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Modes of service innovation: a typology

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Abstract

Purpose – The purpose of this paper is to explore different modes of service innovation by examining business model innovation alongside two traditional modes: product innovation and process innovation.
Design/methodology/approach – The authors first empirically test a typology using archival data from 69 service innovation projects in a major mobile telecom company. The authors then extend the typology by investigating the interrelationships among service product, service process, and business model innovation based on empirical evidence from multi-mode service innovations. Finally, the authors study the patterns of modes in a networked environment.
Findings – The results indicate that the typology is applicable and all three modes of service innovation exist in the sample. The authors find that all of the business model innovations involve external partnerships during the development process, while only a small proportion of service process innovations involve external partnerships.
Originality/value – This study has empirically validated a typology of service innovation and discussed the theoretical and managerial implications of multi-mode innovations, contributing to service innovation literature and practices.

Keywords Typology, Innovation management, Service innovation, Business model innovation
Paper type Research paper

1. Introduction

The service sector has grown over the past three decades as services dominate in most advanced economies, and countries that historically focussed on manufacturing are now growing rapidly in services (Song *et al.*, 2009). Service research has attracted scholars from different disciplines in recent years, but there is a growing need to refine and promote service research agendas (Ostrom *et al.*, 2010, 2015). The importance of service innovation has become increasingly recognized. Menor *et al.* (2002) addressed the importance of service innovation research by examining areas covered by previous research as well as areas requiring discovery. Ostrom *et al.* (2010) identified service

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innovation as one of the research priorities in the science of service, and Ostrom *et al.* (2015) reemphasized that stimulating service innovation is a major strategic priority for service research. Spohrer and Maglio (2008) also pointed out the need for service innovations to fuel further economic growth. While there is a growing amount of research in this area, there are still many debates and uncertainties that need to be addressed in service innovation research.

Although much research on service innovation has focussed on innovation of the service offering – the service product – it has long been recognized that the simultaneity of service production and delivery implies that service innovation could be the result of innovation in the service process (e.g. Shang *et al.*, 2009), as services can be seen as deeds, processes, and performances (Zeithaml and Bitner, 1996). More recently, there has also been a growing recognition of innovation in business models, especially in the service context, and it can be argued that any typology of service innovation should also consider business model innovation. Therefore, we adopt a typology of service innovation that was originally proposed by Forfás (2006) and was modified by Voss and Zomerdijk (2007). This typology is based on three innovation modes: service product, service process, and business model innovation.

The relationships between the three proposed modes of service innovation are still unclear. One of the dilemmas concerning the design issue in service innovation is the question of whether it is a product or a process that is being designed (Voss and Hsuan, 2009). There is also a debate as to whether service innovations always involve both product and process innovation or if these two aspects are indeed separate (Droege *et al.*, 2009). These authors suggest that one important opportunity in service innovation research is in identifying distinguishable innovation dimensions, because the applicability of the classic "product-process" framework in a service context is often doubted by researchers. There are a number of studies examining the relationship between product and process innovation in manufacturing (Reichstein and Salter, 2006), but studies of this relationship in the service context are relatively scarce and inconclusive (Boone, 2000; Nijssen *et al.*, 2006). The relationship between business model innovation and product/process innovation in the service context is far more under-researched. Ostrom *et al.* (2015) have engaged in an international and interdisciplinary research (19 research centers/networks were involved in roundtables and 334 service researchers participated in an online survey) to identify priorities for service research. They point out that "understanding the interrelationships among service-product, service-process, and business-model innovation" is one of the "five important directions for future research in service innovation" (Ostrom *et al.*, 2015, p. 131). In the existing literature, a service innovation is usually based on either just one of these modes (mainly service product innovation or service process innovation) or a blurred combination of all possible modes (i.e. a broad concept of service innovation that basically involves all aspects of service), which impairs the theoretical and practical generalizations of the service innovation concept.

The objective of this research is to explore how different modes are used in service innovation, and the specific patterns with regard to the combinations of, as well as the relationship between each mode.

To validate the typology and explore our research questions, we use secondary document data from 69 service innovation projects in a large telecom firm. To enable an appropriate comparison to be made, we control for success – each innovation has won a best service innovation award. We collected secondary data and award application documents for these projects, supplemented by semi-structured interviews. Based on

these data, we first seek to validate our chosen typology of service innovation; we then conduct analyses to address the four research questions and explore the broader implications of our findings for the theory and literature on service innovation, as well as implications for managerial practice. Finally, we review the limitations of our research and propose a number of avenues for future research.

2. Literature review

The extraordinary power of innovation and its importance in economic development have been well acknowledged for over a century since Schumpeter in 1912 published *The Theory of Economic Development*. For services, the benefits that result from service innovation include enhancing the profitability of existing offerings, improving existing customers' loyalty to the firm, attracting new customers to the firm, and entering into new markets (Storey and Easingwood, 1999). Although an increasing number of manufacturing firms are also incorporating service components within their products (Boone, 2000), in this study, service innovation refers to innovation in services (Barras, 1986; Gallouj and Weinstein, 1997; Sundbo, 1997), which focusses on how firms design or improve service concepts to satisfy unmet customer needs.

The number of service innovation articles published in academic journals has steadily increased during the past three decades (Papastathopoulou and Hultink, 2012). Researchers have categorized previous service innovation studies into three streams: assimilation, demarcation, and synthesis approaches (Coombs and Miles, 2000; de Vries, 2006; Drejer, 2004; Gallouj, 1998). The assimilation approach sees service innovation as similar to manufacturing innovation and views service from a manufacturing perspective; the demarcation approach argues that service innovation is distinctively different from innovation in manufacturing, thus requires new theories and instruments; the synthesis approach suggests that service innovation focusses attention on the neglected elements of innovation, and those are often of relevance to both manufacturing and service. These approaches view service innovation differently and have not yet reached a consensus. Generally, we still lack knowledge about innovation in service firms (Menor *et al.*, 2002; Papastathopoulou and Hultink, 2012).

2.1 Modes of service innovation

Typologies are a key way of organizing complex webs of causal relationships – they are "a form of social scientific shorthand" (Ragin, 1987, p. 149), and thus they provide useful tools for both researchers and practitioners (Delbridge and Fiss, 2013). Snow and Ketchen (2014) argue that well-developed typologies, however, are more than just classification systems. Typologies are conceptually derived and a typology's core constructs must be amenable to valid and reliable measurement.

