Innovation management in information technology service companies in Brazil: planned innovation, rapid application and deliberate *a posteriori* innovation models

Carla M. Kitsuta [1]
Ruy Quadros [1]

[1] Universidade Estadual de Campinas (UNICAMP) / Departamento de Política Científica e Tecnológica, Campinas – SP, Brazil

Abstract

Although service innovations present characteristics that make them different from innovation in goods, literature presents traditional innovation management models, such as those following a structured new service development (NSD) process, as valid and applicable to service companies. This article examines this issue in ten Brazilian IT service companies dedicated to software development, system integration, and mobile services development. The results show that reference innovation management models are applicable to service companies, but four other possibilities are also available, and *a posteriori* innovations can also result from deliberate efforts driven by the firm's innovation strategy. Innovation management models are unable to capture all diversity that exists in different sectors of activity. Firms that acknowledge service innovation in its multiple dimensions and understand that the traditional innovation process is not the only successful way to develop innovations have a greater set of choices when defining and pursuing their innovation strategies.

Keywords: Service innovation. Innovation management models. Software industry.

Gestão da inovação em empresas brasileiras de serviços de tecnologia da informação: modelos de inovação planejada, de aplicação rápida e de inovação deliberada a posteriori

Resumo

Apesar de serviços serem considerados distintos de produtos, os modelos de gestão da inovação, consolidados e desenvolvidos com base em empresas industriais, são ainda apontados como rota principal para o desenvolvimento de inovações também em empresas de serviços. A percepção de que a inovação em serviços pode ocorrer em múltiplas dimensões, de maneira planejada, mas também de maneira não deliberada, identificada *a posteriori*, mostra a necessidade de aprofundamento dos estudos sobre processos de inovação em empresas de serviços. Com base em um estudo de casos múltiplos, com dez empresas brasileiras de controle nacional prestadoras de serviços de tecnologia da informação (TI), analisamos neste artigo os modelos consolidados de gestão da inovação, baseados em planejamento prévio e execução do plano de inovação como os processos estruturados de desenvolvimento de novos serviços (NSD) – também aplicáveis a empresas de serviços de TI. Concluímos que os modelos consolidados de gestão da inovação são aplicáveis, porém foram identificadas quatro outras possibilidades. Três delas estão descritas na literatura: modelo de aplicação rápida por compressão, modelo de aplicação rápida experiencial e modelo baseado na prática. Também identificamos um modelo ainda não descrito, que denominamos inovação deliberada *a posteriori*, resultado de uma estratégia de inovação baseada na prestação de serviços. Apesar de modelos de gestão da inovação não conseguirem captar toda a diversidade existente em cada setor, reconhecer as possibilidades de inovação e de processos abre caminho para que as empresas desenvolvam competências e intensifiquem seus esforços de inovação.

Palavras-chave: Gestão da inovação. Inovação em serviços. Indústria de *software*.

Gestión de la innovación en empresas brasileñas de servicios de tecnología de la información: modelos de innovación planificada, de aplicación rápida y de innovación deliberada a posteriori

Resumen

Aunque los servicios se consideren distintos de los productos, los modelos de gestión de la innovación, consolidados y desarrollados sobre la base de empresas industriales, se señalan como principal camino para el desarrollo de innovaciones también en las empresas de servicios. La percepción de que la innovación en servicios puede ocurrir en múltiples dimensiones, de manera planificada, pero también de manera no deliberada, identificada *a posteriori*, muestra la necesidad de profundizar los estudios sobre procesos de innovación en empresas de servicios. Con base en un estudio de casos múltiples, con 10 empresas brasileñas prestadoras de servicios de tecnología de la información (TI), este artículo analiza si los modelos consolidados de gestión de la innovación, como los que siguen un proceso estructurado de desarrollo de nuevos servicios (NSD), son también aplicables a empresas de servicios de TI. Se concluye que los modelos consolidados de gestión de la innovación se aplican a las empresas de servicios de TI, pero también se identificaron otras posibilidades. Asimismo, se identificó la existencia de un modelo todavía no descrito que denominamos innovación deliberada *a posteriori*, resultado de una estrategia de innovación fundamentada en la prestación de servicios. A pesar de que los modelos de gestión de la innovación no logren captar toda la diversidad existente en cada sector, reconocer las posibilidades de innovación y de procesos abre el camino para que las empresas puedan desarrollar competencias e intensifiquen sus esfuerzos de innovación.

Palabras clave: Gestión de la innovación. Innovación en servicios. Industria de software.

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

INTRODUCTION

This article focuses on the management of innovation in information technology (IT) service companies. We begin with the assumption that innovation management models influence the way in which companies structure their innovation processes and define organizational routines, systems and practices. In their origins, these models were developed with industrial companies in mind, however they have been also considered applicable to service companies by part of the field literature. Reference models for innovation management, such as the one proposed by Tidd, Bessant and Pavitt (2005), the *Stage-Gate* model (COOPER, 2008) and the Innovation Funnel model (CLARK and WHEELWRIGHT, 1993) present innovation as the result of a formal and planned process. This vision is also present in the literature related to "new service development" (NSD)[1] and "service engineering" (SE)[2], in which the process of innovation in services is described in pre-defined stages that consider distinguishable service characteristics, such as intangibility, simultaneity, heterogeneity and perishability.

The literature on service innovation and service innovation management challenges this perspective, especially studies developed from the demarcation perspective (GALLOUJ and WINDRUM, 2009). Two specific characteristics of services are pointed out in this literature. The first refers to the co-production of innovation, or in other words, intense customer participation in innovation development (SUNDBO and TOIVONEN, 2011). The second refers to *ad hoc* innovation (GALLOUJ and WINDRUM, 2009)*,* presented initially by Gallouj and Weinstein (1997) as an innovation that emerges from the service practice and that is identified *a posteriori,* and formalized to make it replicable for other customers. Toivonen (2010) uses the term *a posteriori* innovation and presents three modes through which the innovation process can occur in services: a model based on planning, an innovation model which emerges based on providing a service, and an innovation model in which planning and execution occur simultaneously with the collaboration of customers (TOIVONEN, 2010).

Toivonen (2010) argues that the innovation process based on projects that precede the service practice is not the only possible form or even the most successful way of creating innovations in services. Other authors also argue that various different innovation processes are possible and desirable. Salerno, Gomes, Silva et al. (2015) identify eight types of innovation processes, which differ in terms of structure and content in accordance with the characteristics of the innovation project.

In this article, we explore the management of innovation in IT services through the following research question: are the consolidated approaches to innovation management applicable and adopted by Brazilian IT service firms? In this sector, companies are considered innovative and act as specialized suppliers. These companies invest more resources in innovation than other service sectors (MIOZZO and SOETE, 2001), and they act as diffusors of innovation for other economic sectors (BERNARDES and ANDREASSI, 2007; MILES, KASTRINOS, BILDERBEEK et al., 1995; TOIVONEN, 2004).

