IS capabilities, supply chain collaboration and quality performance in services:

The moderating effect of environmental dynamism

Structured Abstract:

Purpose – The purpose of this study is to explore the effects that information systems (IS) capabilities can have on supplier collaboration and customer collaboration and on quality performance in service contexts. In addition, the study examines how supply chain collaboration influences quality performance under various levels of environmental dynamism.

Design/methodology/approach – The conceptual model for this study is designed on the basis of the resource-based view (RBV) and dynamic capability view (DCV). A survey of 156 UK service firms was conducted and the data analyzed to test theoretical model using the structural equation modeling method. Furthermore, the moderating effect of environmental dynamism was investigated.

Findings – The results show that IS capabilities are positively associated with supply chain collaboration. Both supplier collaboration and customer collaboration are positively related to quality performance. Supplier collaboration has a positive effect on customer collaboration. Environmental dynamism significantly moderates the relationship between customer collaboration and quality performance, but no moderating effect on the relationship between supplier collaboration and quality performance.

Originality – This study takes a step towards quelling concerns about the business value of IS, contributing to the development and validation of the measurement of IS capabilities in the service supply chain context. The study deepens our understanding of supply chain collaboration by making a distinction between supplier collaboration and customer collaboration and investigating the correlation of supplier collaboration and customer collaboration. The findings extend the empirical application of RBV and DCV. In addition, this study’s findings direct service firms to develop IS capabilities that can enhance specific kinds of supply chain collaboration activities, thereby enabling improved quality performance.

Keywords: IS capabilities, service supply chain, supplier collaboration, customer collaboration, quality performance, environmental dynamism

Article Type: Research paper

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1. Introduction

In today's hypercompetitive marker environment, firms are completing as part of a supply chain, against other supply chains, to better respond to market changes (Wu *et al.*, 2014; Li *et al.*, 2019). Given the nature of interdependence between supply chain members, collaboration is a necessary requirement for integrating operations in order to achieve the mutual goals of all entities in a supply chain (Jayaram *et al.*, 2011). Successful collaboration with external parties, suppliers and customers, is critical for service firms to maintain or strengthen their competitiveness by offering superior service to customers (Heirati *et al.*, 2016). Supply chain collaboration is one of the key capabilities that enable firms to leverage their resources to create a seamless and synchronized supply chain (Flynn *et al.*, 2010; Liu *et al.*, 2015). Although firms perceive supply chain collaboration as integral to their strategy and make huge investments in creating and sustaining effective supply chain collaboration (Chen *et al.*, 2017), many of them fail to capitalized on its potential (Zhang and Cao, 2018). Therefore, it is crucial to understand the key drivers of supply chain collaboration and implement them efficiently (Li *et al.*, 2019; Cui *et al.*, 2020).

Information technology (IT) has been argued as a major driver of supply chain management (SCM) as supply chain partners have become increasingly integrated via IT (Huo *et al.*, 2015). This is because IT can facilitate the collaboration of inter-firm processes and span the whole supply chain, including both supply-side and demand-side operations (Asamoah *et al.*, 2021). From the resource-based view (RBV) (Barney, 1991), IT resources by themselves are not sufficiently "unique" and thus it would be more useful and theoretically relevant to focus on IT/IS capabilities as performance differentials (Yu *et al.*, 2017). Despite the emerging evidence of the contributing role of IT/IS capabilities on SCM, the empirical studies in this field predominantly operationalized the constructs of IT/IS capability as the use of IT, or as single or formative constructs (refer to Table A1 for a review of this body of literature), which has resulted in a relatively limited understanding of the influence of IS capabilities on SCM and operational performance. Many studies have focused on the use of specific types of technologies, for example, integrative information technologies (Vickery *et al.*, 2003; Vickery *et al.*, 2010; So and Sun, 2011; Kim, 2017), or the pattens of IT use (Subramani, 2004; Sanders, 2008; Jiang *et al.*, 2020). While other studies have operationalized IT as highly aggregated concepts, such as IT capability (Sanders and Premus, 2005; Peng *et al.*, 2016), IT use/implementation (Xu *et al.*, 2014; Prajogo *et al.*, 2018; Yu *et al.*, 2021), or IT investments (Devaraj *et al.*, 2013). Although a few studies have considered IT as a formative construct consisting of different sub-constructs (Rai *et al.*, 2006; Asamoah *et al.*, 2021), their tests cannot disentangle the individual role of each IT capability in enhancing SCM. Consequently, these studies investigating the relationships between IT/IS capabilities, SCM, and operational performance are yet to empirically test the influence of different dimensions of IT/IS capabilities on SCM.