There has been a renewed interest in the development and use of typologies in theory development. Delbridge and Fiss (2013) note a decline in the use of typologies, but argue that as we continue to witness the emergence of new phenomena of interest, this should provide enough impetus for either the proposal of novel typologies or the revision of existing ones. Snow and Ketchen (2014) argue that typologies are needed in both fundamental and emerging topic areas. Fundamental organizational topics are those that involve organization structure and context; fundamental management topics are those that involve control and coordination mechanisms; emerging topics are those that involve new developments requiring new organizational approaches through which to explore and exploit them. We therefore conclude that the use of an appropriate typology is appropriate for our study.

Service product innovation can be defined as the development of a new service, which may be either a new market offering or a service that is new to the firm or the industry (Boone, 2000). The dominant way of categorizing innovations and developing typologies for both product and service has been concerned with the nature of the innovation. For example, the degree of newness to the firm and how much change has been made in products. Johnson *et al.* (2000) proposed a classification by which service innovations are grouped into radical innovations (including major innovations, start-up businesses, and new services for the market that is presently being served) and incremental innovations (including service line extensions, service improvements, and style changes).

Innovation does not just take place in products, but also in processes, and potentially, innovation can be combined from both process and product. Wheelwright and Clark (1992) proposed three types of innovation; namely, breakthrough projects (fundamental changes to existing products and processes), platform projects (new product lines), and derivate projects (incremental changes to products and processes). Process innovation in manufacturing firms is usually separate from product innovation, whereas in services, as production and consumption are simultaneous, product and process innovation are central to service innovation. Zomerdijk and Voss (2011) defined service process innovation as either radical changes in the service delivery process that create a new service experience, or incremental improvements to an existing delivery process that customers perceive as being new. Service process innovation can be a realignment of the service delivery process leading to new ways of meeting customer needs (Boone, 2000). Service processes include those that are part of the delivery of the process, and those that can be seen as back-office processes supporting the front-end processes. Categorizations of the modes of service innovation have moved from focussing on product innovation, to examining both product and process innovation. Several studies have thus considered the innovation in the service process as a mode in taxonomies of service innovation (e.g. Bettencourt, 2010; den Hertog, 2000; Gadrey *et al.*, 1995).

More recently, it has been argued that there is a third important mode: business model innovation. It is often argued as being influential in the revolution of the industry, in the creation of new markets, and in the transformation of the company (Amit and Zott, 2012; Johnson *et al.*, 2008; Kindström and Kowalkowski, 2015). Apple's great success in revolutionizing the portable entertainment industry and mobile telecom industry can be seen to be largely due to the successful combination of the iPhone/iPad/iPod with its iTunes Store in the business model. Competitors may find it more difficult to imitate or replicate an entire novel activity system than a single novel product or process, because business model innovation could create switching costs or enhanced incentives for participants to stay and transact within the activity system (Amit and Zott, 2012).

Companies commercialize new ideas and technologies through their business models. Every company has a business model, no matter whether they articulate it or not, since a business model defines the value proposition and value capture of a company, with a series of activities from procuring raw materials to satisfying final consumers, of which some proportion enables the company to earn profit (Chesbrough, 2007). Chesbrough and Rosenbloom (2002) argued that a business model contains six parameters: value proposition, market segment, structure of the value chain, revenue-generation mechanism(s), position of the firm within the value network, and formulation of the competitive strategy by which an innovating firm will gain and hold advantage over its competitors. The innovation of business models is at the heart of disruptive innovation in organizations (Markides, 2006). Voss and Zomerdijk (2007) defined business model innovation as involving a substantial or

even complete change in the way in which revenues and profits are earned (for one or more businesses), which is often accompanied by innovations in organizational arrangements in order to accommodate the changes in the business model. Previous literature suggests that there is no particular business model design that outperforms others, while various business models can create equally solid financial outcomes if they fit the business contexts (Nenonen and Storbacka, 2010).

Therefore, we choose to use a typology of service innovation that includes three modes: business model innovation, service product innovation, and service process innovation. This typology of service innovation was originally proposed by Forfás (2006) and was modified by Voss and Zomerdijk (2007). Business model innovation involves a complete or substantial change in the way in which revenues and profits are earned; service product innovation is the most analogous to traditional product innovation in manufacturing settings, and it refers to the introduction of new services; service process innovation primarily takes place in operational areas related to the service process and system, as well as the customer journey, since in experiential services, the processes are often described as customer journeys, which see the provision of service as a journey (for customers) consisting of multiple components and touchpoints over the time period of service provision (Rawson *et al.*, 2013). By conceptualizing business model, service product, and service process into a single framework of service innovation, the typology can picture service innovation more comprehensively. Details of the typologies of service innovation discussed above are shown in Table I.

2.2 The relationship between different service innovation modes

The preceding section has argued for the use of a typology for service innovation covering three modes of innovation: the business model, service product, and service process innovation. An important question is, given that these three modes or types of innovation exist, are they stand-alone or mutually exclusive modes, or are there overlaps or relationships between each of the modes? If so, what are the characteristics of these relationships?

These modes have often been treated separately; some authors have suggested that the product and process could be two separate modes of innovation in services (Damanpour and Gopalakrishnan, 2001). However, others have argued that both could be closely related in reality because process innovation may simultaneously occur with innovation in new service products (Droege *et al.*, 2009). On the other hand, as service product innovation is similar to traditional product innovation in manufacturing settings, some service product innovations may merely be new products associated with the same product line, and these innovations do not necessarily involve the changing of the delivery process or system. However, there could also be new products characterized by radical breakthroughs with a high degree of newness to the company or market, which means that they might be substantially different from previous products, and will need to be delivered differently, thus involving service process innovation as well. Traditionally service innovation has focussed on either the service itself (service product) or the service process, but we need to have a better understanding of how various types of innovation interact to inform value creation and address new markets, and in particular, "it is important to investigate the interrelationships among service-product, service-process, and business-model innovation to capitalize on the potential for new value creation" (Ostrom *et al.*, 2015, p. 131).

