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A Staged Performance Model for Service Innovation

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Abstract

Purpose – Superior innovation performance is vital for enterprises to survive and maintain competitiveness, especially in Internet related industries which are rapidly growing and changing. However, not all innovations can survive to later stages and bring benefits for enterprises. From a staged process perspective, we divide innovation performance into three stages: development performance (cost/time efficiency and experience/solution effectiveness), deployment performance, and financial/non-financial performance, and aim to examine the relationship between modes of service innovation (business model, service process, and service product) and their performance implications in different stages.

Design/methodology/approach – Based on survey data of 200 innovation projects from the Internet related industries in China, this study uses bootstrapping-based partial least squares (PLS) approach to structural equation modeling (SEM) to empirically test the hypothesized relationships.

Findings – We found that business model innovation and service product innovation would have better development (effectiveness) and deployment performance, and process innovation is positively associated with development performance (efficiency). Furthermore, efficiency performance needs to be transformed into good deployment performance to get better final financial performance. When final non-financial performance is considered, non-mediated (effectiveness) and mediated (efficiency) relationships are found.

Practical implications –The findings of this study suggest that managers should evaluate service innovation performance in a staged process perspective. Managers should pay attention to the modes of service innovation when assessing the intermediary performance indicators in the staged model because different modes of service innovation impact these indicators differently. This study also identifies the mediating effects of development and deployment performance between modes of service innovation and final performance, which inspires managers that for a better final performance (both financial and non-financial), resources and attentions should be made to achieve high-quality development and deployment activities.

Originality/value – This study empirically examines key staged performance indicators derived from the new service development process, ties them to modes of innovation and final performance (financial and non-financial), and explores the mediating effects of those staged performance indicators between modes of service innovation and final performance. It extends our understanding of service innovation performance from a staged process perspective.

Keywords: modes of service innovation; new service development process; new service development performance; financial/non-financial performance

Paper type: Research paper

1. INTRODUCTION

After decades of development, services have not only dominated our daily lives but also become the most effective driving engine of the world economy, as evidenced by its 65.08% share of the world's GDP (The World Bank Data, 2017). Under this trend, numerous new services emerge and manufacturing firms that historically focused on producing goods begin to add accompanying services to their products for higher profit margins (Carlborg and Kindström, 2014; Visnjic *et al.*, 2016). Due to the unique characteristics such as intangibility, heterogeneity, perishability, and inseparability of services (Zeithaml *et al.*, 1985), service demands are highly diversified, personalized, unstable, and unpredictable. As such, it is imperative for service firms to continuously innovate to attract customers and gain competitive advantage. Service innovation has thus been viewed as the "next big thing" (Jana, 2007) and the driving force for superior performance (Biemans *et al.*, 2015). A large body of research has been committed to the antecedents and mechanisms of service innovation, such as the modes of service innovation (e.g., Voss and Zomerdijk, 2007; Wang *et al.*, 2015), service innovation process (e.g., Alam and Perry, 2002; Song *et al.*, 2009), service innovation capability (e.g., Menor and Roth, 2007; Menor and Roth, 2008; Agarwal and Selen, 2009), and factors for success (e.g., Storey *et al.*, 2016; Aspara *et al.*, 2018). However, the success rate of service innovations is not high (Page and Schirr, 2008), and firms' performance is not necessarily guaranteed by service innovation (Storey and Hughes, 2013). The reasons for this tension between service innovation and its outcomes may lie behind the way how performance of service innovation is captured and measured.

Firstly, after three decades of development, the studies of service innovation have expanded from broad in scope to specific in detail to bring about several key antecedents of service innovation performance (Arnold *et al.*, 2011; Storey and Perks, 2015). While those antecedents already cover multifaceted factors related to organization structure, organization strategy, innovation strategy, innovation efficiency, internal communication, and external partnerships (Storey *et al*., 2016), systematic examination between innovation success and modes of service innovation is still needed (Wang *et al*., 2015). Since different modes of innovation have different objectives, appear in different domains, exhibit diverse innovativeness, require heterogeneous resources, involve distinct external partners, and are launched in different environments (Voss and Zomerdijk, 2007), the development patterns and performance outcomes derived from different types of service innovation are likely to be different (Avlonitis *et al.*, 2001). For instance, while Kastalli *et al.* (2013)'s research reports a non-linear relationship between service business model innovation and firm profitability, studies demonstrate positive correlations between financial performance and service process innovation (Chen and Tsou, 2012). In addition, an innovation can rarely be a single mode innovation. A substantial proportion of innovations can be considered as multi-mode innovations (Wang *et al*., 2015). Different combinations of diverse innovation modes and degrees are likely to generate different performance implications.

More importantly, although researches have already recognized that service innovation performance is a multidimensional concept (Cheng and Huizingh, 2014), historically, the majority of performance-related studies only focused on different dimensions of the final performance (either commercial success or strategic competitive advantage), ignoring important intermediate performance dimensions in the service innovation process and their associations with final performance (Storey *et al*., 2016). As indicated by previous studies, due to the simultaneous production and consumption nature of services, they cannot be felt by customers prior to purchase (Avlonitis *et al.*, 2001). Without pre-purchase evaluation, the on-site perception of customers become critical to a service innovation's success. Thus, the performance of a service innovation may be influenced by both the service itself and the service delivery system (Sasser *et al.*, 1978). Besides, the intangibility and heterogeneity natures of services make service experience vary across providers and staffs, leading to different perceptions of service quality and willingness to pay (Johne and Storey, 1998). That's why service firms constantly emphasize on staff training. Further, Carbonell *et al.* (2009) found that operational outcomes (innovation speed and technical quality) were the intermediary between customer involvement and final outcomes (sales performance and competitive superiority) in new service development and suggest future endeavors to test other measures of operational outcomes such as development cost or customer satisfaction. That is, intermediate stage outcomes at the development and deployment stages in the new service development process (Melton and Hartline, 2010) are indeed vital to the final outcomes of a service innovation. However, the literature is almost silent on the details of the staged performance model of service innovation.

