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Service productivity vs service quality: a zero-sum game?

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Abstract

Purpose – The purpose of this paper is to verify the relationship between productivity and quality in the services sector. More specifically, this study investigates the relationship between productivity and customer satisfaction and its effect on a firm's performance. In addition, this study investigates the roles of productivity and customer satisfaction in the structural relationships among variables.

Design/methodology/approach – A theoretical model was proposed among innovation, productivity, customer satisfaction and firm performance. A sample of 127 firms from data sets of the American Customer Satisfaction Index and COMPUSTAT was collected. To test the hypotheses, this study used ordinal least squares analysis and path analysis.

Findings – The findings of this study verified that a positive relationship exists between productivity and customer satisfaction and that service productivity and customer satisfaction are positively associated with a firm's performance. In addition, customer satisfaction was found to fully mediate the relationship between productivity and a firm's performance.

Research limitations/implications – This study only focused on a short period for each variable due to the difficulty of matching all the data sets used for measuring each variable, which limited the observation of the different effects of service productivity among industries.

Practical implications – The findings of this study suggest that managers can improve productivity without sacrificing customer satisfaction. In addition, services firms should consider innovation, productivity and customer satisfaction in a holistic way because all of these affect a firm's performance. Furthermore, services firms need to pay more attention to customer satisfaction, which plays an important role as a mediator in increasing a firm's performance.

Originality/value – This study highlights the importance of the relationship between productivity and customer satisfaction in the services sector. In particular, this study extended the theory of service productivity by Rust and Huang (2012) to explore the role of service productivity and customer satisfaction in measuring a firm's performance.

Keywords Innovation, Service, Customer satisfaction, Productivity

Paper type Research paper

Introduction

During the last three decades, service has increasingly become an important part of US economic development. In the 1980s, the service sector represented almost three-fourths of the nation's employment (Mark, 1982). In 2010, service industries comprised approximately 84 percent of the entire US economy and accounted for 82 percent of the US gross domestic product (Haksever and Render, 2013). An important consideration in the context of the services sector is service productivity (Calabrese, 2012; Grönroos and Ojasalo, 2004; Rust and Huang, 2012), which refers to "a function of internal efficiency (e.g. the service provider's productivity), external efficiency (e.g. the productivity from the customer's perspective), and capacity efficiency (e.g. the utilization of service capacity)" (Grönroos and Ojasalo, 2004, p. 417). Ideally, if firms in the services sector can improve productivity and service quality simultaneously, they can enjoy a superior position in their relevant fields

compared to their competitors. Therefore, service productivity is currently considered to be a valid source of a firm's competitive advantage.

The concept of productivity has exclusively focused on the ratio of outcomes over inputs and is well established in the manufacturing sector (Anderson *et al.*, 1997; Cho and Jung, 2014; Den Hartigh and Zegveld, 2011; Filiatrault *et al.*, 1996; Mark, 1982). More scholarly attention needs to be paid to productivity in the services sector (Balci *et al.*, 2011). Recent research suggests that the traditional concept of productivity has not considered the effect of advanced technology and customer participation in productivity (Rust and Huang, 2012). For example, advanced technology helps customers and firms to interact actively with each other even during the process of producing goods and services (Sorescu and Spanjol, 2008; Vivek *et al.*, 2012). In addition, research suggests that firms in the services sector need to develop innovation because it helps clients and providers collaborate to create value or to achieve a mutual goal (Spohrer and Maglio, 2008). Through innovation, firms can develop a tactic that connects their production process and communicates to/with their customers (Dotzel *et al.*, 2013; Schumpeter, 1934; Snyder *et al.*, 2016; Spohrer and Maglio, 2008). In light of this phenomenon, it can be suggested that innovation can be a bridge to connect customers to firms. Firms in the services sector need to develop innovation that enables them to reduce the distance from their customers.

Despite the practical importance of the relationships among customer satisfaction, productivity and innovation, scholars have not given much attention to how they are related to each other. More specifically, relatively little research has provided empirical evidence regarding those relationships in the services sector (Balci *et al.*, 2011; Rust and Huang, 2012). The purpose of this study is to investigate the relationship between productivity and customer satisfaction and its effect on a firm's performance in the services sector. More specifically, this study investigates the role of productivity in the relationships among innovation, customer satisfaction and a firm's performance as well as the role of customer satisfaction in the relationships among innovation, productivity and a firm's performance.