Since business model innovation involves a substantial or even complete change, and is often accompanied by innovations in organizational arrangements (Voss and

Authors	Types of service innovations
Gadrey *et al.* (1995)	*Innovation in the insurance sector* Innovations in service products Architectural innovations (which bundle or unbundle existing service products) Modifications of service products Innovations in processes and organization for existing service products *Innovation in business consultancy services* Product innovation Process innovation Organizational innovation Market innovation Conquest of a new source of raw materials *Innovation in electronic information services* The creation of a new product or new service Innovations in the improvement of products or services Process innovations
Johnson *et al.* (2000)	*Radical innovations* Major innovation: new services for markets as yet undefined Start-up business: new services in a market that is already served by existing services New services for the market presently served: new service offerings to existing customers of an organization (although the services may be available from other companies as well) *Incremental innovations* Service line extensions: augmentations of the existing service line Service improvements: changes in features of services that are currently being offered Style changes: modest forms of visible changes that impact customer perceptions, emotions, and attitudes, but do not change the service fundamentally, only its appearance
den Hertog (2000)	New service concept New client interface: the design of the interface between the service provider and its clients New service delivery system: the internal organizational arrangements that have to be managed to allow service workers to perform their job properly, and to develop and offer innovative services Technological innovations (not always a dimension)
Voss and Zomerdijk (2007)	Business model innovation: involves a complete or substantial change in the way in which revenues and profits are earned Service product innovation: involves the introduction of new services, and it is the most analogous to traditional manufacturing-based innovation activity Process/system innovation: primarily takes place in operational areas and is often related to a service process and system, and service journey
Bettencourt (2010)	New service innovation: innovation comes from the discovery of new or related jobs that a current or new service can help the customer get done Core service innovation: innovation comes from helping the customer get a core job done better by improving a current service or introducing new services Service delivery innovation: innovation comes from improving how the customer obtains the benefits of a service when getting a core job done Supplementary service innovation: innovation comes from helping the customer get jobs related to product usage or consumption done

Table I.
Selected typologies of service innovation

Zomerdijk, 2007), we expect that business model innovation might be associated with innovations in the service product or service process. Product innovations and process innovations could help firms to create superior capabilities and core competencies on which new business models could be built. This leads to the following research questions:

RQ1. What are the relationships between different modes of service innovation? Do they happen separately or in combination?

RQ2. If a combination of different modes exists, what are the patterns of combination, and how do the different modes interact and support each other?

In practice, service innovations often require the collaboration of multiple organizations and are often triggered by modern information and communication technologies (ICT). As the development of new services involves all the activities from idea generation to final commercialization, service innovations may involve different functional departments within the organization, and major customers and business partners within the service network taking part in the development activities (Avlonitis *et al.*, 2001; Melton and Hartline, 2010; Ordanini and Parasuraman, 2011). Service product innovations are typically developed in a service design or marketing department, while service process innovations often emanate from operations or IT departments. In an increasingly open innovation environment, some product or process innovations may be based on business models co-developed by network partners (Colombo *et al.*, 2011; Nenonen and Storbacka, 2010). Therefore, the organizational implications of different modes of service innovation and possible patterns of multi-mode service innovation are interesting issues that deserve further empirical investigation. This leads to our next research question:

RQ3. What are the patterns of innovation modes in a networked environment?

If there are such patterns of multi-mode service innovations, the organizational arrangements that are required to deal with the internal and external complexity become an important issue. How organizations manage their internal and external collaborations in the service innovation processes can have a great impact on the success of a service innovation (Corsaro *et al.*, 2012; Nenonen and Storbacka, 2010; Ostrom *et al.*, 2010). Therefore, how the innovation project should be managed and organized if there is a multi-mode innovation, and the subsequent implications on performance are issues that need to be addressed. We therefore put forward a further research question:

RQ4. What are the organizational implications of multi-mode service innovation?

3. Methodology

The main research method used was the analysis of secondary data from multiple service innovation projects. As this research studies the modes of service innovation in different projects, the level of analysis is at the project level rather than the organizational level. To ensure comparability, examining multiple cases of innovation projects embedded in a single service company (with multiple business units) was chosen as an appropriate research design. Empirical case research utilizing multiple sources of evidence is suited to situations where there are complex variables and processes, but where the established theories are scarce (Yin, 1994). Multiple project design helps reduce observer bias and increase external validity, even though it may also reduce the depth of research when resources are constrained (Voss *et al.*, 2002).

A set of innovation projects from a large mobile telecom firm in China was identified and investigated. Secondary archival data from documents were collected as a major source of data for this study, and semi-structured interviews were conducted to explore the innovation context and to clarify uncertainties in the secondary data.

3.1 Selection of the case company

Case selection was guided by the need to study projects in an innovative environment and to have multiple projects to compare in a controlled manner. The mobile telecommunications industry was selected since this industry has been seen as one of the most important and rapidly changing industries throughout the globe. Technologies, government policies, and the intensifying competition have forced companies in this industry to develop new services or even new business models so that they can maintain or increase their market share. The company chosen is a major mobile telecom operator in China. The company had a reputation for success, not only in terms of its market share and revenue, but also in terms of its innovative new services that were introduced to the market. It is recognized both inside and outside China for its innovation, and was ranked among the "The 50 most Innovative Companies" in 2010 by *Business Week*. The company has a large mobile network and the largest mobile customer base (767 million customers as of the end of 2013) in the world.

3.2 Selection of service innovation projects

The company has a formal service innovation management system and presents awards for successful service innovations annually. It has departments/centers for research and design at different organizational levels to take charge of innovation activities; at the national-headquarters level as well as at its 31 independently operating provincial companies (each has many city-level subsidiaries as well), respectively. Based on analyses of customer needs and internal requirements, the firm strategically plans for innovations in service products, technologies, and managerial arrangements, and it continuously encourages employees to propose innovative ideas. It has an information system in place to collect, process, evaluate, and implement innovation ideas from its employees. After an initial innovation idea has been evaluated and seen as implementable, a project team becomes responsible for the development activities. The project team could be either within a department or across different functional departments when necessary. Weekly meetings and monthly coordination conferences are regularly held, and for key projects, regular reports to top management are also required. In addition to the formalized management process of innovation proposals and innovation projects, the company also provides enough investment and other resources to support other innovation activities.