Against this background, the purpose of this study is to build up a staged performance model for different modes of service innovation. That is, this research attempts to identify key staged-performance indicators for different stages of the new service development process and associate them with different modes of innovation and final performance for the first time. More specifically, this study focuses on performances of two stages: the development stage and deployment stage of the service innovation process. Since the development stage has two dual objectives: efficiency (time/cost) and effectiveness (functionality/experience), the development performance has two dimensions (Sasser *et al.*, 1978; Carbonell *et al.*, 2009). In doing this, this study (1) identifies the modes of 200 innovation projects from the IT service industry; (2) explores the effects of each mode of innovation on three stage-performance indicators; and (3) investigates the mediating effects of the development performance and deployment performance between modes of innovation and the final innovation performance (financial and non-financial).

2. THEORETICAL FRAMEWORK

2.1 Modes of Service Innovation

It is vital to distinguish between innovation types because due to the huge differences in process of generation and characteristics of different types of innovation, their adoption at the firm or project level is also quite different from each other (Tornatzky and Fleischer, 1990; Damanpour *et al.*, 2009). Existing literature has introduced several conceptual typologies for service innovation. A general and most commonly used way of categorizing is based on the innovativeness of the service innovation. For instance, Wheelwright and Clark's (1992) three types of innovation, namely, breakthrough projects, platform projects (new product lines), and derivative projects, distinguished fundamental and incremental changes in different areas. Johnson *et al*. (2000) grouped service innovation into radical innovations (e.g., major innovation, start-up businesses, and new services to existing market) and incremental innovations (e.g., service line extensions, service improvements, and style changes). Moreover, combined with the focus and outcome of innovation, Avlonitis *et al.* (2001) offered an expanded innovation typology: new to market services, new to company services, new delivery processes, service modification, service line extensions, and service repositioning. Similar to this, considering the sources of idea generation, a classification of push innovation (enterprise driven), pull innovation (market driven), refining services from products, information and technology driven service innovation, and innovation on societal trends were given by Fitzsimmons and Fitzsimmons (2011). Further, Berry *et al.* (2006) differentiated service innovation into flexible solutions, controllable convenience, comfortable gains, and respectful access. Voss and Zomerdijk (2007) used the level and domain of service to classify service innovation into service product innovation, service process innovation, and service business model innovation. Bettencourt (2010) classified service innovation into new service innovation, core service innovation, service delivery innovation, and supplementary service innovation. In summary, the existing literature offers several typologies on service innovation. In this study, we employ Voss and Zomerdijk's (2007) typology because it clearly distinguishes service innovations occurred in different levels and domains of an organization which is most applicable to our research design.

Since service offered by service firms are conceptualized to be similar to products provided by manufacturing firms, service product innovation is the most analogous to traditional manufacturing-based product innovation and sometimes the term "product innovation" is used interchangeably with "service product innovation" in the service sector (Oke, 2007; Wang *et al.,* 2015). Service product innovation involves the introduction of new service products, which could be one of the following: new to the market, new to the providing firm, new to customers, service product line extensions, bundling or unbundling of existing service products, modifications or repositioning of an existing service product (Voss and Zomerdijk, 2007; Wang *et al.,* 2015). Thus, service product innovation is related to the developments in the core offerings of a service firm and bring revenues to firms by providing new service or solutions, increasing existing service quality, price, and sales volume (Boone, 2000; Oke, 2007). A good example of a timely service product innovation is the return insurance in the finance industry. Online shopping causes an expenditure in mailing when customers return goods. Insurance companies cooperate with online sellers to provide a return insurance service at the time of purchase. Once the customer does return after purchase, the insurance company will compensate for the costs due to the return. To increase customer confidence and improve sales, many sellers will buy this service for their customers. In this study, we further divide service product innovation into incremental service product innovation and radical service product innovation.

Process innovation focuses on changes in the internal organizational processes to increase firms' efficiency and effectiveness to produce and deliver products or services (Piening and Salge, 2015). For manufacturing firms, the internal nature makes process innovation separate from production and marketing activities and thus can hardly be felt by customers (Wang *et al.,* 2015). Whereas, in the service sector, simultaneous production and consumption of services makes process innovation a proactive way for service firms to better meet customer needs and create new service experience (Boone, 2000). Service process innovation primarily takes place in the operational areas of the service system, including significant changes in the way of information exchange or interface between the service provider and its customers, and the back-office processes or internal organizational structure that can increase the efficiency to develop and deliver innovative services (Zomerdijk and Voss, 2011). Aimed at improving firms' efficiency and effectiveness in technological and administrative processes, several sub-dimensions of process innovation were proposed by previous studies, such as technological process innovation (modification of organization's operating processes and systems by information technology), administration process innovation (new approaches and practices to motivate organizational members), and operational process innovations (new techniques in customer services and procurement) (Hamel, 2006; Damanpour *et al.*, 2009; Piening and Salge, 2015). Process innovation benefits firms through product/service quality enhancement, production and delivery efficiency improvement, turnover growth, and cost and time saving in communication and administration (He and Wong, 2004). For instance, due to the dramatic development of the mobile communication technology, fast food restaurants like McDonald's and Burger King use automatic-order machine and cellphone application to replace manual ordering. This largely increases ordering efficiency and reduces labor cost.

A business model outlines the technologies and features in a firm's product/service, the architecture of revenues, costs and profits associated with the firm developing it, and the mechanism of how the firm delivers the value of the product/service to customers (Teece, 2010). Compared with product and process, the design of business model is more fundamental to a firm's competitiveness since it not only defines a firm's product and operation process, but also how to allocate a firm's asset or resource to fulfill customer needs and convert payments received into profits (Gambardella and McGahan, 2010; Teece, 2010). Thus, the innovation of business model involves both a significant or even complete change in the way firms earn their revenues and the corresponding product and organizational arrangements made to accompany with the change (Voss and Zomerdijk, 2007). The success of a business model is typically grounded in a firm's intangible scientific knowledge and intellectual property to use the asset and resource base of the firm to develop activities and accumulate resources to create a novel consumption system or service experience for customers (Gambardella and McGahan, 2010). Imitation is thus difficult for competitors due to the need to copy the entire system and customers' incentives to stay and interact with the system (Amit and Zott, 2012). Apple's business model successfully combines mobile phone sales, telecom operation service, and entertainment contents download together. High difficult of competitor replication and high customer loyalty due to the ease of use the integrated service facilitate Apple to have higher price and sales volume in the market and accordingly bring great success to it all over the world.