To achieve our proposed objective, we have performed a multiple case study with ten Brazilian companies in order to identify the innovation management model adopted through a mapping of innovation management routines in these organizations. These are domestically controlled firms that provide services with high aggregate value (ROSELINO, 2006), such as the development of customized software, the integration of systems and the development of mobile services. The analysis suggests that traditional management models are applicable to IT service companies, however, four other models have been identified, with three of them being presented in the literature: the compression rapid application model, the experiential rapid application model, and the practice-driven model. The most interesting result of the research is the identification of a model that has not yet been described by the literature, which we term deliberate *a posteriori* innovation.

This article is divided into three sections in addition to the introduction and final considerations. In the second section, we address generalizable models of innovation management and models dedicated to the development of new services. In the third section, we present the methodological procedures adopted, considering the research design, sample selection, data collection and analysis. The fourth section presents our obtained results analyzing the identified innovation management models.

---

[1] New Service Development – NSD – is the "organizational process that links marketing and operational capabilities to conceiving, designing and implementing a new service that is valued by a customer" (TATIKONDA and ZEITHAML, 2002, p. 201).
[2] Service Engineering – SE – is the discipline that treats the systematic development and design of services (BULLINGER, FAHNRICH and MEIREN, 2003).

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

THEORETICAL REFERENCES

The concept of service innovation adopted by this study

We have adopted the concept of innovation proposed by Schumpeter (1997), or in other words, a new good, or a new quality of a good, a new method of production, the opening of a new market, the utilization of new sources of raw materials or semi-manufactured goods, or the new organization of an industry. We also consider innovation in services to be a multidimensional construct, as has been proposed by Bilderbeek, Hertog, Marklund et al. (1998) and Den Hertog, Van der Aa and De Jong (2010) and adopted by the recent literature on service innovation (CARLBORG, KINDSTROM and KOWALKOWSKI, 2014). Service innovations can occur in multiple dimensions, with changes in one dimension generally implying changes in the other dimensions of the service. In this way, we have adopted the dimensions of innovation in services proposed by Den Hertog, Van der Aa and De Jong (2010), searching structured corporate routines for the systematic development of innovations related to the service concept, customer interfaces, delivery systems, technological options, partnerships, revenue models, the opening of new markets and the organization of an industry.

Innovation management models in services

The continuous and systematic development of innovations requires a definition of the structures and routines that make a continuous flow of innovation possible. Tidd, Bessant and Pavitt (2005) propose an innovation management model that in principle is equally applicable to medium and large innovative companies, which involve the following stages: search, selection, implementation, and learning. The search stage includes the analysis of the internal and external environments to identify opportunities for change. The development stage encompasses the transformation of an idea for a product or service, considering the acquisition of the necessary knowledge and technologies, the development itself, the launch of the innovation on the market, the management of the initial process of innovation adoption, and the use of the innovation during the long term. In these stages, the company has the opportunity to learn and improve its development process for future innovations. Through inter-sectoral surveys of the diffusion of innovation management practices, conducted later by Tidd, we have sought to identify in a single questionnaire the incidence of the adoption of the same group of practices in distinct sectors, including IT services, logistics, and financial services (TIDD and THURIAUX-ALEMÁN, 2016).

Two models that are quite disseminated in innovation management are the StageGate© (COOPER, 2008) and Innovation Funnel (CLARK and WHEELWRIGHT, 1993) models – which are quite similar. Despite the fact that they were created with a focus on the development of new products, they have also been considered generalizable for services. The StageGate© model consists of a group of information collection and development stages, seeking to reduce the risks and uncertainties of projects, followed by decision gates. The model encompasses the stages of discovery, the definition of its scope, the construction of a business plan, development, testing, launching and post-launch evaluation. The gates represent points of evaluation and decision-making, when the projects are prioritized and, if necessary, discontinued. In this model, the organization evaluates its innovation project to the extent that it advances and gradually increases its commitment to the project, and uncertainties are discussed during each one of these stages (COOPER, 2008). The Innovation Funnel model also concentrates on the product development process, but it includes the integrated evaluation of multiple projects (CLARK and WHEELWRIGHT, 1993).

The strategic technological innovation management model proposed by Quadros, Santos and Barros Neto (2013), also presents itself as a model oriented towards products and services. It is structured in three dimensions: (i) processes and tools, (ii) governance and organization and (iii) resources. The 'processes and tools' dimension contemplates the main decision-making flows in the innovation process, considering the adoption of structured practices to map and search for technological and market opportunities, ideation, strategic selection, resource mobilization, implementation and appraisal. The 'governance and organization' dimension covers the aspects related to the creation of an innovation culture. The resources dimension has to do with the group of tangible and intangible resources necessary for the development of innovation capability. The elements that compose each of the processes are also present in the previous models, but the analysis of the activities based on the main decision-making flows makes it possible to identify specific routines to deal with the activities of ideation, resource mobilization and evaluation, not just in innovation projects, but also in the innovation management process itself. The mobilization process takes into account a company's internal resources and the establishment of relationships with universities and research institutions, partnerships with other companies and the mobilization of customers and suppliers,

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

contemplating a paradigm of open innovation (CHESBROUGH, 2006). The open innovation model contrasts with traditional models, in which products and services are developed internally and distributed by the company. In the open innovation model, the innovation process is distributed, with managerial and intentional processes that promote the flow of external knowledge within a company's innovation activities, as well as the flow of internal and unexplored knowledge outside of the company (CHESBROUGH, 2006; CHESBROUGH and BOGERS, 2014).

The literature dedicated to the development of new services also has several models which, even though they deal with the sector's particular characteristics, present a general linear character and are supported basically by the same processes and activities identified in the development of new products (FROEHLE and ROTH, 2007; SCHEUING and JOHNSON, 1989; TATIKONDA and ZEITHAML, 2002). The development models of new services present differences in the emphasis placed on process stages, but they both reflect on an innovation process, which is developed from an idea until it is finally launched in the market (SANTOS and SPRING, 2013).

In addition to the approach focused on planning, the literature on innovation in services points to other possibilities, among which the model based on characteristics proposed by Gallouj and Weinstein (1997) stands out. In this model, a service is represented by a combination of company and customer characteristics and competencies applied in the conception, design, and delivery of the service (GALLOUJ and TOIVONEN, 2011; GALLOUJ and WEINSTEIN, 1997). While many changes are planned, a set of innovations, denominated *ad hoc* are not planned but emerge from the service practice (SUNDBO and TOIVONEN, 2011). Toivonen (2010) calls this type of innovation *a posteriori*, which is associated with customized services.