Supply chain collaboration requires joint work between the supply chain members, to achieve desirable performance outcomes (Jayaram *et al.*, 2011). For instance, supplier collaboration is critical given that firms increasingly rely on their supplier to obtain competitive advantages (Wang *et al.*, 2016) and suppliers have a great impact on cost, quality, speed and responsiveness of firms (Yu *et al.*, 2021). Similarly, customer collaboration ensures that the voice of the customer is embedded in the product development effort (Huo *et al.*, 2015) and boost a firm's product flexibility and quality performance (Ganbold *et al.,* 2020). Despite this increasing interest, there are some significant gaps in the research on supply chain collaboration in the service sector. First, the context of most relevant studies in operations management (OM) and SCM remains in manufacturing settings (refer to Table A2 for a review of this body of literature). Research on supply chain collaboration and supply chain integration (SCI) in the service sector is highly limited, with only a few studies available on conceptual definitions and/or measurement scales(Aitken *et al.*, 2016; Boon-itt *et al.*, 2017; Wang *et al.,* 2018). Second, relatively little distinction has been drawn on the differences between SCI in manufacturing and service supply chains. Because the visible common link of managing the flow of goods is not presenting in service supply chains and flows may not follow observable sequences, the management of services is often quite different form manufacturing, (Harvey, 2016). The intangibility, heterogeneity, inseparability, and perishability nature of services also makes the service SCM more dynamic (Boon-itt et al., 2017). There is currently a lack of understanding as to whether the results obtained from manufacturing supply chains can be directly extrapolated to service contexts. Third, the report on the connection between supplier collaboration and customer collaboration in the service sector is still very limited. Prior studies considered supplier collaboration and customer collaboration as two distinct concepts and have limited their analyses to collaboration with customers (Li *et al.*, 2019) or suppliers (Zhang *et al.*, 2018) in order to ascertain their distinct contribution to performance. In the service sector, the distance between supply chain parties is often shorter (Akkermans and Voss, 2013). Service firms collaborate with suppliers and customers simultaneously to speed the flow of communication and ensure the accuracy of information to deliver heterogeneous services. The current literature offers a limited reflection on the mechanism of supply chain collaboration lying in the empirical exploration of relationship between supplier collaboration and customer collaboration.

In this study, we investigate the direct impact of supplier and customer collaboration on quality performance. Among the various dimensions of performance, we focus on quality performance as it is critical for service firms in today's demanding and fast changing environment (Prajogo *et al.*, 2014). In order to develop a richer understanding of the relationship between IT-enabled process for supply chain collaboration and quality performance, we focus on one contextual factor – environmental dynamism – that has received considerable attention in IS and OM literature. Much of the recent IT value research has emphasized contextual factors that influence the effectiveness of IT (Bayer *et al.*, 2020). Researching contextual factors not only contributes to a better understanding of how to improve return on IT investment but also helps to explain the varying IT effects across individual firms (Wiengarten *et al.*, 2013). As direct performance effects may not be capable of fully capturing the complexity of the business reality, scholars have acknowledged that the performance effects of certain SCM practices depend upon the environmental context (Wamba *et al.*, 2020). Moreover, the effect of SCM and supply chain collaboration capability is conceptualized as a dynamic capability of the organization (Hong *et al.*, 2018). Hence, environmental dynamism is a key contextual parameter in the dynamic capabilities view, which suggests that the variance of benefits generated via exploitation of organizational capability hinge on environmental dynamism, since dynamic capabilities enable the organization to adjust to the environment (Drnevich and Kriauciunas, 2011). In the service sector, benefiting from supplier and customer collaborations is never automatic, and environmental factors can potentially affect the firm's emphasis on supply chain collaboration to develop superior services (Heirati *et* *al.*, 2016). Without accounting for environmental factors, it is not clear whether supply chain collaboration plays a greater role in generating value to quality performance in dynamic environments, where achieving it may be more beneficial than in more certain environments. Such crucial effects have not been addressed by prior research theoretically or subjected to empirical testing.