This study intends to answer the following questions:

- RQ1. What is the relationship between productivity and customer satisfaction in the services sector?
- RQ2. What is the role of productivity in the relationships among innovation, customer satisfaction and a firm's performance?
- RQ3. What is the role of customer satisfaction in the relationships among innovation, productivity and a firm's performance?

The findings of this study provide empirical evidence about the relationships among productivity, innovation, customer satisfaction and a firm's performance by extending the study by Rust and Huang (2012). A literature review and research hypotheses with a theoretical model are presented first, followed by a discussion of the results of empirical analysis and a conclusion that highlights the scholarly and practical implications and limitations of the study.

Theory and hypotheses development

Since Vargo and Lusch (2004, 2008) conducted their studies, the importance of services has dramatically increased as a portion of the economy. The role of customers is not only as evaluators but also as partners in producing services. Past research suggests that the service sector has taken a different approach from manufacturing industries that includes customer evaluation (Parasuraman *et al.*, 1985, 1988). This point of view may be straightforwardly understandable in terms of a market orientation as a philosophical business statement that firms should understand customers' needs to gain competitive advantage (Narver and Slater, 1990;

Kohli and Jaworski, 1990). Hunt (2011) emphasizes that establishing a sound relationship with customers is a competitive advantage for firms because the market is dynamic, demands are heterogeneous and resources that firms can use are limited. The service sector needs to establish and manage relationships with customers because it will lead to superior firm performance (Morgan and Hunt, 1994). By developing relationships with customers, firms in the services sector can enhance their level of customer participation in the production of products and services and thus increase both the quality of their services and their productivity (Lovelock and Young, 1979).

With the advent of the digital era, customer participation and engagement have dramatically increased and influenced the nature of services. Barker *et al.* (2013) and Donavan *et al.* (2016) argue that social network services (hereafter SNS) help customers more actively participate in the process of producing service and products. Through SNS, customers communicate their thoughts and feelings to others. Thus, customer participation, especially through using SNS, is not unexpected any more, but natural in the market. The concept of co-creation has become an actual value realized by customer participation and engagement. In this vein, service productivity should include the participation of customers. Managing customers and the relationship with customers are key factors for service firms to survive and achieve their goal of superior financial performance (Janeschek *et al.*, 2013; Hunt, 2011). Customer participation is closely associated with the natures of services: intangibility, heterogeneity and inseparability between production and consumption. In the digital era, service firms must be ready for the change in communication with customers because their readiness can lead to rapidly adapting to changes in the service process to create value for both customers and firms, including the changes of increasing and measuring service productivity.

Productivity has been discussed in a wide range of disciplines, such as economics, finance and marketing (Mark, 1982; McLaughlin and Coffey, 1990). During the 1980s and 1990s, the concept of productivity in the services sector highlighted labor productivity as an important input resource (Mark, 1982), perceived role behaviors among employees (Kopelman *et al.*, 1990) and service quality such as timing of demand and capacity and operational outcomes (McLaughlin and Coffey, 1990; Vuorinen *et al.*, 1998). Since the early 2000s, firms have emphasized the heterogeneity of services due to complexity in the service industries (Balci *et al.*, 2011; Calabrese, 2012). The focus on productivity in the services sector has shifted to the mutual relationship between customers and service providers (Grönroos and Ojasalo, 2004; Narteh, 2015) and the quality and productivity relationship (Calabrese, 2012; Rust and Huang, 2012). From this phenomenon, it can be suggested that firms in the services sector now focus on creating and managing their relationships with customers in order to increase service productivity and the customer's well-being (Grönroos, 2008; Vargo *et al.*, 2008). Table I summarizes previous studies of service productivity.

There are some similarities and dissimilarities in these studies. It has been suggested that service productivity needs to be considered as both efficiency and effectiveness (Grönroos and Ojasalo, 2004; Vuorinen *et al.*, 1998). In addition, since the proposal of service dominant (S-D) logic (Vargo and Lusch, 2004) and in light of the advances in digital technology, the role of customers has dramatically increased; for example, customers actively participate in the process of producing services through sharing their experiences and opinions on services. Accordingly, it can be said that service quality is a consequence not only of the performance of services, but also of the interaction between customers and firms. Maintaining an appropriate relationship with customers has been an important determinant for service firms to enhance performance.

There are, however, some dissimilarities among past research regarding service quality. First, conceptualizations of service productivity come from two perspectives: behavioral (Johnston and Jones, 2004; Kopelman *et al.*, 1990) and managerial (Grönroos and Ojasalo, 2004).

