Impact of IS capabilities on service operations: the role of customer transactions

Teng Teng (teng.teng@anglia.ac.uk)
Lord Ashcroft International Business School, Anglia Ruskin University, Chelmsford, UK

Christos Tsinopoulos (chris.tsinopoulos@durham.ac.uk)
Durham University Business School, Durham University, Durham, UK

Abstract

This paper empirically investigates the relationships between IS capabilities, customer transactions, and operational performance of firms in service contexts. We hypothesise that while there may be an effect of IS on service operations performance, such effects are mediated through the processes developed for customer transactions. Using data from a survey of UK service establishments we find that customer transactions partially and fully mediate the effects of different dimensions of IS capabilities on cost and service quality. Service firms that embark on efforts to develop and leverage their IS capabilities should, at the same time, implement processes that encourage customer transactions.

Keywords: IS Capabilities, Customer Transactions, Cost, Service Quality

Introduction

The rapid growth of the service industry over the last 50 years has generated the need for innovations and improved service productivity to fuel economic growth. However, while service operations management has become established as a field of research, very few studies have investigated how service providers can create value through the IS-enabled integration of the processes that extend their organisational boundaries (Ellram *et al.,* 2007). In recent years, the application of Information Systems (IS) has had a significant effect on contemporary service operations. Firms invest in IS with the presumption that they will facilitate operations processes so that their performance will improve. Yet, IS resources by themselves are not sufficiently "unique" and thus it would be more useful and theoretically relevant to focus on the processes they affect (e.g.,Santhanam and Hartono, 2003). Nevertheless, prior studies on IS capabilities have focused on either one specific type of technology or operationalised it as a highly aggregated concept. Moreover, although conceptual frameworks have been identified to show customer integration is valuable in service provision (e.g., Moeller, 2008), there is much to learn about the practices of integrating customer resources (Kleinaltenkamp *et al.*, 2012). Recent research highlights the crucial IS-enabled processes that link firms with their customers, for *customer transactions* in services (e.g., Tsikriktsis *et al.*, 2004).

In this research, we break down IS capabilities into three dimensions based on the framework of Wade and Hulland (2004) and focus on their impact on operational performance in services. With this background, this paper addresses the following questions:

- How do IS capabilities affect operational performance in services?
- How does process integration of customer transactions influence IS capabilities and operational performance in services?

Theory and Hypotheses

Our theoretical model is built on the existing research linking IS to supply chain management and complements it with specific pathways relating the dimensions of IS capabilities (IT for supply chain activities, flexible IT infrastructure, and IT operations shared knowledge) to customer transactions of service firms. To formulate the arguments, the research model is built on past OM research on the relationship between supply chain management and firm operational performance (e.g., Flynn *et al.*, 2010). Further, to complete the research model, the indirect effects of IS capabilities on cost and quality performance are evaluated.

IS capabilities and their impact on customer transactions

IT for supply chain activities (ITSCA) refers to the ability of a firm to use IT for processing transactions, coordinating activities, and facilitating collaboration with supply chain partners through information sharing, reflecting a capability to manage the external relationships (outside-in). Prior IS research has supported the role of IT as a mechanism to streamline processes and automate transactions, and hence to provide business benefits by accelerating processes, substituting labor, and increasing operation volumes (e.g., Brynjolfsson and Hitt, 1996). Firms' use of ITSCA facilitates the automation of the structured and routine processes involved in transactions with customers (Saldanha *et al.*, 2013). ITSCA enables digital business transactions between a firm and its customers through Internet-based information technologies (Thun, 2010). Additionally, advancements such as web-enabled customer order entry systems, fully integrated order-processing systems, and electronic invoicing systems are known to contribute in boosting customer transactions processes by reducing error in processing orders (Ray *et al.*, 2005). Therefore,

> *Hypothesis 1a: The use of IT for supply chain activities has a positive influence on the degree of customer transactions.*

Flexible IT infrastructure (ITINF) refers to a firm's ability to deploy a shareable platform that supports a foundation for data management, communications network, and application portfolio (inside-out). Such an infrastructure provides an integrated platform that enforces standardization of data and processes, making it possible to achieve timely and accurate information gathering and sharing across business function areas (Lu and Ramamurthy, 2011), which enhances business transactions with data driven by corporate databases (Beheshti and Salehi-Sangari, 2007). Specifically, a flexible infrastructure helps to improve customer transaction processes by enabling electronic services, such as personal account maintenance, user recognition, and order tracking. Supported by the firm-wide databases (Thirumalai and Sinha, 2011). This discussion leads to the following hypothesis:

Hypothesis 1b: Flexible IT infrastructure has a positive influence on the degree of customer transactions.