New services are designed and developed by different departments within the headquarters of the provincial companies as well as by different subsidiaries at city level. Each year, all of the departments and subsidiaries can apply for the "service innovation award" by submitting the relevant documents (application file and presentation slides) for their service innovation project. Finally, after oral presentations of all the projects and an evaluation process conducted by a group of 15-20 experts in the company, all the projects are scored across several key aspects. The projects are rated by the evaluation panel on a scale from zero to 100 points, with a maximum of 30 points for innovativeness, 30 points for financial and non-financial performance, 30 points for generalizability, five points for the extent to which a project is conducted and led by the applicant (department or subsidiary), and five points for a patent, respectively. Only the total scores of the

awarded projects, not the individual scores for the different aspects, were made available to the research team. Based on the final scores, 35 service innovations each year are given awards at four different levels; namely, first prize, second prize, third prize, and honorable mention. We collected the relevant documents on all 70 projects awarded in 2010 and 2011. These years were after the reconfiguration of the telecommunications industry in China in 2008 (to eliminate monopolies and to encourage competition and innovation).

3.3 Data collection and analysis

The analysis was based on secondary data from the documents for the 70 projects. In addition, interviews were conducted with company managers to explore the innovation process and to clarify secondary data. All interviews were recorded and transcribed, and notes were taken during the different meetings and observations. Since the projects investigated in this study are all from the annual service innovation award, documentation of the projects is quite consistent in terms of format, which increased the comparability, and facilitated potential literal and/or theoretical replication (Yin, 1994). All the information from the documents, interviews, and other sources was coded and listed in a spreadsheet for all 70 projects. As one project had insufficient data, the analysis was conducted on 69 projects.

The information provided for each project included: team members, involved departments/subsidiaries, involved external partners, project duration, etc.; background introduction to the market/competition/institutional environment and the reason why the particular service innovation was proposed and developed; key innovative aspects, which briefly introduce the project and explain why the project is seen to be innovative; major practices, which basically illustrate how the service innovation is developed and implemented/launched; and outcomes, which summarize the financial and non-financial performance outcomes of the project, and the potential generalizability of the innovation. The interviews were conducted by a team of three researchers, two Chinese scholars, and one western scholar. The full documentation (in Chinese) for the selected projects was translated into English, and the interviews were conducted mainly in Chinese and interpreted from/into English by the researchers themselves.

The first stage of the analysis was to categorize the service innovations in terms of the three modes in the chosen typology. We based this on the approach used by Van Orden *et al.* (2011). Based on the extant literature, we developed criteria for each of the three modes of service innovation. Our criteria for categorization are listed in Table II.

During the categorization process, it became clear that many of the service innovation projects were complex and involved multiple aspects from different service innovation modes. We then examined whether each service innovation project studied was dominated by one type of innovation, but was also related to or supported by one or both of the two other types. By "dominant" we refer to the innovation type that plays the leading role with a bigger impact on the organizational level, that is more complex and broader in terms of the changes/reconfigurations and efforts made by the organization, and that is possibly supported by innovations in other aspects, which were then considered as supporting modes. By a supporting/related mode, we refer to the innovation type that plays a supporting role so that other innovations could be based on it. Therefore, we then categorized projects in terms of their dominant service innovation mode as well as the related ones. When we found it difficult to classify any

Type of service innovation	Criteria
Business model innovation	*Satisfying at least one of the following criteria*
	Substantial change in the way in which revenues and profits are earned, e.g., change of value proposition, cost structure, and revenue streams
	Drastic change of partner relationships or customer relationships
	Can either create a new market or allow the company to enter into a totally different market, compared with the market currently served
	Platform innovation, which builds new customer/partner relationships and creates new product lines
Service product innovation	*Involves the introduction of new service products, which could be any one of the following*
	New to the regional, national, or international market
	New to the providing firm
	New to the client
	Product line extensions
	Bundling or unbundling of existing service products
	Modifications of an existing service product
	Repositioning of an existing service product
Service process innovation	*Satisfying at least one of the following criteria*
	Significant changes in the way information is exchanged between a customer and a service provider, often supported by ICT
	Significant change of the interface between the service provider and its clients
	Significant change of the back-office processes, which may either influence the service delivery or increase efficiency
	Significant change of the organizational structure, i.e., internal organizational arrangements that have to be managed to allow service workers to perform their job properly, and to develop and offer innovative services

Table II.
Criteria used to classify service innovations

service innovation project, we marked it for further investigation, and interviews or consultations with the project team and other managers in the company were conducted when necessary.

To ensure reliability, each project was categorized by two researchers independently. Specifically, two researchers judged the dominant innovation mode (business model, service product, or service process) and supporting innovation mode (null, service product, service process, or service product plus service process) for all of the 69 projects, respectively. There were four projects associated with different opinions (on both the dominant mode and supporting mode), thus the inter-rater reliability was 94.2 percent according to Perreault and Leigh's (1989) reliability formula. Then the reasons for discrepancy were explored and the interpretation of the categorization criteria was clarified jointly by these two researchers. Finally, a concerted version of the classification was presented to the third researcher who made judgments based on his understanding, and the judgments were perfectly consistent. The categorization results were also presented to senior managers from the company a number of times during the research process and the feedback received was always positive.

We illustrate our analysis with details of ten of the innovations (see Table III).