Table 1.
Previous studies of
service productivity

Studies	Orientation	Sample	Definition	Key findings/arguments
Anderson <i>et al.</i> (1997)	Empirical	Firms listed on Swedish Customer Satisfaction Barometer between 1989 and 1992	A ratio of output of input	Verified the traditional (negative) relationship between productivity and customer satisfaction due to use operational measurement of productivity Proposed a further research that investigates the difference of productivity among industries (the traditional measurement of productivity does not work for the services sector)
Calabrese (2012)	A case study			Verified the tradeoff relationship between productivity and quality in the services sector Employed Grönroos and Ojasalo's model (2004) to measure productivity Suggested four variables (such as internal efficiency, external efficiency, capacity efficiency and meaning efficiency) of services market in the way of classification
Donbi <i>et al.</i> (2000)	Empirical	92 service firms operating in Western Canada	A combination of performance, attachment and citizenship behavior	Focused on labor or employees to measure the service productivity Verified that the concept of productivity is complex and integrative Suggested that different approaches are required to achieve organizational values based on various employees' behavioral and psychological responses
Filiatrault <i>et al.</i> (1996)	Empirical	3,001 firms located in Quebec, Canada	A ratio of outputs to input	Proposed quality management to improve productivity in the services sector Argued that there are many ways of classification of the services sector to estimate productivity (size of business, type of customers and status of employees)
Grönroos and Ojasalo (2004)	Conceptual		A process of how effectively input resources are transformed into value for customers	Proposed a new model to measure service productivity with internal efficiency, external efficiency and capacity efficiency Described productivity as a mutual learning experience between customers and service providers (focused on the relationship between them)
Johnston and Jones (2004)	Conceptual		A process of maximizing the experience between operation and customers	Proposed two different ways to measure productivity in the services sector, operational productivity as output/input and customers productivity as (experience, value and outcome)/(time, effort, costs, etc.) Focused on managing the relationship with customers
Kopelman <i>et al.</i> (1990)	Conceptual		A function of individuals' behavior	Psychologically approached to service productivity instead of measuring the concept by the operational way Proposed a new way to measure the productivity with three dimensions, including the perceived role behaviors, organizational commitment and employee affect
Mark (1982)	Conceptual		Labor productivity	Discussed some of the problems of measuring productivity, particularly labor productivity in services industries

(continued)

Studies	Orientation	Sample	Definition	Key findings/arguments
McLaughlin and Coffey (1990)	Conceptual		A total process of evaluating labor, automation and logistics and leadership	Proposed a new way of productivity referring only to the final service and its relationship to input Considered quality of service, timing of demand and capacity impacts in measuring the productivity of service Proposed a new classification method to classify services (labor intensity, degree of contact and interaction with customers and degree of customization)
Rust and Huang (2012)	Empirical	741 firms in 2002 and 751 firms in 2007	A ratio of dollar sales divided by number of employees	Proposed a new model to measure service productivity based on Grönroos and Ojasalo's (2004) model Verified the effect of productivity on a firm's performance Productivity is a function of profit margin, price of unit, industry concentration and wages Showed that service productivity should be lower/higher when factors (e.g. higher profit margin, higher price) motivate/discourage the provision of better service quality
Vuorinen <i>et al.</i> (1998)	Conceptual		The economic performance of a firm	Suggested service productivity includes both efficiency and effectiveness Proposed a new model of measuring productivity, productivity = (quantity of output and quality of output)/(quantity of input and quality of input)

Table I.

The former considers service productivity as a total amount of experience from both customers and firms, and the latter considers service productivity as a determinant or factor in the operational process of service with managerial perspective. Second, before S-D logic (Vargo and Lusch, 2004), service productivity had been assessed by a measurement traditionally used for manufacturing firms that always resulted in a negative relationship between customer satisfaction and service productivity in the services sector (Anderson *et al.*, 1997) even though the characteristics of services, including intangible, heterogeneous demands and inseparable between production and consumption, are different from the characteristics of products (Parasuraman *et al.*, 1985, 1988) (e.g. output divided by input or the ratio of total sales amount divided by numbers of employees).

The relationships among productivity, customer satisfaction and a firm's performance

The concept of productivity has traditionally focused on operational efficiency in the manufacturing sectors, which refers to output divided by input (Anderson *et al.*, 1997; Donbi *et al.*, 2000). From this concept, it can be suggested that firms decrease input so as to increase productivity. However, if firms in the services sector reduce their labor force as a type of input resource, it might be difficult to make their customers satisfied because this reduction comes at the expense of customers served per employee or labor cost. Past research also supports that there is a negative relationship between productivity and customer satisfaction in the services sector (Crosby, 1979; Deming, 1982; Johnson and Fornell, 1991).