2.2 A Process Perspective of Service Innovation Performance

A review of the service innovation process literature is necessary for the design of a staged performance model of service innovation. Compared with the numerous studies concerning tangible product, literature about new service development stages are relatively scarce. Early exploratory researches based on the product innovation process came out with many stages of service innovation, and examples include the eight linear stages in Bowers (1989), 15 stages in Scheuing and Johnson (1989), and 10 stages in Alam and Perry (2002). Recent studies tend to simplify and merge stages due to the need to speed up innovation and great development of technology. Johnson *et al.* (2000) capture the basic shared steps in previous service innovation process literature and propose four general stages of service innovation: design, analysis, development and full launch. Since studies suggest that service innovations must be effectively deployed so as to exert a positive outcome, we extended the label of full launch into launch and deployment to cover both innovation deployment and market launch activities (Fichman and Kemerer, 1999; Wang *et al.*, 2018). Every firm begins its new service development process from the design stage and puts a great effort to it. Typically, it is deeply integrated in the organizational process and involves market research on customers and competitors, discussion by employees and senior managers, and evaluation by current experience (Zomerdijk and Voss, 2011). The aim of this stage is to generate an idea with the greatest potential and design corresponding strategies and objectives. Then, in the analysis stage, "managers assess the potential profitability of the project and obtain company authorization to proceed" (Melton and Hartline, 2010). Any idea that can eventually be commercialized into a service product is perceived to have potential in profitability in these two stages according to the specific evaluation system of an organization. Therefore, we did not put the performance at these two stages into our conceptual model.

The tasks at the development stage are to allocate resources to develop and test the functionality of the core service, associated delivery system, and marketing program; train operation and delivery personnel, and get internal and external feedbacks to refine the offering (Melton and Hartline, 2010). Naturally, the more resources and efforts put into the development process, the better the functionality or customer experience of the service. Thus, firms need to achieve a tradeoff between efficiency (cost/time) and effectiveness (functionality/experience) at this stage based on their own capability and market competitiveness. Accordingly, we divide the development performance into two dimensions: cost/time efficiency and functionality/experience effectiveness. Lastly, the deployment stage includes activities to successfully transfer innovations across all appropriate departments in the firm, lead to proper internal use and delivery to external customers in the entire market, and further evaluate and modify the initiatives as needed (Wang *et al.*, 2018). Greater proficiency in these two stages will be related to improved financial and non-financial performance of the service innovation. Specifically, if firms can get accurate perception of customer needs for the service based on certain modes of innovation, and allocate superior organizational resources and state-of-the-art technologies into service design in the development stage, the service will correctly address the targeted market segments' requirements so that the service will be easily delivered and launched on its promised value proposition and accepted by the target segments in the launch and deployment stage (Crawford and Di Benedetto, 2006; Song *et al.*, 2009). Thus, development performance may mediate the relationships between different modes of innovation and deployment performance.

Similarly, proficiency in the deployment stage increases the efficiency of adoption and delivery of the innovation both within the firm and outside to customers which are conductive to assess internal and external reactions (Wang *et al.*, 2018). Besides, firms doing good in this stage generally have a well-designed commercialization system including pricing strategy, marketing and promotion programs, distribution channels, and after-sale services which contribute to a better chance of both financial benefits and non-financial related outcomes (Song and Parry, 1997; Song *et al.*, 2009). In this manner, deployment performance may also serve as a mediator between development performance and final performance. Taken together, the relationships between modes of service innovation and final performance (financial and non-financial) are likely to be mediated by development performance and deployment performance in a sequential way. Based on the above argument, we propose our conceptual model as depicted in Figure 1.

Insert Figure 1 about Here
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3. HYPOTHESE DEVELOPMENT

Service product innovation is the development of the core offerings has the ability to influence service firms' operation patterns and performance outcomes (Avlonitis *et al.,* 2001; Oke, 2007). For incremental service product innovations in the case of improvements, modifications, repositioning, or line extensions, firms are familiar with the original service, its technology, design, pricing and marketing programs (de Brentani, 2001). This can significantly reduce the difficult, effort, and cycle time needed for the project in the development stage and facilitate firms to develop comparatively advantageous services in a timely manner (Song and Montoya-Weiss, 1998). By contrast, when undertaking service product innovations with dramatic departure from current services, more trial, time, resources, learning, breakthrough technology, employee training, internal synergy, and external partner collaborations are needed to solve design and develop problems (Wang *et al.,* 2015). Moreover, for radical service product innovations which are totally new to the customer, market, or even the firm itself, firms also face the challenge to get customers accept the new concept and appreciate its superiority as compared to existing services (Berry, 1995). Due to the intangible nature of services, more efforts are also needed for service firms to involve customers into the development stage and incorporate customers' feedbacks into the unfamiliar service to create a better customer experience (Zeithaml *et al.*, 1993). Taken together, firms may not able to develop the radical service product innovation in an efficient (time/cost) way.

Process innovation is increasingly viewed as an important source of "competitiveness and organizational renewal" (Keupp *et al.*, 2012), especially in dynamic environment where organizational processes need to be reconfigured from time to time in response to rapidly changing technology, customer preference, market trend, and legal framework (Damanpour *et al.*, 2009). By significantly changing the back-office processes and organizational structures supporting the front-end processes, process innovation increases the efficiency of inter-functional communication and coordination between different departments within the firm (Wang *et al.*, 2015; Piening and Salge, 2015). By changing the way that firms interact with customers, process innovation facilitates firms' acquiring information on customer demands and feedbacks so that they design, test, and modify services in a timely manner. Process innovation may also change the interfaces firms cooperate with external partners, providing firms more external supports to improve the efficiency of knowledge acquisition, resource integration, and market expansion (Westphal *et al.*, 1997). Improved efficiency inside and outside the firm together save time and reduce costs in the development stage of the new service innovation.