This study therefore attempts to address the following two research questions:

RQ1. How do IS capabilities affect supply/customer collaboration, and quality performance in services?

RQ2. How dose environmental dynamism influence the relationship of supply/customer collaboration and quality performance of service firms?

Our study makes the following contributions. First, this study validates RBV with a process level investigation on the impact of IS and contributes to RBV by purifying the conditions under which IT capabilities-enabled underlying mechanism facilitates quality performance. Additionally, it provides empirical evidence to suggest that supply chain collaboration is a source of a competitive advantage (Barney, 2012) for service firms leading to improved operational performance. Second, we respond to calls from SCM 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 (Ostrom *et al.*, 2015; Yu *et al.*, 2021). Third, we contribute to a scarce but increasing body of research on supply chain collaboration and supply chain integration in service contexts, responding to the recent calls for service integration management (Breidbach *et al.*, 2015; Boon-itt *et al.*, 2017; Wang *et al.*, 2018; Liu *et al.*, 2019). Finally, we explore the relationship between supply chain collaboration and quality performance in service contexts; and how this relationship is influenced by firm's business environment. The rest of the study is organized as follows. First, we review the literature on RBV and DCV and our major constructs, and develop our hypotheses. Second, we explain the research methodology and perform the statistical analyses. Third, we draw conclusions and compare our findings with those of previous studies. Fourth, we discuss the theoretical and practical implications of our conclusions, identify the study's limitations and indicate directions for future research.

2. Literature review

2.1 Resource-based view and dynamic capabilities view

The resource-based view of the firm (RBV) considers firms as bundles of resources, which are heterogeneously distributed across those firms, and which cause differences to persist over time (Wernerfelt, 1984). The RBV offers a convincing framework through which to analyze the strategic value of IT resources. It sets out a cogent link between firm-specific resources and sustained competitive advantages, providing a useful approach to measure the impact of IS resources on firm performance (Wade and Hulland, 2004). Additionally, it promotes cross-functional research since the theory develops a basis to facilitate comparisons between IT resources, and between IT and non-IT resources (Liang *et al.*, 2010).

Building on RBV, the dynamic capabilities view (DCV) takes consideration of the sophisticated issues surrounding the utilization of firm capabilities to achieve sustainable competitive advantage in dynamic business environments (Teece *et al.*, 1997; Eisenhardt and Martin, 2000). The DCV framework analyses sources and methods of firms' reconfiguration of internal and external competences responding to rapidly changing environments (Teece, 2007). It provides guidance to identify how IT capabilities might perform under varying environmental conditions (Tallon, 2008).