Toivonen (2010) analyzes the alternatives to the traditional innovation management process in services, and identifies two other models, in addition to the traditional project model that precedes the practice of a service:

a) the "practice-driven model" associated with *a posteriori* innovations. In this case the innovation process is not conscious and deliberate, with the innovation being identified after the service is delivered;

b) the "rapid application model" which has to do with innovation that is not planned in detail *a priori*, but rather developed over time, placed in practice in a preliminary or small scale manner, utilizing information in real time to improve it. This model is based on the observations of Eisenhardt and Tabrizi (1995) of two models to accelerate the development process for new products for the computer industry: the compression model and the experiential model. In the compression model, planning and execution are distinct stages that occur quickly, which is relevant when development involves less uncertainty in relation to markets and technologies. The experiential model is relevant for products with greater uncertainty, when the company faces a turbulent environment, or when the idea is still immature and its development is greatly dependent on tactical knowledge. The rapid application model corresponds to the experiential model proposed by Eisenhardt and Tabrizi (1995).

The alternative models identified by Toivonen (2010) are especially relevant to knowledge-intensive services, such as IT services, in which knowledge and experience accumulated over time are utilized in the construction of new solutions and new knowledge, customers are co-producers of innovations, and innovations are developed as solutions for the specific problems of customers (TOIVONEN, 2010).

It is interesting to observe how the proposal of a rapid application model by Toivonen has a specific parallel in IT services, which corresponds to the methodological discussion of software development introduced by the propositions and practices of the Agile movement at the end of the '90s (Agile methodology of software development). Up until the advent of Agile methodologies, the dominant perspective was to establish a comprehensive planning *ex-ante* of all the functional and technological software requirements (Waterfall model). This concept proved very costly, not just because it does not consider the high level of unpredictability inherent in the software development process, but also because it does not consider the participation of customers in the development process, which is a distinct characteristic of Agile methodologies.

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

METHODOLOGY

In this study we are seeking to answer whether, and to what extent, the consolidated approaches to innovation management are applicable and adopted by Brazilian IT service companies. The methodological strategy adopted is the multiple case study method. Case studies are a recommended strategy when the topic under analysis is new (EISENHARDT, 1989), when questions are related to how and why, and when the researcher has little control over events (YIN, 1984). The unit of analysis is a company, given that we are seeking to explore the relationship between strategy and innovation processes in relation to the dimensions of innovation in services. (HERTOG, VAN DER AA and DE JONG, 2010). We have opted to focus on IT services, knowledge-intensive services which are recognized as innovative, as well as being facilitators and propagators of innovation in other sectors of the economy (BERNARDES and ANDREASSI, 2007; TOIVONEN, 2004).

The case study perspective adopted is based on the works of Nelson, Winter and Teece (NELSON, 1991; NELSON and WINTER, 1982; TEECE, 2007; TEECE, PISANO and SHUEN, 1997), in studies of innovations in services (BILDERBEEK, HERTOG, MARKLUND et al., 1998; GALLOUJ and WEINSTEIN, 1997; HERTOG, VAN DER AA and DE JONG, 2010; SUNDBO and GALLOUJ, 1999; TOIVONEN, 2010), and in consolidated models of innovation management (CHESBROUGH, 2006; CLARK and WHEELWRIGHT, 1993; COOPER, 2008; QUADROS, SANTOS and BARROS NETO, 2013; TIDD, BESSANT and PAVITT, 2005). We have analyzed each company considering its strategy, structure and capabilities (NELSON, 1991). Strategy includes the commitments of the company in relation to innovation, its objectives and how it intends to achieve them. Structure refers to how a company is organized for innovation and how the decision-making flows are managed. Capabilities are understood as having a base in the innovation management routines and practices utilized, grouped according to their function or objective in the innovation process. By analyzing consolidated models of innovation management and studies dedicated to innovation practices and capabilities (QUADROS, INACIO JUNIOR, EGLER et al., 2017; QUADROS, SANTOS and BARROS NETO, 2013; TIDD and THURIAUX-ALEMÁN, 2016), we have grouped the routines in the following innovation process stages: mapping/searching for technological opportunities, mapping/searching for market opportunities, ideation, strategic selection, resource mobilization (their own, public, customer participation, partnerships with other organizations), development, diffusion and appraisal. Interviews were conducted based on a structured script approach covering (i) organizational data, (ii) the perception of the company in terms of innovation in services (concept of innovation for the company and examples of innovations developed over the past two years), (iii) innovation strategy, (iv) the organization of innovation activities, and (v) structured routines and practices for each one of the stages listed above. Public institutional information, financial information and internal documents and videos made available by the companies, news related to investments in innovation and prizes obtained, and case studies developed on companies by learning and research institutions were used as supplementary sources of information.

The selection of the sample involved a preliminary study of companies that operate in this sector, identifying field of operations, solutions offered and the company's discourse in relation to innovation. The criteria used in the definition of the sample were these companies' main activity, seeking diversity in customized software development activities, the integration of development systems for services and mobile apps, and size. The definition of size was determined by the number of employees and gross operational revenues (COMISSÃO EUROPEIA, 2003). Extra large companies (XL) employ more than 250 people and have revenues in excess of R$ 300 million. Large companies (L) employ more than 250 people and have revenues between R$ 90 and R$ 300 million. Medium size companies (M) employ between 50 and 250 people and have revenues between R$ 16 and R$ 90 million. Even though micro- and small companies are predominant in this sector in Brazil (MINISTÉRIO DO TRABALHO E EMPREGO, 2015), we decided to analyze medium and large companies, which have greater potential to systematically develop innovations (INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA, 2013).

Ten Brazilian IT service companies were selected (Table 1), with the objective being to explore the diversity of processes and types of innovation in companies of various sizes performing various activities. The services offered by the companies are considered to be of high aggregate value, and include more complex development solution stages for their software, involving specific knowledge of software engineering, systems analysis, high-tech design and the modeling of architecture solutions (ROSELINO, 2006).

From July to September 2015, we conducted interviews with those responsible for innovation management in the selected companies, and, when possible, with other members of these teams. Since the study required access to strategic information, we interviewed company executives or those responsible for innovation management with access and knowledge of the relationships between strategy and the organization and structuring of innovation routines. The interviews were conducted in person, with just two of them (A_DEV, F_DEV) being conducted by teleconferencing. Executives in companies B_INT, D_DEV and I_INT responded

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

positively to our request for complementary interviews. All of the interviews were recorded and transcribed for analysis. We understand that the utilization of company data for theoretical development presents a potential bias, which can be mitigated by the use of multiple interviewees within each organization (EISENHARDT and GRAEBNER, 2007). This approach was used in accordance with the companies' availability. In most cases, we sought interviews with key interviewees and complementary information, recognizing the limitations that this methodological decision represents in the development of this exploratory study.