4. Results

Our analysis was conducted in two parts: first, we sought confirmatory validation of the typology and then addressed our first research question concerning patterns within

Table III.
Selected cases and the innovation modes

Project ID and name	Project summary	Dominant innovation mode	Supporting innovation mode
2010-04: "Mobile Market"	"Mobile Market" is an online application store for smartphones, which is also the first apps store operated by a mobile telecom company. It provides services such as testing, charging, and advertising to external developers (individuals and companies) so that the developers can develop and upload various smartphone applications and contents (music, videos, or books) to the platform. Customers (using different operating systems and mobile devices) can buy and download the apps and contents to their devices, and the revenue will be shared by the platform owner and the respective developers	Business model	Service product; service process
2010-10:"Customer Complaint Management System"	This is an IT system developed to deal with customer complaints in an integrative way by linking different service channels together. A new complaint-handling system is developed with some intelligent processes (automatic data collection and processing, automatic order distribution, and intelligent maintaining, and alerting) available, which enables the company to solve problems for customers more effectively and responsively	Service process	
2010-14:"Online Service Hall to Improve Cell-phone Number Allocation"	This is a new method to improve the allocation of cell-phone numbers. The company has limited resources for cell-phone numbers based on the current digit capacity, but traditionally, each number will be physically written on a SIM card and distributed to a sales channel, which had low efficiency. This innovation is to put all the numbers in a shared pool and all sales channels are linked to this pool by IT systems provided by the online service hall. This innovation has changed the number-selection process for customers and the sales process for frontline employees (or distribution channel partners), but it optimizes the management of number resources and reduces costs associated with unnecessary SIM cards	Service process	
2010-29: "The Anti-theft System for Vehicles"	This innovation employs global positioning system (GPS) and location-based service (LBS) technologies to locate vehicles, and provides services such as anti-theft, alerts of shifting, roadside assistance, driving track records, etc. This innovation is positioned as a new product to machine users in the market known as the "internet of things." As a new application for existing	Service product	Service process

(*continued*)

Project ID and name	Project summary	Dominant innovation mode	Supporting innovation mode
	technologies, new service processes are developed and new collaborations are also initiated (e.g. with Honda)		
2010-32: "Vending Machine with Mobile Payment"	This innovation enables the company to enter the retail industry by setting up vending machines supported by the company's mobile payment system. Traditional manufactured items (supplied by external suppliers) will be selling in the vending machines, and a real-time monitoring system enables efficiency of logistics and inventory control. Customers can use their mobile phones to pay for the items (the mobile payment service was already in place, thus no new service product is actually being developed). Partnerships with item suppliers, a vending machine supplier, and third-party logistics service providers are required and established in this innovation	Business model	Service process
2011-08: "MID Project"	Mobile internet devices (MIDs) are becoming popular and have great market potential, but because of the special telecommunication technology standard of the company, the mobile tablet computers matching this standard are developing slowly. Therefore, the company cooperates with a design company for terminal devices and develops the first mobile tablet using its standard. The tablets will be manufactured by other firms and customized according to the company's requirements so that the company's apps will be installed. For customers, the selling, delivery, and after-sales service processes are basically the same as those of the customized cellphones provided by the company	Service product	
2011-16: "Electronic Medical Service"	This was developed by a department at the headquarters of the company. The basic function of this service innovation is that customers can call the hotline to make appointments for medical services instead of queuing up in hospitals, and it also provides other related services such as hospital maps. This service innovation has created a new market for the company and changed the way that revenues are earned since the company can gain revenues by providing services to both the consumers and the hospitals. It involves new partnerships (i.e. with the hospitals and governmental departments in charge of the hospitals) and new customer relationships	Business model	Service product; service process

(*continued*)

Table III.

Table III.

Project ID and name	Project summary	Dominant innovation mode	Supporting innovation mode
2011-26: "Digital Authentication Based on PKI"	This innovation provides a technological solution to achieve mobile digital authentication, based on the public key infrastructure (PKI) system, the Certificate authority (CA), and authorization center of the company. Mobile digital authentication combines digital certificates with cell-phone numbers to ensure security and convenience for electronic transactions, and services such as online shopping, mobile payment, attendance systems, etc.	Service process	
2011-28: "A New Mode of WLAN Service"	The wireless local area networks (WLAN) service is an important area for mobile internet business, but it requires the company to invest a lot in the infrastructure and to promote this service to customers. The company also provides a cabled broadband service but falls behind their competitors in this market. This innovation is a repositioning of the two services by creatively linking them together. Specifically, when customers apply for the cabled broadband service, the company will provide them with a broadband device with WLAN function (current customers can choose to upgrade their devices at a low price) so that customers can enjoy both the cabled broadband service and WLAN service (two separate accounts that can be used at the same time). Simultaneously, their neighbors and other people nearby can find the WLAN signal and use their own WLAN accounts to logon and enjoy the service. Technological processes are developed so that customers relying on the same device will not disturb each other	Service product	Service process
2011-35: "A New Service Management and Control System"	This is a new management and control system for processing service information from different sources and improving service quality. The system monitors current services in terms of the entire process and different controlling points, in order to provide feedback to different departments and employees and to improve the process efficiency accordingly	Service process	

the typology. We then explored our second and third research questions through examining data of multi-mode service innovations. Finally, we reviewed the potential organizational implications.

4.1 Patterns of modes of service innovation

The classification based on the dominant innovation mode indicated that 26.1 percent of the 69 service innovations were dominantly business model innovations, 20.3 percent were service product innovations, and 52.6 percent were service process innovations. The results provide confirmation of the validity of our chosen typology, as all modes were found, and we were able to discriminate between them.

In our sample, service process innovations accounted for more than a half of the innovations studied. Given that research to date in new service development and service innovation has focussed primarily on service product innovations (as with most previous studies on innovation in the manufacturing setting), this may seem somewhat surprising. We see a number of possible explanations for this. First, much of the previous service innovation research has not focussed on the service process; thus, a significant area of service innovation is under-studied. Second, it could be argued that as service production and consumption are simultaneous, service product innovations are in fact sometimes primarily service process innovations. For example, case 2011-28 (a new mode of wireless local area network (WLAN) service) is primarily a repositioning and reconfiguring of two existing services, where the original service delivery processes are integrated (see Table III). As we will see later, service product innovation and process innovation often occur jointly, and many service product innovations are supported by an innovation in the process (see case 2010-29 in Table III for an example). We do not seek to generalize the distribution of the innovation modes that were found, as it is very likely that the distribution in our sample may be a function of the context. In mobile telecom firms, telecommunication technologies, and systems play a distinctive role, thus the distribution might be different from other service contexts. Due to the nature of our sample, we are not able to distinguish between these three possible explanations and further research in different contexts is called for. Compared with service process innovation, business model innovations were also a smaller group; we postulate that this might be because they are usually difficult to develop and implement in organizations, as they tend to be generally complex and consume more resources. For example, case 2010-04 (Mobile Market) is a new business model for the mobile telecom company that required the company to invest substantial resources and establish new partnerships. In its 2011 annual report, the company stated that Mobile Market was an essential component of its Mobile Internet Strategy and it had consolidated resources from nine bases of the company's major businesses. As it aimed to be a customer-oriented sales platform, a developer-oriented service platform, and a supply chain-oriented support platform, the platform involved a range of partnerships with system developers, application developers, media content providers, mobile device manufacturers, and other partners.