Productivity in the services sector can be redefined in terms of both effectiveness and efficiency of productivity. Donbi *et al.* (2000), Grönroos and Ojasalo (2004) and Johnston and Jones (2004) found that effectiveness is directly linked to the attitude toward customer participation in the service production process and efficiency is linked with cost reduction. The concept of service productivity can be determined by both reduced operational costs and co-created value from customer participation in the process of producing services as Parasuraman *et al.* (1985, 1988) and Lovelock and Young (1979) argue. Cost reduction can be achieved by investing in automation that enhances customers' participation in the service process (Rust and Huang, 2012). In other words, looking at the change in the nature of services through the development of digital innovation and technology, the active role of customers in the process of producing services should be taken into account in terms of service productivity.

In this study, we specifically suggest that productivity in the services sectors can chase two hares at once: customer satisfaction and operational cost reduction. Past research suggests that service managers use their external labor markets, including customers, to differentiate themselves from competitors (Davis and Vollmann, 1990). When waiting time for services decreases, customers are more satisfied (Johnston, 1995; Rust and Huang, 2012). For example, customers' participation through various technologies (such as ticketing machines, ATMs, self-service checkout systems and kiosks) can help firms to achieve cost reduction. Recent research also suggests that firms can increase their level of customer satisfaction using technology and digital innovation as well as customer participation in the process of service production (Rust and Huang, 2012; Janeschek *et al.*, 2013). Consequently, it can be anticipated that both technological standardization and customer satisfaction can positively influence a firm's performance. With these arguments above, the following hypotheses are suggested:

H1a. There is a positive relationship between productivity and a firm's performance.

H1b. There is a positive relationship between productivity and customer satisfaction.

The relationships among innovation, productivity, customer satisfaction and a firm's performance

During the last decade, firms in the services sectors have developed various strategic methods to sustain a competitive advantage (Bitner *et al.*, 2002; Michel *et al.*, 2008).

Examples of strategic methods include customer orientation strategy (Brady and Cronin, 2001), employee training and development (Goldstein, 2003; Goldstein and Ward, 2004) and front-line employee training to improve service operation performance (Babbar and Koufteros, 2008; Gremler and Gwinner, 2000). Some firms maintain a competitive advantage over other competitors by emphasizing innovation strategy, which is closely linked with a firm's productivity.

We suggest that there is a positive relationship between innovation and productivity. For example, investing in innovation can be positively related to both productivity and quality. When firms invest in research and development (R&D), they can generate new products and services with better quality (Hertog, 2000). We also suggest that there is a positive relationship between innovation and customer satisfaction. For instance, Helms and Mayo (2008) found that customers can value and/or evaluate what they have obtained, in terms of what they initially wanted to obtain. Innovative products and services with better quality generated from R&D investment can reduce the psychological gap between what they want and what they get. In addition, customers can assess the quality of how they are treated and what they gain from a firm's services. Rust and Zahorik (1993) found that quality is significantly and directly related to the degree of customer satisfaction.

We propose that innovation is positively related to a firm's performance. For example, recent research suggests that innovation within a service operation can improve a firm's financial performance (Dotzel *et al.*, 2013). Specifically, innovation can be a new or enhanced intangible asset to increase the firm's performance so that it can be regarded as a strategic activity projected to benefit customers (Berry *et al.*, 2006). In addition, innovation can increase interaction among customers, employees, business owners, alliance partners and communities through new and/or improved service offerings, service processes and service business models (Ostrom *et al.*, 2010). Peterson and Jeong (2010) employed practical data to gauge innovation (as measured by R&D investment) and found that innovation positively influences a firm's brand performance. With these arguments above, the following hypotheses are suggested:

H2a. There is a positive relationship between innovation and productivity.

H2b. There is a positive relationship between innovation and customer satisfaction.

H2c. There is a positive relationship between innovation and a firm's performance.

The relationship between customer satisfaction and a firm's performance

We hypothesize that there is a positive relationship between customer satisfaction and a firm's performance. Past research suggests that maximizing customer satisfaction has been an important goal of businesses and customers have always been considered the leading actors (Anderson and Sullivan, 1993; Drucker, 1954; Izogo and Ogba, 2015; Szymanski and Henard, 2001). It has been argued that a firm's performance can be optimized by maximizing customer satisfaction (Hallowell, 1996). Luo and Bhattacharya (2006) supported this perspective by verifying the mediating role of customer satisfaction in the relationship between corporate social responsibility and a firm's performance. Fornell *et al.* (2006) found that customer satisfaction measured by the American Customer Satisfaction Index (ACSI) is significantly related to a firm's market value by means of a firm's performance. For example, when customers are satisfied with factors such as interaction with service/product quality, participation and time, customer satisfaction in these aspects is correlated with a positive firm performance. With these arguments above, the following hypothesis is suggested:

H3. There is a positive relationship between customer satisfaction and a firm's performance.