Business model innovation is the most disruptive innovation in organizations and involves substantial or even complete changes in the way firms convert revenues into profits (Markides, 2006; Voss and Zomerdijk, 2007). Thus, business model innovation typically leads to a better performance on the functionality of a firm's service, but may take more cost and time. First of all, aimed at providing a completely different service experience for customers, business model innovation not only involves changes on products, processes, delivery channels, marketing programs, but also contains transformations in organization structure, organization culture, governance mechanism, and transaction architectures (Amit and Zott, 2001). Accordingly, more resources and time are needed to conceptualize, design, experiment, fail and re-experiment to generate a new and better business model for the firm (Chesbrough, 2010). At the same time, due to its fundamental nature, business model innovation is supposed to leads to the revolution of an industry, the creation of a new market, or the transformation of a company (Kindström and Kowalkowski, 2015). Time is needed for the new one to completely take over the old one no matter at industry, market, or the firm level (Chesbrough, 2010). Furthermore, as demonstrated by previous in-depth case studies, the execution of business model innovation is a network collaboration rather than a single-firm behavior, involving value co-creation with external suppliers, complementors, and customers in the form of strategic alliances and joint ventures (Dyer and Singh, 1998; Amit and Zott, 2001; Wang *et al*., 2015). The efficiency of the development of business model innovation is thus lowered due to multi-party decision making and coordination of collaborative efforts. Here, we propose:

H1a: Incremental service product innovation is positively associated with the efficiency dimension (cost/time) of development performance.

H1b: Radical service product innovation is negatively associated with the efficiency dimension (cost/time) of development performance.

H1c: Service process innovation is positively associated with the efficiency dimension (cost/time) of development performance.

H1d: Service business model innovation is negatively associated with the efficiency dimension (cost/time) of development performance.

Service product innovation also improves the effectiveness dimension of development performance. An important basis for incremental service product innovation is to differentiate a service offering from homogenous offerings by providing a more satisfying experience for customers (Zeithaml *et al.*, 1993). Thus, incremental service product innovations are typically developed in a service design or marketing department (Wang *et al*., 2015), aiming to provide a more efficient solution, more professional service personnel, or an enhanced responsiveness relationship to customers (de Brentani, 2001). These improvements or modifications gradually remedy service insufficiency, recover customer complaints, and repair technology bugs and ultimately contribute to a continuous slight improvement of the functionality/experience of the service product. On the contrary, radical service product innovations come out with new services that differ greatly from current service and technology category. Those services are typically supposed to either meet customers' specific requirements that can't be met previously due to technology or resource constraints or create a totally new type of service due to technology breakthroughs (Lovelock and Yip, 1996). Thus, the functionality of the services at the development stage will be greatly increased.

Process innovation enhances the functionality of development performance as well. Improvements of the communication efficiency with customers help firms to timely capture information concerning customers' preferences and unmet requirements so that firms can develop new services to accurately address customers' expectations. Due to the intangible and heterogeneous nature of services, after-sale service and service remedy are both important features to distinguish a firm's services from competitive offerings (Fitzsimmons and Fitzsimmons, 2011). Through efficient customer communication enabled by process innovation, firms can also get valuable feedbacks about their defects in the after-sale service and service remedy policies of existing services and use these to increase customer service in future service develop (Chen and Tsou, 2012). Moreover, the adoption of technological and administrative process innovations enables firms to reconfigure their operational processes, get access to more resources and funding, and upgrade their capabilities through resource combination (Zahra *et al.*, 2006; Piening and Salge, 2015). Strong innovation ability and abundant resources naturally lead to better functionality and experience of the service development.

Regarding business model innovation, since it can thoroughly change both the service and the way customers consume the service, it will bring customers a novel service experience that they have never experienced before (Amit and Zott, 2001). In addition, the value embedded in the service provided by business model innovation is derived from the bundle of resources and capabilities from both the firm itself and multiple externally related sources. In light with the resource-based view, such services are more comprehensive, more integrated, and more productive in use (Barney, 1991; Amit and Zott, 2001). These services are hard to replicate and substitute by competitors in a short period of time. Customers are firmly locked in the service system of the new business model of a certain firm exert high loyalty to the firm. As a result, we postulate:

H2a: Incremental service product innovation is positively associated with the effectiveness dimension (functionality/experience) of development performance.

H2b: Radical service product innovation is positively associated with the effectiveness dimension (functionality/experience) of development performance.

H2c: Service process innovation is positively associated with the effectiveness dimension (functionality/experience) of development performance.

H2d: Service business model innovation is positively associated with the effectiveness dimension (functionality/experience) of development performance.

As the world economy becomes more service oriented, firms compete fiercely on new service offerings (Bitnet *et al.*, 2000). If a firm can develop a new service faster and with less costs than competitors, it will have enough time and resources to transfer the service across all appropriate intrafirm departments and external lead customers in the deployment stage (Wang *et al.*, 2018). In a similar vein, when a new service has preeminent functionality, it must be designed and developed properly based on in-depth market research, superior organization resources, and state-of-the-art technologies (Song *et al.*, 2009). Careful development of the value proposition ensures that the service can deliver value correctly to both internal and external target users (Crawford and Di Benedetto, 2006). It is easily for the service innovation to be deployed and diffused inside the firm to synergize supports from different departments and get feedbacks from external users to refine the new offering. Taken together, we posit:

H3a: The efficiency dimension (cost/time) of development performance is positively associated with deployment performance.

H3b: The effectiveness dimension (functionality/experience) of development performance is positively associated with deployment performance.

Better intrafirm deployment enables different departments within the firm to have an adequate understanding of the service innovation, reducing the difficulties in justifying the necessity to allocate managerial resources and exert synergetic efforts to support the launch and after-launch activities of the new service (Wang *et al.*, 2018). Externally, early delivery to lead and other potential customers provides the firm an opportunity to collect initial market reactions to the proposed service and make sufficient adjustments to ensure the service addresses customer needs correctly at full launch (Song *et al.*, 2009). Early market launch and sufficient managerial support facilitate the firm to grab market share and achieve superior benefits ahead of competitors.

