derive innovation processes that develop without defined steps and organized sequences. In order to identify the way these processes happened in the cases of the UHs, it was asked the steps or factors necessary for the project or idea to be converted into an innovation.

Amongst the main prior factors necessary to innovation, the interviewee cited more frequently: identify or elect a coordinator (77%), organize a network (73%), and analyze the target population for the innovation (68%). It is important to notice that such factors mark the limit of a process that starts from an organizer, is conducted by somebody or a set of actors (a net of interactive work), in order to solve the problems of the service or institution (analyzed population). Such results are similar to what Gallouj (2002b) calls "social construction" of an innovative service project. The author considers innovation in services as not being necessarily defined from the existence of an innovation project clearly identified, but it is possible to be recognized as one later. Besides, innovation is usually a non-systematic process, without a formal or informal pattern of interaction among the authors (SUNDBO; GALLOUJ, 1998).

This way, the case studies analyzed confirm the fact that the sector does not organize its innovation processes as suggested by the Linear Model of Innovation, widely diffused in the literature and that describes innovations as coming from R&D activities. Only 30% of the interviewees cited a project (research or administrative project) as being formulated to develop innovation.

According to the models of innovation described by Gallouj (2002a), the aim was to identify the predominant model of innovation in the analyzed services. For such, the interviewee indicated the model that is closer to the dynamics resulting in the creation of a new service or its significant modification. About 36% of the innovations started from the continuous addition of competencies that enabled the establishment of a new service or its significant modification. Thus, most of them did not originate new services, but increased the existent ones (ameliorative innovation) through continuous learning that resulted in the technological accumulation (mobilization of operations M, I, K and/or R) of the participants involved in the process.

Innovations of the type *ad hoc* were developed in approximately 20% of the cases. For instance, the case of the establishment of the Laboratory of Stem at the HC of the UFPR, in which competencies were specifically developed for the laboratory to be established and solved the peculiar problem related to the necessity of a Laboratory to perform some specific types of cardiac surgeries in the hospital.

The recombination of already existent competencies originated innovations or significantly modified about 20% of the analyzed services. This type of innovation, called recombinative, is related to the capacity for adaptation or recombination of actors and technology, as happened in the remodeling of the Humanization Service at the HUUFMA. In this case, the professionals already had the necessary competencies, but were reallocated in different projects for internal customer service. This type of innovation describes and confirms the multiplicity of operational configurations or set of operations mobilized by different actors. These dynamics describe innovations that are developed from small changes in the relationship among the actors.

The addition of a technical characteristic related to the service resulted in a significant modification in 11% of the cases. This innovation, traditionally known as incremental innovation, is usually a result of simple changes or adaptations. An example is the Vascular Ward made in the Emergency Room of the HCPA. Its coordinators decided to add specific protocols and procedures to the routines for vascular diseases and created a specialized service.

Also, 11% of the innovations were developed from the codification of the services through manuals and protocols. The possibility of making a service more tangible solves the problem related to the immateriality of the product of the service. The restructuring of the Laboratory of Clinical Analysis at the HSP is an example of services and procedures that when codified, substantively improve and change the service provision. In this case, the restructuring also allowed offering new services. Thus, when the service is well described by a sequence of procedures, by determining its physical characteristics (participants and goods necessary for the production) or competencies (mobilized operations), its identification, evaluation, and/or measurement, became possible.

Conclusions

This paper aimed to empirically verify the way specific characteristics of the service industry impact on the processes of innovation in hospital services. The analysis conducted in the light of the neo-schumpeterian approach, enabled an expanded analysis of the innovations, considering the diversity of competencies and knowledge mobilized through technical operations. Meanwhile, it allowed the consideration of the multiplicity of the participants who influenced the knowledge exchange that led to the process of innovation in a dynamic way.

The fact that the multidisciplinary teams are formed among different departments of the hospital displays the fact that analyzed university hospitals develop diversified nets of actors in its innovation processes. This diversity seems to supply the demand of the variety of interfaces that configure the services: tangible goods, codified information, knowledge, and the actors and their different mobilized competencies, as described by Djellal *et al* (2003).

This way, we aimed to identify the way the conception of a new service results from the mobilization of operations, or the combination of operations in relation to the support in which it is organized. The results highlighted that a series of operations and combinations of operations are mobilized to create new or different services. This perspective shows that the service industry is able to combine knowledge related to the introduction of new equipment, and information and communication systems, to the competencies regarding the relationship between participants and new methodologies. These characteristics confirm the fact that the integrative approach seems to be more adequate to integrate the several interfaces found in hospital services.

From the analysis of the cases, it was not possible to describe only model of the innovation process. Even if the identification of a coordinator, the set of a network, and the analysis of the population were the most important factors cited as prior to the innovation process, such factors do not allow the definition of specific steps. However, based on the models described by Gallouj (2002a), the interviewees indicated the way the dynamics of combination of competencies happened. The results of this exercise indicate that the models of innovation suggested are enough to deal with the plurality of the technological characteristics of the actors involved in the innovation processes of university hospitals.

This article has examined the way particularities of the services industry influence in the innovation processes in university hospital services in isolation of one another and can, at best,

only give a partial understanding of this sub-sector. A better understanding about hospital services, as a whole, can be achieved by analyzing a bigger number of cases and by including non-university hospitals.

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