IT operations shared knowledge (ITOSK) refers to the knowledge that the operations manager possesses about how IT can be effectively used to achieve the supply chain processes and operations activities, enabling a firm to link these outside and inside capabilities into the overall corporate strategy (spanning). Previous research has emphasized the significance of business managers' familiarity with information technologies and their potential business impacts (e.g., Bassellier *et al.*, 2003). Placed within an operations context, ITOSK reflects the extent to which a firm enables management's ability to understand the value of IT resources and ensures the speedy, effective, and sufficient translation of innovative responses that usually require radical changes to transaction possesses (Lu and Ramamurthy, 2011; Wade and Hulland, 2004). To this end, operations managers who possess IT shared knowledge are more likely to understand and promote the use of IT innovations for transaction processes with customers. Therefore,

Hypothesis 1c: IT operations shared knowledge has a positive influence on the degree of customer transactions.

The mediating effect of customer transactions on cost

ITSCA can enhance transactions processes associated with order placement, order monitoring, and payment submission by customers (Wu *et al.*, 2003). ITSCA-enabled transactions with customers facilitate cost reductions in transactions between buyers and sellers (e.g., Subramani, 2004). The use of ITSCA provides opportunities for the firm to automate customer transaction processes in order to reduce the internal costs of serving customers (Rust and Lemon, 2001). For example, insurance firms have created real-time quotes, the travel sector has set up online bookings, and almost every major bank has offered an online banking system to complement its traditional branch, ATM, and mail channels (Tsikriktsis *et al.*, 2004). Such service transactions enable customers to obtain answers to questions and place orders in a convenient manner, and without having to rely on human response (Thirumalai and Sinha, 2011). Therefore,

Hypothesis 2a: Customer transactions are positively related to cost performance and mediates the ITSCA–cost relationship.

ITINF enhances customer transactions by accomplishing digital customer order management, enabling the potential of a firm to provide low cost service. A flexible infrastructure can provide accurate product or service information by using data from corporate databases. Through the records of customers' order histories, ITINF-enabled transaction services can provide fast assistance for customer ordering, matching customers' tastes and needs and the products and services that satisfy them from a wide set of alternatives (Thirumalai and Sinha, 2011). Customers are, therefore, able to complete their transactions more efficiently with minimal needs for human assistance.

Hypothesis 2b: Customer transactions are positively related to cost performance and mediates the ITINF–cost relationship.

ITOSK can enhance customer transactions by promoting the use of IT innovations for transaction processes. Through responding to the requirements of changes in transaction processes in a rapid manner, ITOSK-enabled transaction innovations can create low cost service for the focal firm. ITOSK can leverage information and web technologies on the basis of knowledge about customer preferences, creating new electronic transaction processes to support the needs of various customer segments (Hu *et al.*, 2009). For example, as promised by the use of IT innovations such as time and location-independent services, ITOSK-enabled transaction innovations provide the most obvious form of convenience to customers (Tan *et al.*, 2013). Such electronic transactions allow customers to complete the entire order transaction online without resorting to staff assistance, thus leading to lower costs of services.

Hypothesis 2c: Customer transactions are positively related to cost performance and mediates the ITOSK–cost relationship.