Moreover, the more proficiently the intrafirm deployment and refining is undertaken, the better the value proposition of the new service will be (Wang *et al.*, 2018). Subsequently, superior value proposition of the new service increases the target market's acceptance to the service and gradually locks customers in the service. Due to the high searching costs and switching costs for customers to switch to another service provider, the firm can charge a relatively high price for premier benefits which ultimately lead to a better financial performance. Moreover, service experience derived from the superior functionality that is not provided by other service providers increases customers' satisfaction and commitment as well. Therefore, we hypothesize:

H4a: Deployment performance is positively associated with financial performance.
H4b: Deployment performance is positively associated with non-financial performance.

4. METHODS

4.1 Sampling and data collection

To test our hypotheses, 1000 companies were randomly selected from the four first-tier cities in China, namely Beijing, Shanghai, Shenzhen and Guangzhou. The sampling pool consisted of the service firms listed in the database of National Bureau of Statistics and headquartered in any of the four cities. According the national standard for the classification of industries in China (GB/T 4754-2011), we selected the "Category I: information communication, software, and IT services", as these industries are the most prosperous ones in recent years in terms of service innovation.

The unit of analysis is the NSD project. Based on the feedback gathered during the pilot tests of the questionnaire, it was established that the most appropriate way was to get the project leaders as the key informants who are knowledgeable and familiar with NSD activities. The survey was conducted from 2015 to 2016, and one of the largest professional survey companies in China was employed to collect the data. First, the survey company trained its data managers about the data collection criteria and process. Then, randomly selected firms were contacted by the data managers via telephone to identify the contact information of the most suitable informants, and each firm could provide contact information of no more than two service innovation projects in the charge of different leaders. Finally, an appointment with each informant was made by a data manager, who would then take a printed copy of the questionnaire to the informant and conduct an on-site visit to collect the data. In total, the data collection efforts resulted in usable responses of 200 service innovation project from 141 companies for a response rate of 14.1%.

4.2 Measures

To ensure that the measurement items used in this study were appropriate, we reviewed previous literature and interviewed both academics and practitioners in service industries. To design the measurement items, we invited three operations management professors and one marketing professor, all of whom were actively involved in teaching and research in Chinese and Western universities. 60 managers of service innovation projects were invited to pilot-test the questionnaire, and face-to-face interviews were conducted with them to examine whether the measurement items were appropriate and relevant to their practices and whether any important aspect might be missing. To ensure the reliability of the questionnaire, it was developed in both Chinese and English, with two-way translations double-checked by Chinese and Western professors on the research team. Based on these results, the measurement items were developed (as listed in Table 1).

In this study, incremental and radical service product innovativeness were measured by three items respectively capturing the magnitude of newness, adapting from Avlonitis *et al*. (2001) and Wang *et al*. (2015). In a similar manner, business model innovativeness and service process innovativeness were measured by four items capturing the changes regarding business model and service process respectively. We used a 7-point Likert scale with '1' anchored as 'strongly disagree' and '7' as 'strongly agree'. The question was framed as "before the actual development of this innovation, we thought the concept of this innovation has the following characteristics", and respondents were asked to indicate their degree of agreement.

Development performance was measured by four items regarding efficiency (i.e., time and cost) and three items of effectiveness (i.e., functionality and experience), and deployment performance was measured using three items on efficiency in terms of speed, cost and other objectives, adapted from previous studies including Carbonell *et al*. (2009) and Melton and Hartline (2010). Financial performance was measured by five items from Song and Parry (1997) and non-financial performance was measured by six items adapted from Avlonitis *et al*. (2001).

4.3 Respondent profile

A wide variety of service innovation projects were included, and respondents were mainly from top management or general managers. The average number of project team members was 11.86; the average project development investment was 2.22 million RMB; the average project deployment investment was 0.86 million RMB.

5. Analysis and Results

5.1 Non-response bias and common method bias

As in all survey-based empirical studies, non-response bias is a concern. To address this problem, the early and late (after several rounds of calls) responses for number of employees, number of project team members and the other variables used in this study were compared (Armstrong and Overton, 1977; Stank *et al.*, 2001); t-tests showed no significant differences, indicating that non-response bias does not appear to be a major concern in this study.

As we used one informant from each firm to answer the self-reported questionnaire in this study, the potential for common method bias in the results was assessed. First, as appropriate arrangements of the items in a questionnaire can somewhat reduce respondents' consistent motivation and thus decrease the common method bias in self-reporting (Podsakoff *et al.*, 2003), we adopted different instructions for different scales, and the adjacent variables in the conceptual model were put in distinct sections. Second, to confirm this conclusion, we conducted a test following the recommendation of Podsakoff *et al.* (2003). Accordingly, two measurement models were compared following the analytical procedure in PLS proposed by Liang *et al.* (2007), with one measurement model including all of the traits and the other model adding in a method factor. The results showed that the path coefficients were very subtle and insignificant. Third, we checked the correlation matrix to see if there were any high correlations, as Pavlou *et al.* (2007) suggested that common method bias is unlikely if there are no excessively high correlations (> 0.9). The results of these tests suggested that the common method bias is unlikely to exist in this study.

5.2 Reliability and validity

A rigorous process was used to develop and validate the survey instruments. Prior to the data collection, content validity was supported by previous studies, executive interviews, and pilot tests. After the data collection, a series of analyses were performed to test the reliability and validity of the constructs.

We followed a two-step method to test construct reliability. First, we conducted exploratory factor analyses (EFA) using both orthogonal and oblique rotations to ensure high loadings on the hypothesized factors and low loadings on cross-loadings in the datasets. All of the items loaded onto the expected factors without significant cross-loadings. Then, the reliability of each construct was tested using Cronbach's alpha. The Cronbach's alpha values, shown in Table 1, were over 0.7 for all of the constructs, indicating that all of the constructs were reliable.