Table 1
Sample companies

Company[3]	Main Activity	Size	Market		Market	Interviews
A_DEV	Custom Development	XL	B2B Global		Large companies, Segments: insurance, finance, retail and services.	Director of Corporate Innovation (1 interview), 90' duration, by teleconferencing.
B_INT	Integration	XL	B2B Global		Large companies. Segments: finance, insurance, industry, oil and gas, means of payment, public sector, telecommunications and retail.	Director of Innovation (2 interviews), Coordinator of Innovation (2 interviews), 3 Innovation Consultants (2 interviews), 180', in person.
C_MOB	Mobile services	XL	B2B and B2C Global		Large companies and final consumers. Segments: telecommunications, logistics, means of payment, messaging, digital content.	CEO (1 interview, 60'), Head of HR (1 interview, 60'), in person.
D_DEV	Custom Development	L	B2B National		Large and Medium companies. Segments: Information Law, industry, education, energy, health, equipment testing, digital content.	Superintendent (1 interview 60'), Innovation Manager (3 interviews, 180'), in person.
E_INT	Integration	L	B2B National		Large companies. Segments: finance, insurance, public sector, education.	Director of Marketing and Alliances (1 interview, 120'), in person.
F_DEV	Custom Development	M	B2B National		Large and Medium companies. Segments: finance, energy, public sector, industry, services and retail.	CEO (1 interview, 90'), in person.
G_DEV	Custom Development	M	B2B National		Large and Medium companies. Segments: Information Law, telecommunications, industry, mobile apps, and digital content.	Executive Manager (1 interview, 90'), in person.
H_DEV	Custom Development	M	B2B National, seeking Internatio-nalization		Large and Medium companies. Segments: finance, insurance, health, retail, mobile apps.	Executive Director (1 interview, 120'), in person.
I_INT	Integration	M	B2B National		Large companies. Segments: telecommunications.	Director of Innovation (2 interviews, 170'), in person.
J_INT	Integration	M	B2B National, seeking internatio-nalization		Large companies. Companies with large operations. Segments: telecommunications, retail, finance, energy.	Director of New Business, Manager of R&D (1 interview, 150'), in person.

Source: Elaborated by the authors.

---

[3] Due to issues of confidentiality, the names of the companies have not been published. They have been replaced by codenames based on their main activity (DEV: Custom development, INT: Systems integration, MOB: development of mobile services).

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

Data analysis was conducted by listing all the routines and practices presented by the companies in each phase of the innovation process, comparing them to identify differences and similarities. We associated the routines and practices with different dimensions of innovation in services (HERTOG, VAN DER AA and DE JONG, 2010) based on the collected information in terms of the purpose of the routines and examples of innovations developed, seeking evidence of their structured nature. Two aspects pointed out in the theoretical references (TOIVONEN, 2010) deserve attention in terms of data collection and analysis: the planned and deliberate nature of the initiatives and the construction of a rapid market application. Their conscious and deliberate nature was pointed out by the executives when they presented how the innovations are identified. The existence of practices to iteratively delve deeper into the requisites and the validation of ideas in development with customers and users indicated the construction of innovation with a market application. After listing the structured practices and routines, we analyzed the sequence of activities in the dimensions of service innovations and began to propose innovation process models associated with the innovation dimensions. The data analysis occurred in a recursive manner: it began with the first case and it was reevaluated with the analysis of each company. To the extent in which we included each case, we reevaluated the proposed models, validating whether they were capable of representing the company's processes or whether other models should be proposed. This comparative analysis made it possible to refine the models in each cycle. At the end of the study, the models were presented to the participating companies.

RESULTS

We have identified structured routines for innovation management related to the dimensions of **service concepts, delivery systems and technological options**. The conception of a solution based on virtual reality for the training of operators in power plants and the conception of a solution for monitoring traffic based on sensors, and cameras and various software modules supplied by partner companies are examples of innovation in the service concept. These innovations involve the conception of a new solution, with the possible development of software modules or the utilization of third party software modules. However, this final solution cannot be considered an example of off-the-shelf software. Innovations in delivery systems are related to internal processes and organizational practices related to the providing of services. Examples of innovations in technological options are the development of a curating system for digital content based on user preferences, a tax surveillance system that uses artificial intelligence to analyze invoices emitted by companies, and a system for constructing dashboards aggregating information from multiple operational management systems. In the other dimensions of service innovations (interfacing with customers, partnerships, revenue models, new markets and industry organization), we identified initiatives, without, however, evidence of structured routines and practices for the systematic development of these types of innovation.

We have identified four models of innovation development associated with the three dimensions of innovation which corroborate to a large extent the innovation processes presented by Toivonen (2010). Given the proximity of the models encountered, we opted to maintain the nomenclature initially proposed by Toivonen (2010), emphasizing the experiential rapid application model and including the compression rapid application model. The innovation development models identified in the literature are: (i) the project model separated from practice, (ii) the compression rapid application model, (iii) the experiential rapid application model and (iv) the practice-driven model. However, our empirical findings demonstrated the existence of a fifth model, which we call the deliberate *a posteriori* innovation model, as a case close to but distinct from the model based on practice. In the following sections, we will detail each one of these models.

1054-1061

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

Project model separated from practice

Figure 1
Project model separated from practice[4]
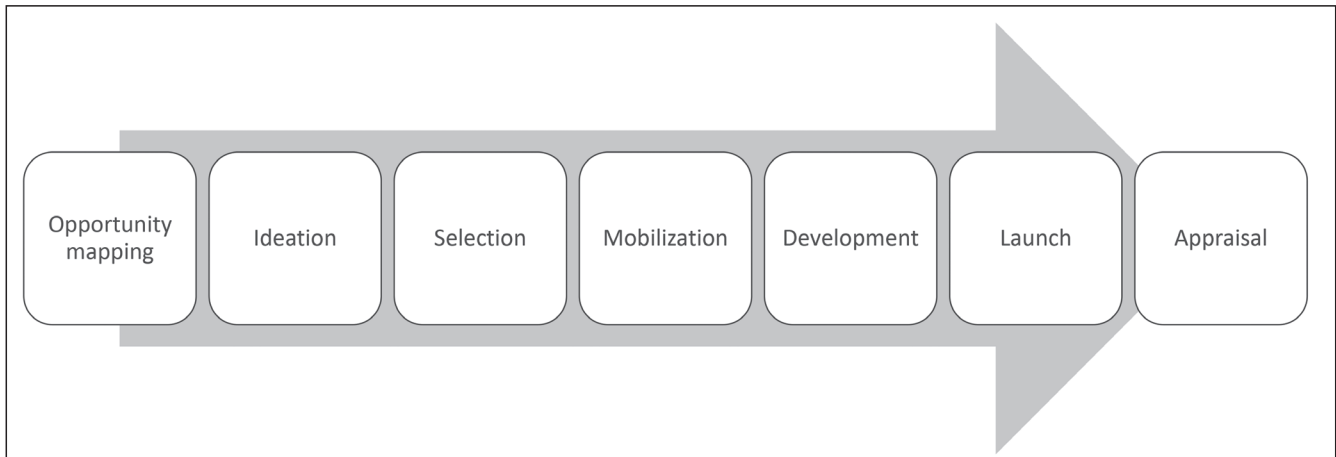
Source: Elaborated by the authors.