4.2 Multi-mode innovation: a refined typology of service innovation

The next stage in our analysis was to examine the evidence for multi-mode innovation (i.e. innovations involving two or three modes). We categorized the service innovation projects based on the dominant innovation mode as well as on the supporting mode(s). Of the 69 service innovations, 31 (45 percent) were found to be multi-mode, including 12 service innovations with all three modes. The results are shown in Table IV and are

summarized in the Venn diagram in Figure 1. This clearly indicates that a substantial proportion of service innovation projects could be considered as multi-mode innovations. Our data contrast with previous research and typologies that considered just one mode of innovation.

We illustrate multi-mode innovation by examining case 2011-16, "Electronic Medical Service." First, it can be seen as a business model innovation because: it has created a new market for the company and has changed the way that revenues are earned since the company can gain revenues by providing services to consumers as well as hospitals, which is different from the way in which a traditional mobile telecom firm earns money; and it involves new partnerships and customer relationships. Second, there are also innovations in both service products and the associated service processes: making appointments was the main service provided at the early development stage of this business model, but later on, hospital maps and other information-based products were added into the business model; and the original reservation systems of the hospitals were revised/upgraded (or created, in cases where hospitals did not have their own reservation systems) to be integrated with the new system, which incorporated information from different hospitals into a new integrative system.

The data in Table IV and Figure 1 show some interesting patterns. First, all projects where the dominant mode was business model innovation also had supporting product innovations or process innovations, or both. This is consistent with our earlier supposition that business model innovations are complex and do not take place in isolation. Only two of the product innovations took place alone; most had supporting process innovation activities. An example is case 2010-29 (Anti-theft System for

Table IV.
Evidence for multi-mode service innovation

Dominant mode	Number (%)	Dominant mode alone	With business model innovation	With service product innovation	With service process innovation
Business model innovation	18 (26.1%)	0	–	14	16
Service product innovation	14 (20.3%)	2	0	–	12
Service process innovation	37 (52.6%)	37	0	0	–

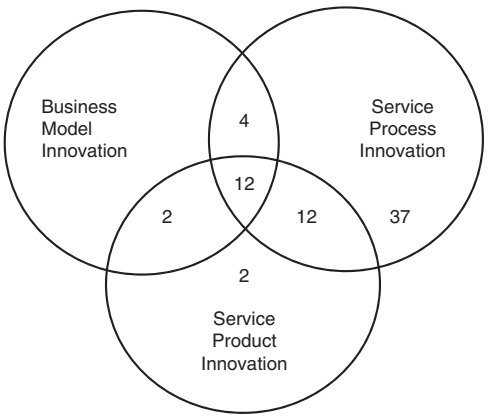

Figure 1.
The classification of service innovation projects

Vehicles), which provided new services such as anti-theft, alerts of shifting, and track records to automobile users. These new services were based on the changes to and integration of the service delivery processes of the two existing technological systems and processes. Our data address Droege *et al.*'s (2009) question concerning whether product and process innovation are separate or occur together. We conclude that both scenarios are possible. The results are also consistent with Menor and Roth (2007, p. 826), who suggest that a new service is "an offering not previously available to the firm's customers that results from either an addition to the current mix of services or from changes made to the service delivery process." Given that most service product innovations involved supporting process innovations, the data are more supportive of the view that as the service product also embraces the service process, service product innovation will usually involve service process innovation in some form.

Our data indicate that the pattern for process innovations is different. All of the innovations where the dominant mode was service process innovation, took place alone without other supporting innovation modes. Where there were combined modes, service product or business model innovation was the dominant mode. A possible explanation is that typically process innovation may precede product innovation, for example, to build an information system or other infrastructure on which service product innovations can subsequently take place. Therefore, these innovation projects were initially positioned as process innovations, but they may lead to other product innovation projects in the future. For example, case 2011-26 (Digital Authentication Based on Public Key Infrastructure (PKI)) is an innovation of the system infrastructure (focussing on security assurance). It is clearly a service process innovation supporting a back-office process and is not visible to customers. The expectation of the company was that in the future more services (service product innovations) such as online shopping, mobile payments, attendance systems, digital approvals in office automation systems, and membership card-related services could be based on or facilitated by this innovation.

4.3 Innovation modes in a networked environment

Service innovation often does not take place just in the innovating company, but involves others, including suppliers and customers. Our third research question was to explore whether there were network patterns associated with the different modes of innovation. To do this, we examined the degree to which different innovation modes involved external partners. We analyzed the documentation and conducted further interviews to identify whether there was substantial external collaboration during the development of these service innovations. Some projects had explicitly specified which external partner(s) had participated in the development process. For other projects, when we found evidence of possible external collaborations, we interviewed the general managers to determine if there was actual collaboration. The results are summarized in Table V.

We examine each innovation mode in turn. First, all business model innovations involved collaboration with external partners. We see this as reflecting the nature of business model innovations. A company's business model is a system of interconnected and interdependent activities that determines how the company does business with its customers, partners, and vendors (Amit and Zott, 2012). As a result, business model innovation is potentially more substantial and radical compared with product and process innovation. The complexity and interconnectedness would thus require more interactions and collaborations, especially collaborations with external partners. An example is case 2010-04 (Mobile Market). This involved partnerships with a major

Table V.
Projects with/without external collaboration

Dominant innovation mode	With major external partner(s)	No major external partner	Project example
Business model innovation	18 (100%)	0	2010-04: a system-development partner, many developers (individuals and companies), etc.
Service product innovation	8 (57.1%)	6	2010-29: collaborate with automobile manufacturers such as Honda. 2011-28: no external collaboration (the main partner is another subsidiary of the company)
Service process innovation	7 (18.9%)	30	2011-26: system-development partner, equipment suppliers. 2010-10: no external collaboration

system-development company who helped in developing the platform, various apps developers, advertising companies, and other business partners. Another example is case 2010-32 (Vending Machine with Mobile payment), which involved partnerships with item suppliers, a vending machine supplier, and third-party logistics service providers. A third example is case 2011-16 (Electronic Medical Service), which involved partnerships with hospitals and the government.