Figure 1 shows the theoretical model for this study, representing the relationships among innovation, productivity, customer satisfaction and firm performance along with the role of customer satisfaction in the relationships among innovation, productivity and firm performance, and the role of productivity in the relationships among innovation, customer satisfaction and firm performance.

Method

Data and sample

In order to test the stated hypotheses, we used two secondary data sources: COMPUSTAT and the ACSI. Much business research has been conducted using archival data sets, such as COMPUSTAT and ACSI, to supplement and strengthen the scientific objectivity of theoretical arguments (e.g. Fornell *et al.*, 1996; Hult *et al.*, 2017; Klingner *et al.*, 2015; Kim and Prater, 2011; Rust and Huang, 2012, etc.). Using COMPUSTAT, we collected accounting data about more than 30,000 public companies in the USA and Canada. We narrowed down the list of 30,000 by selecting only service firms identified by the North American Industry Classification System, then we investigated the service productivity of each firm in the services sector including wholesale and retail trade, transportation and warehousing, information, finance and insurance, real estate and rental and leasing, management of companies and enterprises, administrative and support services, educational services, health care, entertainment and recreation, accommodation and food services and other services. The categories in the services sector are the same ones Rust and Huang (2012) used. The ACSI included seven major economic sectors: manufacturing/non-durable, manufacturing/durables, transportation/communication/utilities, retail, finance/insurance, services and public administration/government. According to Fornell *et al.* (1996), companies in each sector interviewed approximately 250 customers who purchased and experienced a product/service of each company from 48 duplicate national probability samples of households in the USA. The ACSI includes customer satisfaction evaluations of more than 400 companies in the US markets. This study focused on companies that provided data to the ACSI in 2012. These companies were matched with COMPUSTAT accounting data. Many firms in the COMPUSTAT data set did not report wage information, so these firms were excluded. After the matching process was completed, our final sample included 127 firms in the services sector during fiscal year 2012.

Measurement

To measure productivity, we used the theory of optimal productivity suggested by Rust and Huang (2012) which includes important managerial determinants, such as profit margin, price per unit, market concentration (operationalized as the Herfindahl–Hirschman index),

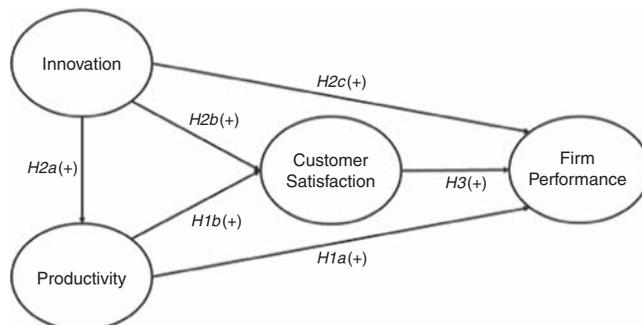


Figure 1.
Theoretical model

wage and factors other than service quality that affect sales. In detail, Rust and Huang (2012, p. 50) suggest, “The firm decides the level of service productivity to pursue to maximize profit. The service quality level is a function of the labor per unit from the selected productivity level and the automation per unit which reflects the level of technology.” With these assumptions, this study formalized productivity as follows:

$$P^* = R / [\theta^* N_S + (1 - \theta^*) N_A],$$

where P^* is the optimal productivity; R the price per unit; θ^* the optimal level of labor to use in service provision; $(1 - \theta^*)$ the optimal level of automation to use in service provision; N_S the labor per unit; and N_A is the automation per unit.

Building on Grönroos and Ojasalo’s (2004) study, Rust and Huang (2012) attempted to estimate service productivity based on the ratio of output divided by input. They formulated the numerator and denominator including managerial factors that explain the characteristics of service productivity. For example, collaboration between customers and firms can create and achieve a common value: customer lifetime value and superior firm performance (Berger and Nasr, 1998; Hunt *et al.*, 2006; Vargo and Lusch, 2004). This measurement presumes that in the given or assumed level of technology, service productivity can increase firm performance. We hypothesize that service productivity (including operational cost reduction and customer participation) can positively influence firm performance. Based on this suggestion, the concept of service productivity should reflect the change of the nature of service from an exchange of service between customers and firms to value co-creation. Rust and Huang (2012) found that each managerial factor mathematically proves its role and influence measuring service productivity. For instance, market concentration and labor wage are positively associated with service productivity, yet unit price and profit margin are negatively associated with service productivity.