This model corresponds to the traditional models of innovation management, in which companies initiate the process seeking opportunities, generating ideas, selecting those that appear more promising for development until the service is finally offered to the market and evaluated (Figure 1). The launch of an innovation in the market occurs only at the end of this process. This model is characterized by its deliberate and planned nature, with practices to elicit requirements and definition of scope before development, similar to the waterfall software development model and traditional project management practices (PMI, 2008). These practices were identified in relation to delivery system innovations, technological options and the concept of a service (Box 1).

Box 1
Examples of the application of the project model separated from practice

| Interviews	Company	Innovation dimension
"If it is internal development, we detail what we want. We detail the business requirements. [....] putting it in macro-terms: problem, concept, and finance. It is a mix of Design Thinking with Stage-Gate [...] Sometimes you succeed in being Lean, sometimes you do not. I could approve everything, approve this, approve that, but if I do not have the entire vision. What happens if it does not fit in the second stage? It is a platform with multiple modules. Each module costs R$ 1.5 million. What if I buy one, and not the other?"	B_INT	Delivery system
"We select themes that are related to some business area with future possibilities. They are things that are on a wave in front of the projects, which eventually turn into something that we can do, and we develop prototypes, an area of knowledge to negotiate new projects and open new fronts of work. It has an annual cycle. For 12 months, we invest in some people who have been individually selected to develop knowledge. During the year they hold 1 and a half to 2 month meetings to present their results [...] Creating internal competencies that allow us to offer services based on this knowledge in the future."	D_DEV	Concept of service

Source: Elaborated by the authors.

---

[4] Despite the figures presented, in their entirety or in part, such as linear models, in practice this does not occur. The processes present coming and going and feedback, with chaotic behavior which is characterized as a "fuzzy front end" (ALAM, 2006). There are many interactions between the stages of the innovation process, which have not been presented in order to permit a better visualization of the differences between the models.

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

Compression and experiential rapid application models

The idea of previous planning is present in the project model separated from practice. The emphasis on planning and later validation by the market are problems that led to a new approach by project managers in this sector, with practices that encourage co-creation with customers and short ideation, development and solution validation cycles. In the experiential rapid application model (TOIVONEN, 2010), the planning and execution stages are integrated and occur in an iterative, incremental and rapid manner, based on information obtained directly from the market. This approach materializes in companies in the form of using Agile development practices, especially the Scrum methodology. The experiential rapid application model follows Toivonen's proposal (2010), and is supported by the market application.

Figure 2
Experiential Rapid Application Model
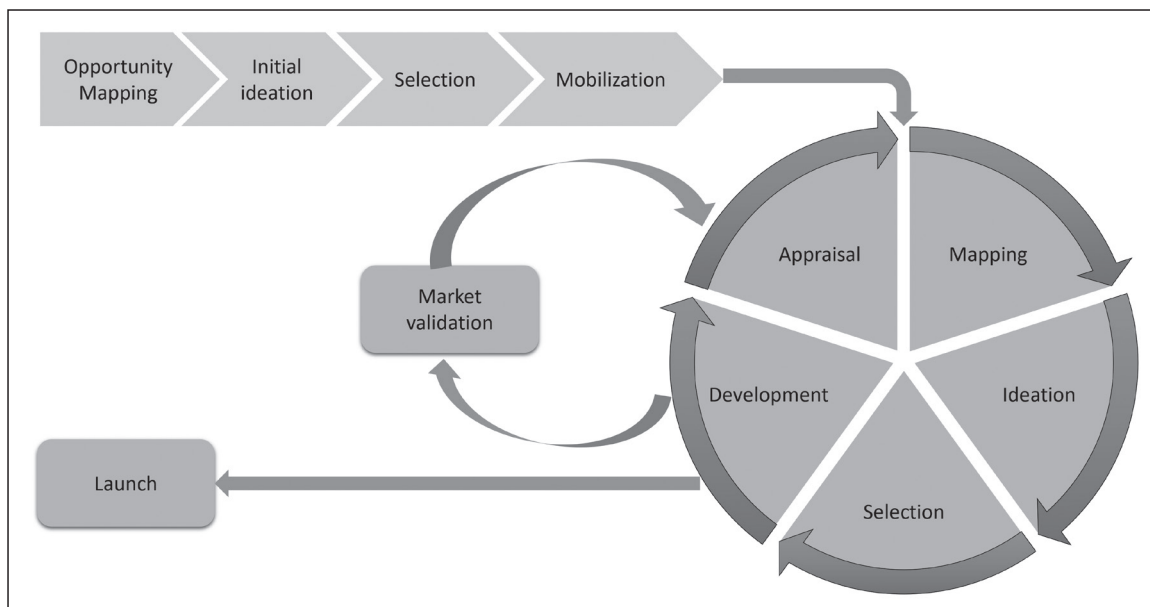
Source: Elaborated by the authors.

When innovation projects refer to ideas capable of opening new markets, uncertainties exist in relation to the problem to be solved, the target market, and the solution that should be offered, resulting in a greater perception of risk. The C MOB, I INT and J INT companies adopted the experiential rapid application model (Figure 2), which is also based on Agile practices, however, it inserts a validation component directly with the market at the end of the cycles. In the IT service sector, the experiential rapid application model became known as the "Customer Development Methodology," proposed by Steve Blank, which, even though it is designed for startups, has also been disseminated among established companies that seek to create new businesses (BLANK, 2013). The interview of the CEO of company C MOB illustrates the utilization of this model.

> It is all very rapid here. Putting it online is to put an app in the store. You develop in 4, 5 or 10 days. You put it online and wait. One customer arrives and tests it. Another arrives and makes another test. You do everything. You do it manually. It is different from saying: I have a project, I am going to automate everything, the system, the ERP, and it is going to be incredible! No, to all that! We are not going to do any of that. You do everything yourself. Did it work well? Are the customers happy? Is everything functioning? Then, we automate it. [...] The day we need it, we do it. Two people, do it themselves. Now I have 50 customers and a month has passed. Now I have data. Are they interested? Not interested? Does the customer like it? Doesn't like it? How much is the customer willing to pay?