Next, convergent validity and discriminant validity (O'Leary-Kelly and Vokurka, 1998) were tested using the service and manufacturing datasets. Following Bagozzi and Yi (1988), we computed composite reliability (CR) scores to assess construct reliability. As reported in Table 1, all of the factors had CRs greater than 0.70, and the average variance extracted (AVE) suggested by Fornell and Larcker (1981) for all of the constructs satisfactorily exceeded 0.50. For our model, all of the factor loadings were greater than 0.50, and all of the *t*-values were greater than 2.0, thus convergent validity was achieved. Further, the squared correlation between each pair of constructs was less than the AVE reported in Table 1 for each individual construct. These results provided strong evidence of discriminant validity.

--- Insert Table 1 about Here ---

5.3 Structural equation modeling and results

In this study, the bootstrapping-based partial least squares (PLS) approach to structural equation modeling (SEM) was used. PLS is a second-generation modelling technique that simultaneously assesses the quality of research constructs and the proposed relationships between these constructs, and has been widely adopted in business research fields such as information systems, marketing, and operations management (Peng and Lai, 2012). PLS also has a better capacity in handling complex model with relatively small sample size. In this study, SmartPLS software (3.2.7 version) was used to assess the measurement and structural models.

We used the bootstrapping-based partial least squares (PLS) approach to structural equation modeling (SEM) to test the overall model and relevant hypotheses. PLS simultaneously assesses the quality of research constructs and the proposed relationships between constructs, and has been widely adopted in business research fields such as operations management, information systems, and marketing (Peng and Lai, 2012).

Results show that incremental service product innovation exerted a significant positive effect on development efficiency ($\beta = 0.196$, $p < 0.01$). Radical service product innovation, service process innovation and service business model innovation exerted a nonsignificant positive effect on development efficiency respectively ($\beta = 0.088$, $p = 0.381$; $\beta = 0.111$, $p = 0.261$; $\beta = 0.139$, $p = 0.238$). As such, H1a was supported while H1b, H1c, H1d were not supported. Incremental service product innovation and service process innovation exerted a nonsignificant effect on development effectiveness respectively ($\beta = 0.075$, $p =0.345$; $\beta = 0.098$, $p =0.267$). Radical service product innovation and service business model innovation exerted a significant positive effect on development effectiveness respectively ($\beta = 0.163$, $p < 0.10$; $\beta = 0.173$, $p < 0.05$). As such, H2b and H2d were supported while H2a and H2c were not supported.

Further, both development efficiency and development effectiveness exerted a significant positive effect on deployment performance ($\beta = 0.251$, $p < 0.001$; $\beta = 0.356$, $p < 0.001$ respectively). H3a and H3b were thus supported. Finally, deployment performance exerted significant positive effects on both financial performance and non-financial performance ($\beta = 0.569$, $p < 0.001$; $\beta = 0.441$, $p < 0.001$ respectively), supporting H4a and H4b.

6. CONCLUSION AND IMPLICATIONS

In recent years, the service sector has become dominant in economy and service firms compete fiercely in new offerings (Bitnet *et al.*, 2000). Given the growing popularity of service innovation activities and the complex outcomes of service innovation, this study attempts to build a staged-performance model for service innovation. The main objectives of this study were to identify key staged performance indicators derived from the new service development process, tie them to modes of innovation and final performance (financial and non-financial), and explore the mediating effects of those staged performance indicators between modes of service innovation and final performance. Three basic findings emerged from the data analysis of 200 service innovation projects: modes of service innovation do exert effects on final performance in a staged way; different modes of innovation have different effects on each staged performance indicator; the staged performance indicators have some mediation effects between modes of service innovation and final performance. Each of these makes important contribution to extant literature.

To start with, this study highlights the importance to see service innovation performance in a staged model. There is a concern from both academy and industry that firms' performance cannot be necessarily guaranteed by service innovation even a huge investment has been made into innovation (Page and Schirr, 2008; Storey and Hughes, 2013). This may be attribute to the overly emphasis on direct economic dimensions of performance in evaluating innovation performance in previous studies (Avlonitis *et al*., 2001). Our study, by providing a staged model with multiple performance indicators, points out the need to assess innovation performance from a staged process perspective since service innovation performance not only contains different dimensions, but also presents in a sequential way. The empirical results of our results suggest that different modes of service innovation first impact development performance, then deployment performance, and ultimately financial and non-financial performance. In light with this, although some types of innovation cannot directly save costs and time for a firm (e.g., radical service product innovation, business model innovation), longitudinally they may improve the functionality of the service, simplify launch and deployment efforts, and ultimately earn customers' satisfaction and bring benefits to the firm. Thus, it is more rationale and accurate to look at innovation performance from a staged process perspective.

Further, we enrich the extant research on service innovation by showing that different modes of innovation have different staged performance models. Although previous research has already pointed out that different types of innovation may be associated with different development patterns and performance outcomes, relevant framework concerning such associations is still lacking (e.g., Avlonitis *et al.*, 2001). We find that incremental service product innovation is significantly related to efficiency (cost/time) but not to effectiveness (functionality) of development performance. For incremental service product innovation, improvement, modification, updating, and bug repair to the existing service are the main purposes. Speed and costs are naturally the primary considerations rather than adding new functions to the service. In contrast, radical service product innovation is significantly related to effectiveness (functionality) but not to efficiency (cost/time) of development performance. Radical innovation typically comes up with brand new service which can bring a new service concept into existing market, start up a new business, or cause the perish of old services (Johnson *et al.*, 2000). Breakthroughs in functionalities of these services are the most important. Time and costs spent in the innovation are not big concerns.

In addition, the effects of service process innovation on efficiency (cost/time) and effectiveness (functionality) of development performance were both non-significant. These findings appear to be inconsistent with what has been suggested in literature. More specifically, it is argued that process innovation has the potential to reduce costs and time, improve quality, productivity, and turnover (e.g., Baer and Frese, 2003; He and Wong, 2004; Piening and Salge, 2015). However, we should notice that in previous studies those positive effects of process innovation are embedded in its ability to sense market and technology opportunities (Teece, 2007), induce various activities to acquire, integrate, and disseminate knowledge and resources (Pavlou and Sawy, 2011), and train employees (Edmondson *et al.*, 2001) for the success of the core offerings of a firm. Our study, by providing non-significant empirical evidence, shows that process innovation cannot improve development performance directly. Lastly, service business model innovation was found to be significantly associated with effectiveness (functionality) but not with efficiency (cost/time) of development performance. This has something in common with the results of radical service product innovation in that business model innovations are usually radical innovations that fundamentally change both the service experience and the way customers consume the service.