This study controlled outliers of the factors by winsorizing, which takes care of 1 and 99 percent outliers of each variable to reduce the impact of extreme performances. This study also standardized all variables in the equations to have a mean of 0 and a standard deviation of 1 to ensure direct comparability. The study’s dependent variable was operationalized by using return on assets (ROA) as shown in Table II. We tested multicollinearity by running the variance inflation factor (VIF). VIF values were consistently below the recommended threshold level of 10 (Hair *et al.*, 2010). We concluded that multicollinearity is not an issue in this analysis. As shown in Table II, this study averaged all four variables to measure productivity.

Innovation refers to the ability of the organization to successfully adopt or implement new ideas, processes or products (Hurley and Hult, 1998). In service-oriented markets, innovativeness in the service sector includes endeavors from both firms and customers to achieve a common value to satisfy both parties. Innovation was measured by the R&D expenditure of each firm as reported in COMPUSTAT, in accordance with the use of R&D expenditure as an indicator of innovation in past research (Hurley and Hult, 1998; Kibbeling *et al.*, 2013; Padgett and Galan, 2010; Peterson and Jeong, 2010).

To measure customer satisfaction, this study employed ACSI data provided by the Consumer Research Institute at the University of Michigan. These data are used to study the science of firm-level customer satisfaction and include more than 400 publicly traded firms in the US stock market. ACSI scores are based upon telephone interviews with 250 customers of each firm and are reported on a 0–100 scale (Fornell *et al.*, 1996). The ACSI data have been found to be reliable and consistent with previous studies regarding customer satisfaction in business disciplines (Anderson *et al.*, 1997; Eugene *et al.*, 2004; Angelova and Zekiri, 2011; Fornell *et al.*, 1996; Morgan and Rego, 2006).

To measure a firm’s performance, this study used Tobin’s Q ratio. Past research suggested that Tobin’s Q ratio is appropriate for measuring a firm’s performance because it

Table II.
The result of
productivity
measurement

	Unstandardized coefficients		Std. coef.	<i>t</i>	Sig.	95.0% confidence interval for B		Correlations			Collinearity statistics	
	<i>B</i>	SE	β			Lower bound	Upper bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	0.571	0.006		97.817	0.000	0.560	0.583					
PRO.MAR	-0.059	0.010	-0.441	-6.170	0.000	-0.078	-0.040	0.469	-0.518	-0.239	0.293	8.416
PRICE	0.006	0.001	0.334	8.481	0.000	0.004	0.007	0.374	0.639	0.328	0.963	3.039
HHI	113.914	7.785	1.044	14.633	0.000	98.477	129.352	0.660	0.820	0.566	0.294	8.404
WAGE	-0.450	0.037	-0.481	-12.228	0.000	-0.523	-0.377	-0.493	-0.768	-0.473	0.968	3.033

Notes: Dependent variable: ROA, $F > 141.058$, $p^* < 0.000$, $R^2 = 0.845$; PRO.MAR, profit margin; PRICE, price a unit; HHI, market concentration; WAGE, labor cost

consists of the total sum of current firm value, encashment and long-term book value divided by total assets of firm (Chung and Pruitt, 1994; Simon and Sullivan, 1993; Torres and Tribo, 2011). Previous studies argued that Tobin's Q ratio is able to estimate brand equity as another indicator of a firm's performance showing the firm value evaluated by customers (Dotzel *et al.*, 2013). This study adopted Tobin's Q ratio that estimates brand equity as a firm's performance using financial stock value (Chung and Pruitt, 1994, p. 71):

$$\text{Tobin's } Q = (\text{MVE} + \text{PS} + \text{DEBT}) / \text{TA},$$

where MVE = (share price) \times (number of common stock outstanding); PS = liquidating value of the firm's preferred stock; DEBT = (short-term liabilities – short-term assets) + book value of long-term debt; and TA = book value of the total assets of the firm.

Tobin's Q is widely used as an indicator of intangible assets in economic research (Dowell *et al.*, 2000). Tobin's Q ratio indicates that the firm has intangible assets when the value of Q is greater than 1.0. In this study, innovation, customer satisfaction and productivity are considered intangible assets.