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

However, not all companies support their development in a real time experience. Thus, we propose the maintenance of the compression model with the name "compression rapid application model," in which planning and execution occur in rapid cycles, incrementally, but they are supported just by the organization's internal validation (Box 2).

We have identified the compression rapid application model being used mainly in the development of technological options, or in other words, software components, systems or solutions (A DEV, B INT, C MOV, F DEV, G DEV, I INT, J INT), but also in the development of technological competencies for new service concepts (G DEV).

Box 2

Examples of Compression Rapid Application Models

Interview	Company	Innovation dimension
"So, it's been a while that the company has been using the Scrum Agile methodology. They have to enter the *backlog* of the specific [team]. [...] In reality, it is building a team, prioritizing an activity and getting started. It is like working on a normal project and they dedicate hours to this and extra hours. [...] I want to work in the facilities market, so we are making a prototype for the Energy area. However, it is coming from my head, and my head is not that great. Therefore, the new business people, but also the [team], are forming vertical groups here inside. It is good to have people specialized in areas where we operate, like Health, Energy."	G_DEV	Concept of service
"Today we only function with Agile. We are going to do a proof of concept with this project or we're going to test this hypothetical situation. Probably with something from the customer or an idea that someone has had and we say "let's dive into this idea," prove this concept, and then we will see how to apply it. We call internal projects, capacity building, there is a ton of names. Deep down it is investment in innovation – where people are testing things, bringing new ideas, making experiments. There's no participation by the customers in the concept and development of projects."	H_DEV	Concept of service

Source: Elaborated by the authors.

Practice-driven model and deliberate *a posteriori* innovation

In this fourth model, innovation development occurs as part of customer projects. Toivonen (2010) believes that in this model, innovations are developed in a non-deliberate manner, or in other words, they occur as part of the service practice and only afterwards are recognized as innovations and those developed based on this model are termed *a posteriori* innovations (GALLOUJ and WEINSTEIN, 1997; TOIVONEN, 2010). This model is distinguished by the anticipated sale of the solution and the mapping and formalization stages at the end of development (Figure 3). In the sample, innovations of this type are related to the concept of a service, and the interview with the director of corporate innovation at company A DEV illustrates this model of innovation.

> Innovations, in truth, flourish where the company works. The company works where it is developing projects, in areas of business or infrastructure where it is facing challenges. [...] Sometimes the leaders are taking actions when they perceive an innovation. [...] The company has to have forms where everyone can easily visualize successful cases. The innovation process has much more need to exist sometimes to map than necessarily stimulate things that happen.

Even though company A DEV is sensitive to innovations *a posteriori*, routines for mapping and formalization were still being structured: "It is at this very moment that we are trying an experiment. We are providing a budget to an area to make projects viable, with the simple objective of mapping the actions that occur in this process". In Company B INT, there are structured practices to map innovations supported by governmental incentive programs, as described by the innovation coordinator:

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

> We have tried to centralize this type of thing. We have done the [innovation] mapping. The organization has all of this information. There are companies that it has already acquired. There are technologies that are being developed. We also manage to give this internal feedback. We see the deliverable along with the mapping of projects considered the most innovative in the company as being strategic. We have this mapping, in function of the governmental incentive program. The mapping is annual. Therefore, this information will always come. Our idea is to always have a strategic vision of this.

Despite the fact that the development of innovations based on the service practice is a possibility for custom software development and systems integration companies, other companies in our sample were not sensitive to this option.

Figure 3
Innovation according to the practice based model
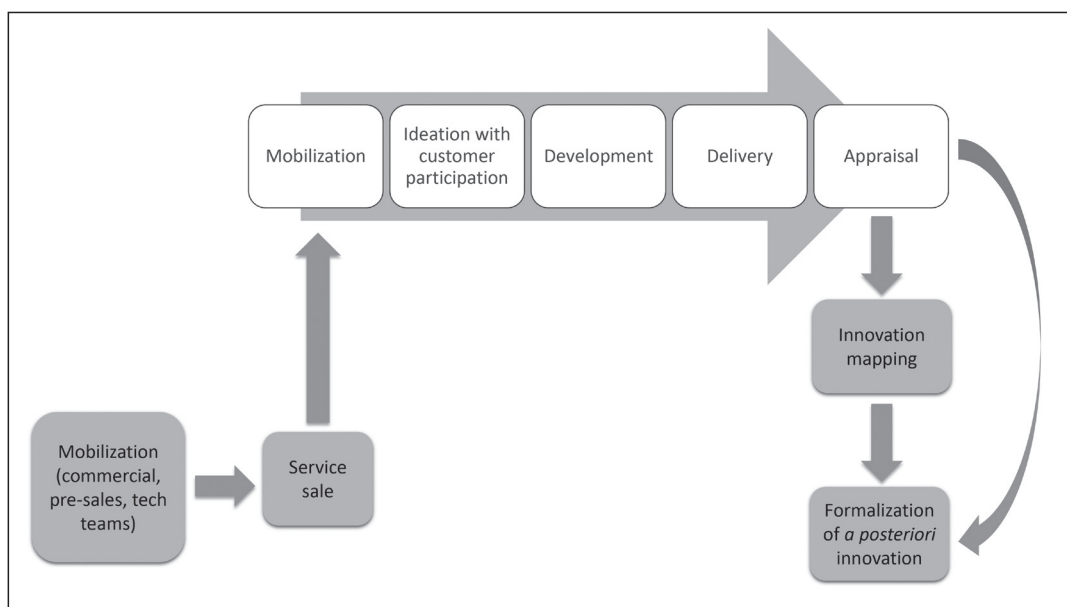
Source: Elaborated by the authors.

It is interesting to note that Toivonen describes *a posteriori* innovation as unconscious innovation. However, we have identified a company in the sample (E INT) that applies this model in a conscious and intentional manner. This company dedicates itself to system integration activities. Innovation opportunities in service concepts are generally associated with the utilization of new custom software components or new applications of existing components. Once the opportunity is identified, the commercial and marketing teams mobilize to identify clients willing to develop the project, while the technical team acquires the necessary knowledge internally or externally. The innovation project begins only when some client is willing to develop the project, acting as its sponsor.

> The trend is that we have a discourse; we have an infrastructure, which facilitates the implementation of solutions based on a nucleus. If the solutions at the end are different, they probably will be, but they will have the same principle, the same base. For example, an operation control room is a solution which we delivered to a large client. The idea is that we replicate this room. We are going to have differences for each type of client, but the nucleus will be very similar. [...] We come to have a sponsor, someone who will pay for that project, trusting us. [...] All clients are very involved, but in this conception of first having to make a framework, there is a different status. First, I have to get an idea from nowhere and work inclusively with this client to create something. In this process of creating, after I have already pre-sold, sold and delivered, I have learned a lot, mainly about the rules of that industry. There I begin to understand what particular characteristics I can take from that client and just concentrate on the rules of the industry.