Third, this study also explored the mediation effects of development performance and deployment performance between modes of service innovation and final performance. Regarding development performance, its efficiency (cost/time) dimension fully mediates the relationship between incremental service product innovation and deployment performance. And its effectiveness (functionality/experience) dimension fully mediates the relationship between service business model innovation and deployment performance. These results provide favorable evidence for the argument in existing literature about the importance of the proficiency in development stage of service innovation (e.g., Carbonell *et al.*, 2009; Song *et al.*, 2009), especially for incremental service product innovation and service business model innovation. Referring to deployment performance, it fully mediates the relationship between efficiency (cost/time) of development performance and both financial and non-financial performance. While only a partially mediation effect is found between effectiveness (functionality/experience) of development performance and non-financial performance, it can also fully mediate the relationship between effectiveness (functionality/experience) of development performance and financial performance. While studies have emphasized on the critical role of development performance in the final performance of service innovation, empirical evidence concerning the importance of deployment performance is still rare (Wang *et al*., 2018). The facts of the three full mediation and one partial mediation effect between two dimensions of development performance and two final performance strongly enrich the existing literature about the importance of development performance and financial performance in service innovation.

6.1 Managerial Implications

Although subject to future refinement and testing, the results of this study have implications for managers operating in project innovation in service firms. First, managers frequently confront a question: whether a new service idea can bring benefits to a firm after launched to the market? The findings of this study suggest that they should evaluate service innovation performance in a staged way. For instance, a poor final financial performance or non-financial performance do not necessarily mean that the service idea does not meet market demands. It is likely due to the poor execution and performance in the development and deployment of the service innovation.

Second, managers should pay attention to the modes of service innovation when assessing the intermediary performance indicators in the staged model because different modes of service innovation impact these indicators differently. Concerning incremental service product, efficiency (cost/time) of development performance is an important mid-range indicator. While for radical service product innovation and business model innovation, effectiveness (functionality/experience) of development performance is the critical index. The most challenging job for managers is the performance evaluation of service process innovation due to its insignificant direct effects on both efficiency and effectiveness of development performance. A possible solution is to indirectly examine process innovation's ability in helping firms to acquire, integrate, and disseminate knowledge and resources.

Finally, this study also identifies the mediating effects of development performance and deployment performance between modes of service innovation and final performance. This inspires managers that for a better final performance (both financial and non-financial), resources and attentions should be made to achieve high-quality development activities and deployment activities in service innovation since only through well-executed development activities can service innovation ideas be developed and launched to customers, and only through well execution of deployment can efforts made in development activities be transferred into final financial and non-financial performance.

6.2 Limitations and Recommendations for Future Research

The findings of this research have several limitations that also indicate opportunities for future research. First, this study used data from IT-related service industries only. Therefore, the results found in this research are tentative and subjective to characteristics of IT services. Further replications efforts are needed to test the conceptual model and relevant hypotheses in other service settings, such as personal services, professional services, or tangible products related services to advance the literature. Likewise, the cross-sectional nature of the data may cause biased results. Longitudinal data, multiple informant data, or data from multiple sources are therefore required in future studies to verify the results of this study. Third, our sample is constrained to the Chinese firms. Thus, the generalization of the results in other areas beyond China should be made with caution.

Lastly, in the empirical analysis of this study, we captured modes of service innovation from 200 innovation projects from IT-related service industries and then explored the individual effect of each mode on different staged performance indicators. However, as suggested by existing literature, different modes of innovation can coexist in a same innovation project (Wang *et al*., 2015) and exert synergetic effects on innovation performance (Visnjic *et al*., 2016). Considering the sample size and the complexity of the conceptual model, we neither proposed nor tested the interaction effects of different modes of innovation in this study. Thus, further empirical research is needed to enhance our understanding of the coexistence of different modes of service innovation and their interactive effects on staged innovation performance indicators.