Results

We used ordinal least squares analysis to test our hypotheses. As shown in Table III, all hypotheses were supported. Specifically, the findings of the hypothesis tests supported that there are statistically significant positive relationships among innovation, productivity, customer relationship and a firm's performance. In addition, we tested the mediating effects of customer satisfaction and productivity. In doing so, this study employed Baron and Kenny's (1986) method of using three regression equations which are from an independent variable to a mediator, from an independent variable to a dependent variable and from a mediator to a dependent variable. As shown in Table IV, customer satisfaction fully mediated the relationship between productivity and a firm's performance. However, customer satisfaction did not mediate the relationship between innovation and a firm's performance. In addition, the results did not support a mediating effect of productivity on the relationship between innovation and customer satisfaction nor on the relationship between innovation and a firm's performance.

Discussion

Past research suggested that service sectors have specific attributes, such as customer involvement in the service process, simultaneous production and consumption of services, service quality and productivity and labor intensiveness (Fitzsimmons and Fitzsimmons, 1997). The findings of this study show that there are significantly positive relationships among innovation, productivity, customer relationship and a firm's performance in the services sector. Specifically, this study provides empirical evidence by supporting that

Hypothesis	t -performance	p -performance	Hypothesis test
H1a. Productivity \rightarrow (+) firm performance	2.515	0.013*	Supported
H1b. Productivity \rightarrow (+) customer satisfaction	2.130	0.035*	Supported
H2a. Innovation \rightarrow (+) productivity	2.538	0.020*	Supported
H2b. Innovation \rightarrow (+) customer satisfaction	8.091	0.000*	Supported
H2c. Innovation \rightarrow (+) firm performance	37.071	0.000*	Supported
H3. Customer satisfaction \rightarrow (+) firm performance	7.897	0.000*	Supported

Notes: $n = 127$. *Significant at $p < 0.05$

Table III.
The result of hypothesis test

	β	SE	<i>t</i> -performance	<i>p</i> -performance	Results
P→CS	0.514	0.241	2.130	0.035*	
P→FP	0.134	0.053	2.515	0.013*	
P+CS→FP	(CS) 0.115 (P) 0.070	0.018 0.046	6.432 1.523	0.000* 0.131	CS mediated
I→CS	3.040	0.376	8.091	0.000*	
I→FP	1.039	0.028	37.071	0.000*	
I+CS→FP	(CS) -0.006 (I) 1.055	0.007 0.035	-0.800 30.399	0.426 0.000*	CS not mediated
I→P	0.421	0.179	2.358	0.020*	
I→CS	3.040	0.376	8.091	0.000*	
I+P→CS	(P) 0.195 (I) 2.805	0.204 0.391	0.954 7.166	0.342 0.000*	P not mediated
I→P	0.421	0.179	2.358	0.020*	
I→FP	1.039	0.028	37.071	0.000*	
I+P→FP	(P) 0.012 (I) 1.034	0.015 0.029	0.767 35.941	0.445 0.000*	P not mediated

Table IV.
The result of
mediating effect test

Notes: P, productivity; CS, customer satisfaction; I, innovation; FP, firm's performance. *Significant at $p < 0.05$

customer satisfaction fully mediates the relationship between productivity and a firm's performance. Overall, the findings of this study suggest that firms in the services sector need to develop and invest in their competencies, particularly customer satisfaction.

Theoretical contributions

This study makes a number of contributions to the research on service productivity. First, the findings provide empirical evidence about the relationship between productivity and other variables in the services sector (such as customer satisfaction, innovation and a firm's performance). Specifically, service productivity can help to improve a firm's performance not only by cost reduction (e.g. focusing on efficiency), but also by quality improvement (e.g. focusing on effectiveness). This is because the nature of services, such as heterogeneity, inseparability between consumption and production and intangibility, leads to changes in the role of customers and the relationship between customers and firms. By investing in automation in producing services, firms are able to achieve the goal of cost reduction. In the meantime, firms using innovation developed from automation are able to increase the level of customer participation, leading to increased customer satisfaction in the process of producing services. Past research suggests that service quality has become a main factor that affects customer satisfaction and it is positively associated with labor (Anderson *et al.*, 1997). It has also been suggested that service quality may not be able to be obtained only by the firm itself because the nature of customers' demands of services are different and heterogeneous (Hunt and Morgan, 1995). Thus, a high level of service quality affecting customer satisfaction can be achieved not only by firms' attempt to develop a sound relationship with customers but also by customers' direct participation in the process of producing a service. With this point of view, this study reexamined the theory of optimal service productivity suggested by Rust and Huang (2012) and supported that the concept of productivity has to consider both effectiveness and efficiency to correctly project and estimate productivity in the services sector. The findings of this study support that both quality and productivity must be considered simultaneously when firms in the services sector measure productivity and firm performance.