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

The process begins with the mapping of an opportunity, selecting it, the preliminary design of the solution and selling the project. It is only afterward that the innovation project begins with participation of the client in the conception of the final solution. At the end of the project, there is an analysis stage and the formalization of the innovation, in which the company identifies the elements of the solution that can be replicated in other projects. Contrary to the proposal presented by Toivonen (2010), *a posteriori* innovation in company E INT is deliberate and consists of the company's main strategy to develop new service concepts.

FINAL CONSIDERATIONS

Our study identifies at least five innovation management models in IT service companies, and explores the relationships between these models and the dimensions of innovation in services. We contribute to the literature on innovation in services by identifying and describing a distinct and alternative model to those presented in the literature: the deliberate *a posteriori* innovation model. This reinforces the argument that planned projects separate from service practice do not constitute a single or more successful form of innovating (TOIVONEN, 2010; SALERNO, GOMES, SILVA et al., 2015). There are other models of innovation to be considered, whose relevance and effectiveness require that we examine them in greater detail.

The compression model was initially identified by Eisenhardt and Tabrizi (1995) within the context of developing new products. In the IT service sector, we have identified the compression rapid application model being used mainly in the development of innovations in technological options and in the development of technological competencies for new service concepts. In the compression rapid application model, companies integrate planning and execution in rapid cycles, gradually constructing their capabilities and innovation, supported by internal validation.

The innovation model based on practice (TOIVONEN, 2010) presents innovation *a posteriori* as a result of an unconscious process. However, we have observed that it can also result in a conscious and deliberate process. In this case, companies recognize *a posteriori* innovation as part of an innovation strategy centered on the development of new services, identifying opportunities and engaging clients to act as sponsors and co-creators of solutions. The deliberate *a posteriori* innovation model represents a promising alternative for companies that provide customized services. Its incorporation into the innovation process transforms a company from being reactive to innovations developed in custom projects to being active in searching for innovations that can expand the company's activities with a co-creating client sponsor. Our findings reinforce the theoretical approach which emphasizes the sectoral specificities of innovation management processes. Broad and universal innovation management reference models, such as Tidd, Bessant and Pavitt (2005), are useful tools for practitioners and researchers to delineate the limits of the innovation management field and establish the main groups of practices and interactions between them. However, they lack the analytical sharpness to understand how patterns of sector competition determine different patterns of adoption in innovation management practices (PAVITT, 1990). Moreover, as this study has shown, innovation process models vary between business segments within a given sector, and we even encounter distinct business models within a given segment.

This study is of an exploratory nature. The sample was directed towards IT service companies who consider themselves innovative or which are recognized as innovative by innovation awards and rankings based on rates of return, work conditions and internationalization. Our intentional and robust sample based on a selection of companies that stand out in the sector makes us believe that the identified practices correspond with what is most advanced in terms of innovation management in Brazilian IT service companies and they are related mainly to custom software development and integration solutions. For innovation managers in IT service companies, acknowledging the diversity of types and models of innovation makes it possible for companies to be sensitive to the development of innovation capabilities, beyond those related to traditional models, broadening their portfolio of strategies and managerial practices in the development of innovation.

Future studies exploring the relationships between innovation models and innovation dimensions in services, the development of process maturity scales in innovation management, metrics for the evaluation of processes considering sectoral differences, and the life cycle of organizations can help managers in this task, which is proving to be more important each day for the growth and survival of these companies. The concept of *a posteriori* innovation in service companies also requires further investigation, whether it is in terms of its deliberate or non-deliberate nature, the managerial practices put in place to systematically identify and formalize these innovations, the similarities and differences between *a posteriori* innovation models and other models used by companies in developing custom products and processes (NASCIMENTO and FERRAZ, 2000; SALERNO, GOMES, SILVA et al., 2015), or its relationship with firm performance when compared with other innovation strategies.

Innovation management in information technology service companies in Brazil: planned innovation, rapid application and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

REFERENCES

ALAM, I. Removing the fuzziness from the fuzzy-front end of service innovations through customer interactions. **Industrial Marketing Management**, v. 35, n. 4, p. 468-480, 2006.

BERNARDES, R.; ANDREASSI, T. **Inovação em serviços intensivos em conhecimento**. São Paulo: Saraiva, 2007.

BILDERBEEK, R. et al. **Services in innovation: Knowledge intensive business services (KIBS) as co-producers of innovation**. SI4S Synthesis Paper, 1998. Available at: <https://www.academia.edu/19783553/SI4S_Services_in_Innovation_-_Knowledge-Intensive_Business_Services_KIBS_as_co-producers_of_innovation>. Accessed on: July 10, 2019.

BLANK, S. **The Four Steps to the Epiphany**: successful strategies for products that win. 2nd. ed. Pescadero: K&S Ranch, 2013.

BULLINGER, H.; FAHNRICH, K.; MEIREN, T. Service engineering – methodical development of new service products. **International Journal of Production Economics**, v. 85, n. 3, p. 275-287, 2003.

CARLBORG, P.; KINDSTROM, D.; KOWALKOWSKI, C. The evolution of service innovation research: a critical review and synthesis. **The Service Industries Journal**, v. 34, n. 5, p. 373-398, 2014.

CHESBROUGH, H.; BOGERS, M. Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation. In: CHESBROUGH, H.; VANHAVERBEKE, W.; WEST, J. **New Frontiers in Open Innovation**. Oxford: Oxford University Press, 2014. p. 3-28.

CHESBROUGH, H. **Open innovation**: Researching a new paradigm. Oxford: Oxforf University Press, 2006.

CLARK, K.; WHEELWRIGHT, S. **Managing New Product and Process Development**. Boston: Harvard Business School, 1993. p. 291-362.

COMISSÃO EUROPEIA. Recomendação da Comissão de 6 de Maio de 2003 relativa à definição de micro, pequenas e médias empresas. **EUR-Lex Access to European Union law,** May 06, 2003. Available at: <http://eur-lex.europa.eu/legal-content/PT/NOT/?uri=CELEX:32003H0361>. Accessed on: July 13, 2019.

COOPER, R. The Stage-Gate Idea-to-Launch Processes – Update, What's Next and NextGen Systems. **Journal of Product Innovation Management**, v. 25, n. 2, p. 213-232, 2008.

EISENHARDT, K. Building theories from case study research. **Academy of Management Review**, v. 14, n. 4, p. 532-550, 1989.

EISENHARDT, K.; GRAEBNER, M. Theory building from cases: Opportunities and Challenges. **Academy of Management Journal**, v. 50, n. 1, p. 25-32, 2007.

EISENHARDT, K.; TABRIZI, B. Accelerating adaptive processes: product innovation in the global computer industry. **Administrative Science Quarterly**, v. 40, n. 1, 84-110, 1995.