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Figure 1. Conceptual Model

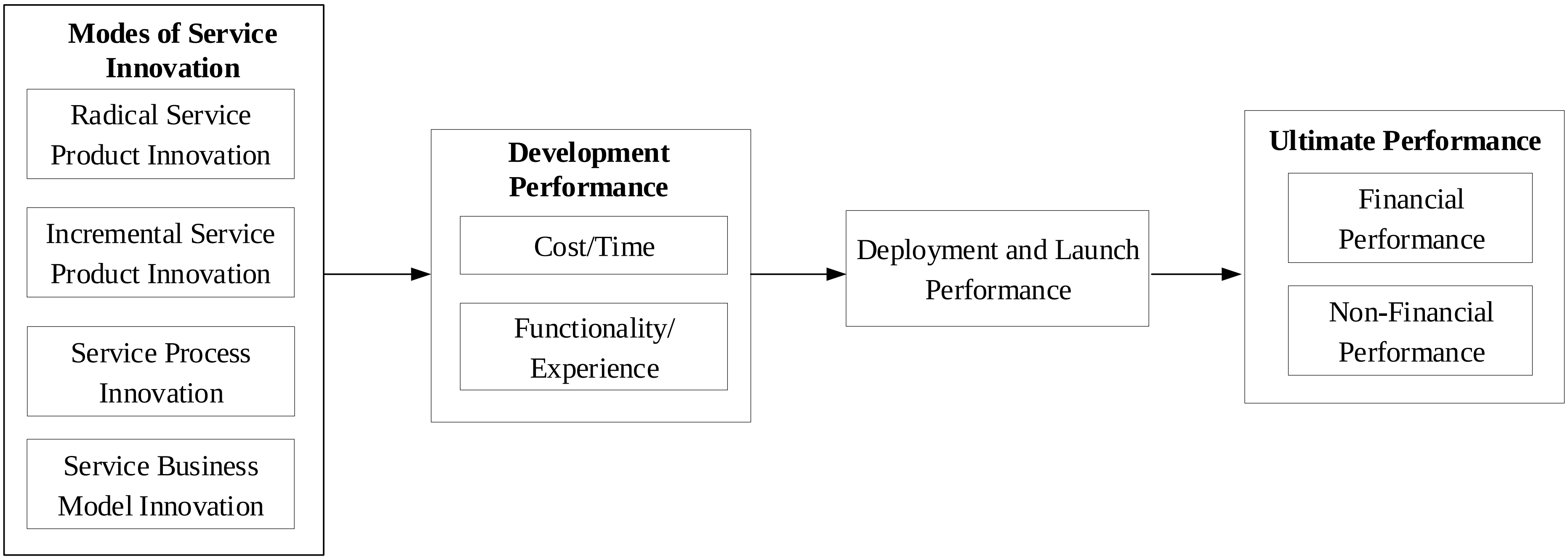

Table 1. Construct reliability and validity

Constructs and items	α	CR	Factor loading	AVE
Business model innovativeness (BMI)	0.708	0.816		0.525
BMI1. would change the revenue model of our company			0.765	
BMI2. would create a new market for our company			0.708	
BMI3. would enable our company to enter into a totally different market, compared with the market currently served			0.719	
BMI4. would dramatically change the cost structure for the delivery of the service			0.711	
Radical service product innovation (RSI)	0.776	0.865		0.683
RSI1. would develop new service product(s) to the market			0.909	
RSI2. would develop new service product(s) of our firm			0.839	
RSI3. would develop new service product(s) to our existing customers			0.723	
Incremental service product innovation (ISI)	0.762	0.860		0.672
ISI1. would be mainly about bundling or unbundling of existing service products			0.771	
ISI2. would be mainly about modifications of an existing service product			0.859	
ISI3. would be a repositioning of an existing service product			0.827	
Service process innovativeness (SPI)	0.733	0.847		0.649
SPI1. require changes in the service delivery process			0.836	
SPI2. require changes in the internal organizational processes			0.777	

SPI3. require changes in the IT systems			0.800	
Service development efficiency (SDEa)	0.812	0.887		0.642
SDE1. This innovation was developed faster than major competitors			0.758	
SDE2. This innovation was completed in less time than what was considered normal for industry			0.849	
SDE3. This innovation was launched ahead of the original schedule			0.865	
SDE4. This innovation had less than planned new service development project costs			0.724	
Service development effectiveness (SDEb)	0.755	0.861		0.676
SDE5. This innovation had fewer technical problems than our nearest competitors			0.715	
SDE6. This innovation had better service experience than our competitors			0.887	
SDE7. This innovation had provided customers a better solution than our competitors			0.853	
Service deployment performance (SDP)	0.827	0.885		0.659
SDP1. The deployment was faster than originally expected			0.823	
SDP2. The deployment had less than planned project deployment costs			0.739	
SDP3. The deployment had well achieved the performance objectives for deployment			0.872	
SDP4. The resources needed for deployment were well allocated			0.808	
Financial performance (FP)	0.912	0.935		0.741
FP1. Relative to your firm's objectives for this innovation, how successful was it in terms of *impact on profits*?			0.847	
FP2. *impact on revenues*			0.889	
FP3. *impact on sales*			0.873	
FP4. *impact on market share*			0.798	

Table 2. Results of the hypothesis testing

Path in the structural model	Path coefficient		Outcome
	β	p	
ISI → SDEa (H1a)	0.196	***	Supported
RSI → SDEa (H1b)	0.088	0.381	Not supported
SPI → SDEa (H1c)	0.111	0.261	Not supported
BMI → SDEa (H1d)	0.139	0.238	Not supported
ISI → SDEb (H2a)	0.075	0.345	Not supported
RSI → SDEb (H2b)	0.163	*	Supported
SPI → SDEb (H2c)	0.098	0.267	Not supported
BMI → SDEb (H2d)	0.173	**	Supported
SDEa → SDP (H3a)	0.251	****	Supported
SDEb → SDP (H3b)	0.356	****	Supported
SDP → FP (H4a)	0.569	****	Supported
SDP → NFP (H4b)	0.441	****	Supported

$^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$, $^{****}p < .001$

Table 3. Post hoc analyses of mediation effects

Path in the structural model	Path coefficient (simple/full model)		Outcome
	β	p	
ISI → SDP	0.144/0.085	*(0.083)/0.234	SDEa fully mediates ISI→SDP; SDEb partially mediates BMI→SDP
RSI → SDP	-0.057/-0.166	0.640/**	
SPI → SDP	-0.039/0.085	0.684/0.118	
BMI → SDP	0.316/0.237	****/***	
ISI → SDEa → SDP	0.191, 0.239	***, ****	
ISI → SDEb→ SDP	0.063, 0.357	0.359, ****	
BMI → SDEa → SDP	0.121, 0.239	0.248, ****	
BMI → SDEb→ SDP	0.158, 0.357	*(0.061)/, ****	
SDEa → FP	0.184/0.071	**/0.387	SDP fully mediates SDEa → FP and SDEa → NFP; SDP partially mediates SDEb → FP
SDEa→ NFP	0.167/0.114	**/0.119	
SDEb → FP	0.310/0.147	****/*(0.059)	
SDEb→ NFP	0.443/0.362	****/****	
SDEa → SDP→ FP	0.247, 0.467	****, ****	
SDEa → SDP→ NFP	0.247, 0.212	****, ***	
SDEb → SDP→ FP	0.354, 0.467	****, ****	
SDEb → SDP→ NFP	0.354, 0.212	****, ***	

$^{*}p < .1$, $^{**}p < .05$, $^{***}p < .01$, $^{****}p < .001$

FP5. *impact on revenue growth rate*			0.893	
Non-Financial performance (NFP)	0.830	0.876		0.542
NFP1. This innovation had a positive impact on the company's perceived image			0.632	
NFP2. This innovation improved the loyalty of the company's existing customers			0.695	
NFP3. This innovation enhanced sales and profitability of other services offered by our organization			0.705	
NFP4. This innovation attracted a significant number of new customers to the company			0.760	
NFP5. This innovation gave our company an important competitive advantage			0.842	
NFP6. The innovation was highly recognized by our customer community.			0.758	