Second, this study extends the scope of services research related to service productivity. Past research suggested that it is not viable to obtain the effect of business

strategies without considering any interactions with customers, especially in the services sector (Homburg *et al.*, 2000). This study provides empirical evidence that there is no direct relationship between productivity and a firm's performance since customer satisfaction fully mediates that relationship. Customers are the key players who respond to business strategies in the services sector. This study argues that firms in the services sector need to shed new light on the interaction between customer satisfaction and a firm's performance not only when constructing service operation management but also when estimating the effect of quality management in the services sector.

Third, our empirical results did not support a mediating effect of productivity on the relationship between innovation and customer satisfaction nor on the relationship between innovation and a firm's performance. However, our findings are theoretically important because our statistical results show that innovation and productivity are mutually exclusive. In addition, this study empirically supports that both productivity and innovation act as antecedents of customer satisfaction, and customer satisfaction acts as a mediator in the process of measuring a firm's performance. Therefore, this study argues that both innovation and productivity can play important roles as antecedents in estimating a firm's performance and customer satisfaction.

Managerial implications

The findings of this study have a number of managerial implications. First, firms in the services sector need to consider how to improve productivity with quality through customer satisfaction. Service includes the utility that comes from the interaction between users (e.g. customers) and providers (e.g. firms in the services sectors) as well as the consumption of products and/or services. Therefore, firms need to increase and maximize their level of interaction with customers and customers' utility through optimizing their level of productivity. In addition, past research suggested that firms design, produce and manage services with customers who can enhance and evaluate the final performance of the services (Chase and Erikson (1988). Customer satisfaction is the core value of quality management in the services sector. Overall, this study suggests that firms in the services sector need to develop service productivity that enables them to maximize the level of customer participation and utility in the process of providing services.

Second, service firms need to strive to reinforce their relationship with customers as well as improve quality and productivity in the process of providing services. The findings of this study support that customer satisfaction positively responds to service productivity, which is closely related to a firm's performance. In addition, managers need to develop an interactive relationship with customers and think of them as strategic business partners. This is consistent with past findings that managers need to focus on the relationship with customers because their target customers are more likely to influence performance (Drucker, 1954). The findings of this study suggest that increasing the level of interaction with customers can help firms in the services sector maintain a higher level of competitive advantage in their businesses.

Third, this study suggests that managers in service firms need to develop innovative thoughts and assets of service operations which can make their firms sustainable. It is believed that innovative thinking and endeavors in service firms should be positioned as the culture of services organizations. The findings of this study indicate that innovation can make this happen. Through enforcing innovative competency, firms in the services sector can promptly respond to changes in customers' needs. Overall, this study suggests that due to innovation, service productivity as well as customer satisfaction can go hand in hand to better achieve a firm's sustainable performance.

Limitations

This study has limitations that need to be addressed in future work. First, this study only focused on firms in the services sector. There were a limited number of sample firms, which

might not capture the difference of the level of service productivity in different types of services, such as high labor-demand firms vs low labor-demand firms and service industries and non-service industries. Expanding the sample size could give more comprehensive results. It might be worth examining the difference of the level of service productivity within our theoretical framework. We believe would increase the study's generalizability.

Second, this study only focused on a limited time period with one-year cross-sectional data due to the difficulty of matching each variable in all the data sets. Our data might not fully verify the effect of changes in service productivity and in the structural relationships among variables. Examining the change in our study's variables by using time series analysis is recommended for further studies.

Another challenge which this study needs to overcome is to extend the structural relationships to other industries or different levels of service firms. This limitation is related to the measurement of each variable because this study only looked at the firm perspective. Future researchers should look at the theoretical and structural relationships among variables measured from a customer perspective. This would be meaningful practically as well as theoretically.

Conclusion

This study empirically examined the relationships among innovation, productivity, customer satisfaction and a firm's performance in the services sector. The empirical results of this study supported that there is a positive relationship between productivity and customer satisfaction and that customer satisfaction fully mediates the relationship between productivity and a firm's performance. In addition, innovation and productivity act as antecedents of customer satisfaction and a firm's performance. However, the empirical results did not support that customer satisfaction mediates the relationship between innovation and a firm's performance. Furthermore, productivity did not mediate the relationship between innovation and customer satisfaction or the relationship between innovation and a firm's performance.

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Further reading

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