A substantial proportion of the service product innovations (57.1 percent) also involved external partners. We see a number of potential reasons for this. First, it is now recognized that customer and business partner involvement in the innovation is important for success. The data from some of the case firms are consistent with this. For example, in case 2010-29 (The Anti-theft System for Vehicles), the company used the global positioning system (GPS) and its own location-based service (LBS) system to provide services including anti-theft services to automobile users. To develop this innovation, collaboration with automobile manufacturers was important to draw on their experience with the context and with customer needs. Second, increasingly, there are triadic relationships in the delivery of services, through which a customer may have both direct and indirect (with intermediaries playing a role) interactions with a supplier. We found that many of the innovations fitted this pattern. Some service products provided in a new business model involved both direct and indirect interactions. An example is case 2011-16 (Electronic Medical Service), a business model innovation supported by innovations in service products and processes. The appointment-making service and hospital information are provided to customers by the case company, while the information on the availability of doctors, the capacity of appointments, hospital maps, and other instructions is shared with the case company by each hospital. Developing these innovative and convenient services for customers required building relationships with a number of external organizations. A final context was new services developed by the company itself by the bundling or unbundling of existing services (or service components). An example is case 2011-28 (A New Mode of WLAN Service), which is an innovation based on the combination and reconfiguration of two existing services provided by the company. In this case, the two existing services (WLAN and cabled broadband) are provided by one functional department and one subsidiary, respectively. Although this subsidiary was an independent company before the aforementioned industry reconfiguration in 2008, it became the company's subsidiary after the reconfiguration.

We would also expect service process innovations to have external partnerships for a number of reasons, including the need to partner with external technology or equipment suppliers, the involvement of third-party service providers in the delivery process, and the possible need to have external consulting firms. An example is case 2011-26 (Digital Authentication Based on PKI), which involved external collaboration with suppliers and a system-development partner (similar to the role of consulting firms). However, only 18.9 percent of the service process innovations had external partners. There are a number of possible reasons for this seemingly low involvement. First, in this company, process innovation projects are usually carried out in departments that are separated from direct interaction with the customer. Second, technology and systems may be seen as proprietary assets and sources of competitive advantage that should not be shared with others, therefore companies will build their own teams to innovate in technologies and systems when it is a core process. This may be particularly true of a large technology-based company such as the one under study. Third, the development of a new process usually requires a deep understanding of the internal organizational routines of the company, which increases the communication cost when involving external partners.

Finally, with the data set available, we also tried to conduct further analyses. The beginning and finishing dates of each project was provided in the application documents for the annual service innovation awards, allowing us to calculate the total development time of each project. Since most projects provided date information in the format of month-year rather than exact dates (and there were also missing values), we calculated the development time of each project by month. In addition to development time, the number of people in the project teams was also provided in the documents. As we expected that the degree of complexity associated with service process, service product, and business model innovations may increase accordingly, it would have an impact on the time and/or people needed to develop the innovation. However, when one-way ANOVA was performed, statistical results indicated that there were no significant differences among the three groups divided according to the dominant mode of innovation, although we did find that the most time-consuming project and the most people-consuming project were both business model innovations. The insignificance of differences might be explained by the fact that all the innovation projects are from the same organization which has a formal innovation management system, requiring a certain number of people to participate in an innovation project and to finish it within a certain period of time. The statistical results are shown in Table VI.

5. Discussion

This paper set out to explore different modes of service innovation by using an existing typology of service innovation. An important contribution of our study has been to

	Dominant mode	*n*	Mean	SD	Min.	Max.	df	*F*	Sig.
Time	Service process	34	11.067	4.488	3.00	22.00	2	0.266	0.767
	Service product	10	10.510	5.056	4.00	18.00			
	Business model	16	11.881	5.614	4.00	25.00			
People	Service process	36	10.056	3.162	4	20	2	1.495	0.232
	Service product	12	8.250	2.896	5	13			
	Business model	16	10.313	4.316	2	21			

Table VI.
One-way ANOVA

bring in business model innovation as a core mode of service innovation. Previous studies tend to focus on just service product innovation and service process innovation, whereas innovation in the business model has often been neglected by service innovation research. By validating the original typology, this study builds up a more comprehensive and workable typology of service innovation. The first step was to validate the typology empirically. To do this, we followed Snow and Ketchen (2014), who argue that well-developed typologies must be amenable to valid and reliable measurement. We developed and tested measurements for each of the three constructs in the typology and sought evidence that all three constructs could be found in service innovation. We then followed Delbridge and Fiss (2013), who argue that the emergence of new phenomena of interest provides enough impetus for the revision of existing typologies. Our empirical data indicate that a simple three-way categorization does not reflect the reality of much service innovation, and we revised the original typology to reflect multi-mode service innovation.

The distinctive aspect of both the original and revised typology was that it introduced business model innovation as one possible mode of innovation. Of the service innovations studied, 26.1 percent were categorized as having this as the dominant mode of innovation. Increasingly, business model innovation is being seen as crucial to business success and our findings reinforce this. We postulate that as the importance of digital services and the digitization of traditional services increases, so will the need for business model innovation. Our data also indicate that this form of innovation is more complex and more likely to need the involvement of external partners.

We put forward four research questions concerned with multi-mode service innovation. The first research question was answered positively, as a significant proportion of our sample of innovations were multi-modal in nature. It is also important to note that the majority were still single mode with more than half of the projects in our sample being process innovations. We thus conclude that in an organization, there are likely to be both single- and multi-mode innovations. The observed relative proportion of single- to multi-mode innovations may be a function of the context of the sample innovations. However, we do conclude that as business model innovation comes to play an increasing role in services, the proportion of multi-mode innovations will increase.

Our second question addressed the patterns of multi-mode innovation. Our data indicate that both business model innovation and service process innovation typically involve innovation in one or two other innovation modes. In particular, 12 of the 14 (85.7 percent) service product and 16 of the 18 (88.8 percent) business model innovations also involved process innovation (see Figure 1 and Table IV). No business model innovations exhibited a stand-alone mode, and only two service product innovations were stand-alone, whereas 37 service process innovations were stand-alone in nature. We postulate that this pattern may in part be due to the nature of the technology innovation in the company, but it might also reflect a longitudinal pattern.