The mediating effect of customer transactions on service quality

ITSCA promotes and accomplishes transactions processes between a service provider and its customers in terms of order placement, order monitoring, and payment submission, all of which can improve the focal firm's quality performance. Specifically, ITSCA-enabled transactions with customers facilitate improved service quality as perceived by customers (Field *et al.*, 2004). Moreover, the enhancement in transaction timeliness and accuracy improves service quality through providing information about products, troubleshooting, and service online (Wu *et al.*, 2003). For example, web-enabled customer interaction allows customers to easily access products and services, and to obtain replies to enquiries consistently and quickly. To this end, ITSCA-enabled transactions can promote service reliability and credibility through providing products and services information in an accurate and timely manner (Rust and Lemon, 2001). Thus,

Hypothesis 3a: Customer transactions are positively related to quality performance and mediate the IT for supply chain activities–quality relationship.

ITINF enhances customer transactions by enabling digital customer order management, such as customer account maintenance and order tracking. ITINF-enabled transactions help to deliver information content to customers. A flexible infrastructure can enhance customer transactions by providing comprehensive, reliable, high quality, and relevant product and service information to customers, improving service quality in terms of credibility and reliability (e.g., Parasuraman *et al.*, 2005). Moreover, ITINF-enabled transactions facilitate improvements in transaction convenience since they decrease the customer's perception of the amount of time and effort required to effect a transaction (Berry *et al.*, 2002). Specifically, ITINF-enabled transactions tailor transaction processes (i.e. purchase and delivery) to customers. Such transaction services simplify ordering processes for the customer and increase information transparency in respect of customer ordering. Thus,

Hypothesis 3b: Customer transactions are positively related to quality performance and mediate the flexible IT infrastructure–quality relationship.

ITOSK enhances customer transactions by promoting the use of IT innovations within transaction processes. Service firms often adopt innovations because they are driven by the external pressure of the 'bandwagon' effect, and many traditional service providers have been forced to switch to electronic transactions for online retailing in the face of upstart competition (Tsikriktsis *et al.*, 2004). ITOSK leverages information and web technologies on the basis of knowledge about customer preferences, creating new electronic transaction processes to support the needs of various customer segments (Hu *et al.*, 2009). Based on customer information obtained either previously or in real-time during the transaction processes, the electronic customer transactions are tailored to the customer needs and preferences, and enable firms to customize their offerings for each customer (Thirumalai and Sinha, 2011). This ability to make customized offerings enhances the perceived quality of services from the customer's perspective (Mithas *et al.*, 2005). Therefore,

Hypothesis 3c: Customer transactions are positively related to quality performance and mediate the IT operations shared knowledge–quality relationship.

Figure 1 shows the hypothesized research framework of the proposed indirect effects of each dimension of IS capabilities (ITSCA, ITINF and ITOKN) on cost and service quality through their positive effects on customer transactions.