FROEHLE, C.; ROTH**,** A. A Resource-Process Framework of New Service Development. **Production and Operations Management**, v. 16, n. 2, p. 169-188, 2007.

GALLOUJ, F.; TOIVONEN, M. Elaborating the characteristics-based approach to service innovation: making the service process visible. **Journal of Innovation Economics & Management**, v. 8, n. 2, p. 33-58, 2011.

GALLOUJ, F.; WEINSTEIN, O. Innovation in services. **Research Policy**, v. 26, n. 4-5, p. 537-556, 1997.

GALLOUJ, F.; WINDRUM, P. Services and Service Innovation. **Journal of Evolutionary Economics**, v.19, n. 2, p. 141-148, 2009.

HERTOG, P. D.; VAN DER AA, W.; DE JONG, M. Capabilities for managing service innovation: towards a conceptual framework. **Journal of Service Management**, v. 21, n. 4, p. 490-514, 2010.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA. **Pesquisa de Inovação 2011**. Rio de Janeiro: IBGE, 2013.

MILES, I. et al. **Knowledge-intensive business services**: users, carriers and sources of innovation. Manchester: The University of Manchester, 1995.

MIOZZO, M.; SOETE, L. Internationalization of Services: A technological perspective. **Technological Forecasting and Social Change**, v. 67, n. 2-3, p. 159-185, 2001.

MINISTÉRIO DO TRABALHO E EMPREGO. **Bases Estatísticas RAIS e CAGED**. Brasília, 29 jul. 2015. Available at: <http://bi.mte.gov.br/bgcaged/inicial.php>. Accessed on: July 15, 2019.

NASCIMENTO, P.; FERRAZ, F. Akros: a subcontratação do desenvolvimento de produtos. In: SIMPÓSIO DE GESTÃO DA INOVAÇÃO TECNOLÓGICA, 21., 2000, São Paulo. **Anais...** São Paulo: PGT/FEA/FIA/POLI-USP, 2000.

NELSON, R. Why do firms differ? How does it matter? **Strategic Management Journal**, v. 12 (S2), p. 61-74, 1991.

NELSON, R.; WINTER, S. **An evolutionary theory of economic change**. Nova York: Oxford University Press, 1982.

PAVITT, K. What we know about the strategic management of technology. **California Management Review**, v. 32, n. 3, p. 17-26, 1990.

PMI. **Project Management Body of Knowledge (PMBOK)**. Pennsylvania: Project Management Institute, Inc, 2008.

QUADROS, R. et al. Diffusion of innovation management practices in manufacturing industry in Brazil. In: PORTLAND INTERNATIONAL CONFERENCE ON MANAGEMENT OF ENGINEERING AND TECHNOLOGY, 2017, Portland. **Proceedings…** Portland: PICMET, 2017. p. 1-9.

QUADROS, R.; SANTOS, G.; BARROS NETO, M. R&D+i strategic management in a public company in the brazilian electric sector. **Journal of Technology Management & Innovation**, v. 8, n. 2, p. 235-250, 2013.

ROSELINO, J. Análise da Indústria Brasileira de Software com Base em uma Taxonomia das Empresas: Subsídios para a Política Industrial. **Revista Brasileira de Inovação**, v. 5, n. 1, p. 157-201, 2006.

SALERNO, M. et al. Innovation processes: which process for which project? **Technovation**, v. 35, n. 1, p. 59-70, 2015.

SANTOS, J; SPRING, M. New service development: managing the dynamic between services and operations resources. **International Journal of Operations & Production Management**, v. 33, n. 7, p. 800-827, 2013.

SCHEUING, E.; JOHNSON, E. A proposed model for new service development. **Journal of Services Marketing**, v. 3, n. 2, p. 25-34, 1989.

Innovation management in information technology service
companies in Brazil: planned innovation, rapid application
and deliberate *a posteriori* innovation models

Carla M. Kitsuta
Ruy Quadros

SCHUMPETER, J. **Teoria do Desenvolvimento Econômico**. São Paulo: Editora Nova Cultural, 1997.

SUNDBO, J.; GALLOUJ, F. Innovation as a loosely coupled system in services. In: METCALFE, J.; MILES, I. **Innovation Systems in the Service Economy**. Norwell: Kluwer Academic Publishers, 1999. p. 43-68.

SUNDBO, J.; TOIVONEN, M. **User-based innovation in services**. Cheltenham: Edward Elgar Publishing Limited, 2001.

TATIKONDA, M.; ZEITHAML, V. Managing the new service development process: multidisciplinary literature synthesis and direction for future research. In: BOONE, T.; GANESHAN, R. (Eds.). **New directions in supply-chain management**: technology, strategy and implementation. New York: American Management Association, 2002. p. 200-235.

TEECE, D. Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. **Strategic Management Journal**, v. 28, n. 13, p. 1319-1350, 2007.

TEECE, D.; PISANO, G.; SHUEN, A. Dynamic Capabilities and Strategic Management. **Strategic Management Journal**, v. 18, n. 7, p. 509-533, 1997.

TIDD**,** H.; BESSANT, J.; PAVITT, K. **Managing innovation**: integrating technological, managerial organizational change. New York: McGraw-Hill, 2005.

TIDD, J.; THURIAUX-ALEMÁN, B. Innovation Management Practices: Cross-sectorial adoption, variation and effectiveness. **R&D Management**, v. 46, n. 3, p. 1024-1043, 2016.

TOIVONEN, M. **Expertise as business**: Long-term development and future prospects of knowledge-intensive business services (KIBS). 2004. 297 f. Thesis (PhD in Philosophy) – Helsinki University of Technology, Helsinki, 2004. Available at: <http://lib.tkk.fi/Diss/2004/isbn9512273152/isbn9512273152.pdf>. Accessed on: July 22, 2019.

TOIVONEN, M. Different types of innovation processes in services and their organisational implications. In: GALLOUJ, F.; DJELLAL, F. **The handbook of innovation and services** – A multi-disciplinary perspective. Cheltenham: Edward Elgar, 2010. p. 221-249.

YIN, R. **Case study research**: design and methods. Londres: Sage, 1984.

Carla de Mattos Kitsuta

ORCID: https://orcid.org/0000-0003-4127-852X

PhD Student in Scientific and Technological Policy at the State University of Campinas (UNICAMP), Campinas- SP, Brazil.
E-mail: carlakitsuta@ige.unicamp.br

Ruy Quadros

ORCID: https://orcid.org/0000-0002-7100-8064

PhD in Development Economics from the University of Sussex; Professor at the State University of Campinas (UNICAMP); Full Professor at the Department of Scientific and Technological Policy at the State University of Campinas (UNICAMP), Campinas- SP, Brazil. E-mail: ruyqc@ige.unicamp.br