The data employed in our research were primarily cross-sectional; thus, we were not able to pick up longitudinal nuances or patterns. An interesting question is whether there are longitudinal patterns of innovation modes. For example, one substantial form of a service process is a platform or system on which various service product innovations can be based (Voss and Hsuan, 2009). An example in our sample is case 2011-26 (Digital Authentication Based on PKI), and we can expect more service product innovations to be based on it in the future. Another example is 2010-04 (Mobile Market). If we could trace its origins, it is likely that there were process innovation projects enabling this business model innovation. Therefore, in this context, service innovation is more likely to be multi-modal on a sequential basis over time.

Many service products might be developed only after the process or platform has been developed. Alternatively, for one single project, early in the innovation cycle, the dominant mode might be a process innovation, which is subsequently followed by a product or business model innovation, which then becomes the dominant mode. This proposition is consistent with Barras (1986). He contrasted the service innovation life cycle with the product innovation life cycle, and argued that the traditional product life-cycle model of innovation needs to be reversed when applied to services, because he observed that innovation in financial services was driven by processes before products. Innovation in services may thus follow a pattern whereby innovation of a process allows new products to be introduced. This also presents a strong implication that future research in this area needs to be longitudinal.

Our third research question addressed multi-mode innovation in a networked environment. Our data indicate that increasingly all three modes are likely to take place in a networked environment. A question for future research is whether the lower proportion of external collaboration in process innovation in our sample was a function of the innovation strategies of the company or of a more general pattern. It is possible that the greater the importance of proprietary technology, the higher the risks, and hence the lower the importance of external collaboration.

Our final research question concerned the organizational implications of multi-mode innovation. If, as our research indicates, multi-mode innovation is common, and, if as we postulate, there might be multi-mode service innovations on a sequential basis, the organizational implications for companies regarding their innovation strategy and management of innovation activities will be substantial.

We argued earlier that in services the three modes of service innovation tend to be located in different functional units within the organization. Thus, the nature and existence of multi-mode innovation can lead to requirements for both organizational and information mechanisms for coordinating and integrating the innovation efforts made by different organizational units. In our case company, the problem would seem to have been addressed, at least in part, by pervasive and effective information systems. In addition, multi-mode innovation implies a need for a clear specification of responsibilities. The case company handled this by having a single post or department responsible for the whole project and coordinating the efforts from other associated departments. Nevertheless, external partnerships are even more difficult to manage compared with internal collaborations between functional departments, especially in the case of service innovations with potential uncertainty and risks.

Compared with manufactured product companies, service companies are often reported to have an unsophisticated or haphazard process that tends to be ad hoc or based on trial and error (de Brentani, 1989; Menor *et al.*, 2002). All the business model innovations in our sample involved external partnerships, and all the business model innovations were substantially supported by innovations of either the service product or service process (or both), which indicated that for multi-mode service innovations, companies need mechanisms to deal with collaborations both internally and externally.

We conclude that the service innovation strategy of an organization should embrace service process innovation, service product innovation, and business model innovation. As this research indicates that the three modes are often commingled, companies also need to identify the linkages between these modes both in parallel and sequentially over time, which in turn leads to important organizational implications regarding the governance mechanisms for service innovations. Therefore, to manage innovation activities effectively, service organizations may need to have different project-management practices

for different modes of innovation, such as setting different objectives, allocating different resources, and relying on different internal/external parties. The taxonomy and related findings were presented to both the middle and top management of the case company and we discussed the results with them. The managers showed great interest in this typology and agreed that it was applicable and meaningful in practice. Following the discussions, they considered using this typology to separate their annual service innovation awards into three different groups and to bestow awards separately.

6. Conclusions and future research

In this research, we set out to extend our understanding of service innovation through empirical analysis of modes of innovation in 69 service innovation projects. Our first major contribution has been to incorporate business model innovation into the study of modes of service innovation. To do this, we have taken an existing typology of service innovation, developed measures, and empirically extended it to reflect multi-mode innovation.

Our second contribution has been in using the empirical results to help us understand the modes of service innovation and the interrelationships among service-product, service-process, and business-model innovation more profoundly, which has been proposed by Ostrom *et al.* (2015) as one of the key research priorities in service research. In particular, our data indicated that the development of business model innovation typically required support from either service product and/or process innovation; a pattern found, but less widely, in service product innovations. A further contribution is that the results of this study indicate that business model innovation relies on external collaboration to a greater extent than the other two modes do. This result echoes the fact that business model innovation is the most radical and complex innovation and it is often beyond the capability of one single organization. In today's service economy, a business model innovation often requires many parties in the service network to work together and innovate jointly to serve customers, and many of our cases reinforced this.

The findings of this study also need to be interpreted in light of several limitations. First, all of the projects and data came from a single company and industry. While this does not limit our conclusions regarding the validity of the proposed taxonomy, it does limit the generalizability of the findings regarding the patterns of innovation modes (single- or multi-mode, and relationships between different modes), as these patterns may vary in different contexts. Future research could collect data from multiple companies in different contexts. The second limitation is that although we set out clear criteria for categorizing innovations, we still feel that the empirical and statistical criteria for distinguishing between different service innovations should be developed in further research. If measurement scales could be developed for different modes of service innovation, analyses that are more sophisticated could be conducted accordingly. Third, we chose to control for success, with all innovations being rated as successful by the organization. We thus did not nor were able to examine relationships between modes of innovation and collaboration and success. Fourth, our data are mainly cross-sectional, although the interviews were also conducted ex-post for better understanding and for clarification purposes. As Henard and Szymanski (2001) pointed out, no assumptions of causality can be generated from cross-sectional data. Hence, future research could try to study service innovations from a longitudinal perspective, which may help in exploring the evolution of service innovation modes over time. In particular, we postulate that a longitudinal view will see the stand-alone process innovations becoming the basis for further service product or business model innovations. Finally, not only the development,

but also the diffusion of service innovations can be studied from a longitudinal viewpoint. The final success of service innovations also depends on the effective deployment or generalization of initial innovation outcomes. In further research, some of the individual projects studied in this paper could be traced over a longer term through longitudinal case-study research.

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