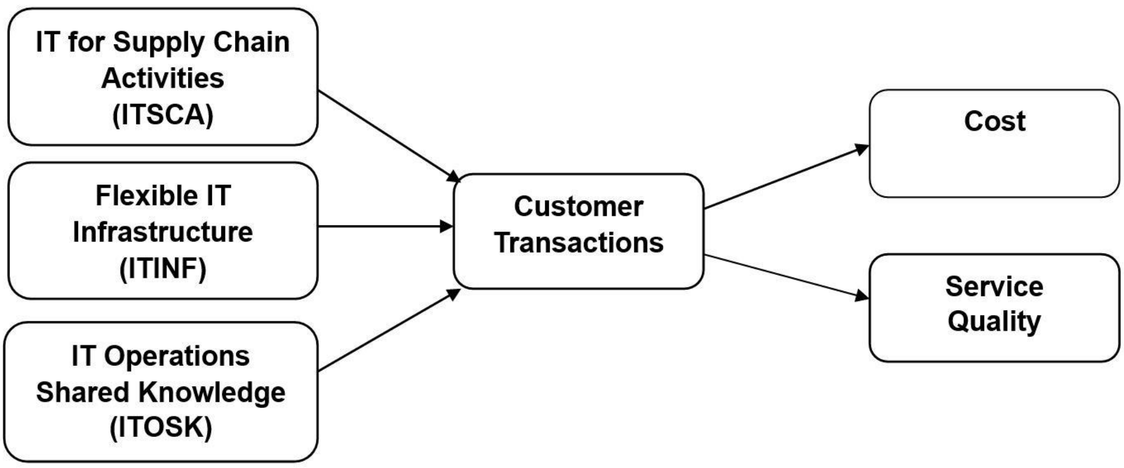

Figure 1 – Hypothesised Framework

Methodology

Sampling and data collection

The data were collected via an online survey sent to 1158 service establishments in the UK, sampled from Dun and Bradstreet database. The sample frame included firms from eight industries (education; hotels and restaurants; banks, insurance and other financials; wholesale and retail trade; business activities; transport, storage and communications; health and social work; and other services). The survey was focused on senior managers as key informants with titles such as ‘Vice President,’ ‘Manager,’ ‘Director’ or ‘Head’, and with functional area of ‘Operations’. The initial contact included email of cover letter and the link to the online survey. After one month of the initial contact, reminder emails were sent to the respondents. After removing 15 returned surveys due to firm policies not to respond and 3 incomplete surveys, a total of 156 usable surveys were received (13.6% response rate). This response rate is consistent with response rates of similar studies in the field (Carey *et al.*, 2011).

Non-response bias

To ensure that the sample of responses collected was representative of the population, non-response bias was tested through comparing the early wave of returned surveys to the late wave (Armstrong and Overton, 1977). Mann-Whitney U and Kolmogorov-Smirnov Z tests were used to compare early and late responses across all the variables in the survey. No statistically significant differences among variables were found, suggesting that the non-response bias is minimal.

Measures

The survey scales were either established scales or developed from the extant literature. *IT for supply chain activates* are represented in our survey by measuring the extent of implementation of 20 different types of process-level IT applications that used in service industry. Consistent with prior IS and OM research (e.g., Saldanha *et al.*, 2013), we measure the extent of implementation (adoption) of each type of IT applications. *Flexible IT infrastructure* was measured using a two-item scale on a 1-7 Likert scale (from “Strongly Disagree” to “Strongly Agree”), assessing the degree to which the firm has established corporate rules and standards for hardware and operating systems to ensure platform compatibility; and has identified and standardized data to be shared across systems and operations department (Ray *et al.* 2005; Chen *et al.*, 2009; Lu and Ramamurthy, 2011). *IT operations shared knowledge* was measured using a three-item scale on a 1-7 Likert scale (from “Strongly Disagree” to “Strongly Agree”), indicating the degree to which they agree with there is a common understanding between IT and operations managers regarding how to use IT to improve operational performance (Ray *et al.*, 2005; Bassellier *et al.*, 2003). *Customer transactions* was assessed using a three-item scale on a 1-7 Likert scale (from ‘Not at all’ to ‘Extensive’), indicating the extent of integration or information sharing between their firms and customers on transactions processes (Tsikriktsis *et al.*, 2004). *Cost* and *Service Quality* were measured using a seven-item scale on a 1-7 Likert scale (from “Much Worse than Competition” to “Much Better than Competition”), rating cost performance (Safizadeh *et al.*, 2003); and the external service quality (Safizadeh *et al.*, 2003; Parasuraman *et al.*, 2005).

Data analysis

Exploratory factor analysis using principal components extraction, with direct oblimin rotation, was used to extract factors with eigenvalues greater than 1.0. Bartlett's Test of Sphericity (2348, p<.000) and the Kaiser-Meyer-Olkin (KMO) statistic (.855) confirmed the suitability of items for factor analysis. All factor loadings were considerably above .70 and are therefore considered significant (Hair *et al.*, 2009). A screen test confirmed that no more than five factors (ITINF, ITOSK, customer transactions, cost, and service quality) should be retained. The Cronbach's alphas ranged from .801 to .956, consistent with the suggestion that alpha levels above .80 are very good (Hair *et al.*, 2009).

Findings

Our model examines whether the level of supplier integration mediates the relationship of IS capabilities and service quality. Following Carey *et al.* (2011), mediated multiple regression (Baron and Kenny, 1986) is used to test the hypothesised model. Table 1 shows the results of mediated regression analysis.

Table 1 – Results of regression analysis for mediation

	Customer Transactions			Cost			Service Quality	
		Step 1		Step 2	Step 3		Step 2	Step 3
	β	β	β	β	β	β	β	β
Controls								
Industry1 Education	-.075	-.062	.004	.010	.029	-.122	-.123	-.104
Industry2 Hotels	-.162	-.155	-.078	-.072	-.025	-.151	-.148	-.100
Industry3 Banks	-.243*	-.178	.074	.125	.179	-.118	-.099	-.043
Industry4 Wholesale	-.153	-.143	.042	.039	.082	-.118	-.134	-.089
Industry5 Business	-.185	-.115	-.041	.025	.060	-.242	-.201	-.165
Industry6 Transport	-.037	-.072	.039	-.020	.002	-.008	-.072	-.050
Industry7 Health	-.239*	-.132	-.080	.036	.076	-.123	-.033	.008
Firm Size	.109	.108	-.025	-.017	-.050	-.196*	-.179*	-.213
Direct effects								
ITSCA		.208*		.235**	.173*		.185*	.120
ITINF		.015		.099	.094		.150	.145
ITOSK		.247**		.267**	.193*		.219**	.142
Mediating effect								
Customer					.302***			.312***

Transactions								
ΔR^2	.086	$.103^{**}$	.027	$.149^{***}$	$.223^{***}$	.067	$.123^{***}$	$.202^{***}$
Overall R^2	.086	.189	.027	.176	.250	.067	.190	.269
Adjusted R^2	.036	.127	-.026	.113	.187	.016	.128	.207
Overall model F	1.733	3.046^{**}	.502	2.793^{**}	3.969^{***}	1.317	3.065^{**}	4.379^{***}

* p<.05; ** p<.01; *** p<.001

The results of the analysis show support for Hypothesis 1a: the ability to use ITSCA (β=.212, p<.05) was positively and significantly related to customer transactions; and H1c: ITOSK (β=.248, p<.01) was positively and significantly related to customer transactions. No significant relationship between ITINF and customer transactions (β=.015, ns) was found, and therefore, there was no support for H1b.

Cost (Steps 2 and 3) shows the results for H2a, H2b and H2c. Customer transactions were positively related to cost performance (β=.302, p<.001), with the previously significant ITSCA–cost relationship (β=.235, p<.01) becoming less significant (β=.173, p<.05); and with the previously significant ITOSK–cost performance relationship (β=.267, p<.01) becoming less significant (β=.193, p<.05), providing evidence of partial mediation and thus, partial support for H2a and H2c. There was no relationship between ITINF and cost performance, thus no support for H2b.

Quality (Steps 2 and 3) shows the results for H3a, H3b and H3c. Customer transactions were positively related to quality performance (β=.312, p<.001), with the previously significant ITSCA–quality performance relationship (β=.183, p<.05) losing significance (β=.117, ns); and with the previously significant ITOSK–quality performance relationship (β=.211, p<.01) no longer significant (β=.143, ns), providing evidence of full mediation, and thus, full support for H3a and H3c. Again, there was no significant relationship between ITINF and quality performance, and thus, no support was found for H3b.

Based on our results, we can argue that IS capabilities do have an impact on customer transactions, while customer transactions affect service quality. Put differently, customer transactions, involving information sharing and operational co-ordination in respect of customer transactions and order management activities, are the means by which the intrinsic value of ITSCA and ITOSK is translated into reduced cost and improved quality performance.

Conclusions

The study makes the following contributions. Firstly, we contribute to a scarce but increasing body of research on customer and supply chain integration in service contexts. Specifically, we provide and validate a process-specific approach to empirically investigate customer integration (e.g., Moeller, 2008). We therefore respond to recent calls to better understand the practices of integrating customer resources (Kleinaltenkamp *et al.*, 2012). Secondly, we explore the relationship between customer integration and operational performance in service contexts. We find that in service contexts IS capabilities lead to improved performance when they help develop processes for the integration of customer transactions first. The practical implication of our finding is that service firms that embark on the development of IS capabilities should at the same time implement processes that encourage customer transactions. Finally, we respond to calls from supply chain management literature to explore a comprehensive range of IT in SCM by developing and validating the measurement scale of IS capabilities in managing service supply chains (e.g., Ostrom *et al.*, 2015; Zhang *et al.*, 2011).

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