2.2 Dimensions of IS capabilities

This study adopts RBV to explain a firm's superior performance using IS resources classified as *outside-in*, *inside-out,* and *spanning* (Wade and Hulland, 2004). As this is a general typology, it needs to be situated within appropriate research contexts and with variables tailored to the specificity of the IS domain. Further, the types of IS capabilities also need to take consideration from the perspective of the business and the firm's choices about how and where IS resources were to be deployed (Stoel and Muhanna, 2009). This study focuses on a taxonomy that captures the manner in which IS resource endowments are deployed in support of supply chain processes and is therefore helpful for understanding IS capabilities in the context of SCM. IS capabilities in this study refer to firm-specific IT assets and abilities that influence how post-implementation IT applications and IT-related resources are used in the supply chain environment, namely, *(a)* IT for supply chain activities (ITSCA), referring to a firm's use of IT for processing transactions, coordinating activities, and facilitating collaboration with suppliers and customers through information sharing. The use of ITSCA represents *outside-in* IS capabilities that facilitate a firm's efforts to manage the linkages with its suppliers and customers; (b) flexible IT infrastructure (ITINF), referring to a firm's ability to deploy a shareable platform that supports a foundation for data management, a communications network, and an application portfolio. ITINF represents *inside-out* IS capabilities for a firm and these capabilities influence the strategic use of IT; and *(c)* operations manager's IT knowledge (OMITK), reflecting the overlapping know-how between IT and line managers. OMITK is defined from the perspective of the line manager and refers to the knowledge that the operations manager possesses about how IT can be effectively used to achieve the supply chain processes and operational activities, representing *spanning* IS capabilities for a firm.

2.3 Supply chain collaboration in services

As markets become more competitive and customers more demanding, service firms need to look outside their organizational boundaries for opportunities to collaborate to ensure that their service offerings are efficient and responsive to the increasing complexity of customer needs (Heirati *et al.*, 2016). As service suppliers usually contribute directly to service delivery and customer contact, a failure in the supply side may simultaneously leads to a failure in performance (Baltacioglu et al., 2007). Collaboration with suppliers about services, products, processes, and capabilities makes it easier for firms to produce and deliver services required by customers (Ju et al., 2021). Moreover, collaboration with customers in services involves the combination of customer resources with the focal firm resources, in order to transform customer resources (Moeller, 2008). Integrating of customer resources require processes and forms of collaboration (Kleinaltenkamp *et al.*, 2012). Information sharing is often central to the integration processes (Maglio and Spohrer, 2008), and the role of IT in enabling such processes is a key issue within service systems research (Breidbach *et al.*, 2013).

2.4 Quality performance

Because the nature of the service sector is such that its products are mostly intangible, the notion of quality is different from that in manufacturing (Krishnan *et al.*, 1999). Our quality performance construct incorporates the multiple dimensions related to both internal and external quality. The following section discusses the hypotheses underlying the research model (Figure 1).

Figure 1 here.

3. Research hypotheses

3.1 Relationships between IS capabilities and supply chain collaboration

A firm's use of ITSCA promotes its collaboration with suppliers and customers by digitally enabling the process of acquiring and assimilating customer requirements information and related knowledge of service needs (Ashrafi *et al.*, 2019). ITSCA supports a firm's ability to communicate with, and transfer data to and from, its suppliers (Bakos and Katsamakas, 2008). For example, Internet-based technologies have significantly improved collaboration and integration among supply chain partners, permitting more efficient demand forecasting and order scheduling (Peng *et al.*, 2016). Moreover, ITSCA enables the firm to electronically communicate with customers, and to manage relationships with them (Lusch and Nambisan, 2015). For example, web-enabled customer interaction technologies provide the firm with an integrated set of functionalities at the customer interface to gather and store customer information and knowledge (Mithas *et al.*, 2005). Further, a good understanding of customer needs is required for the effective management of demand and capacity (Boon-itt *et al.*, 2017). Service capacity systems enable service providers to manage customer's needs and deliver service plan to meet customer's requirements efficiently (Wulf *et al.*, 2017). A firm's capability to implement and use ITSCA enables real-time information sharing to collaborate the allocation of resources across the supply chain. ITSCA facilitates to establish links between different resources owned by different supply chain parties, transferring them into bundles of co-existing resources and improving a firm's ability to collaborate with suppliers and customers (Huo *et al.*, 2015).Therefore, we propose the following hypotheses:

H1a. The use of ITSCA has a positive impact on supplier collaboration.

H1b. The use of ITSCA has a positive impact on customer collaboration.

ITINF provides an integrated platform that enforces standardization of data and processes, making it possible to achieve timely and accurate information gathering and sharing across a firm's supply chain (Lu and Ramamurthy, 2011). Supply chain information and data that are produced in a shareable manner should promote consistency in the various communication channels that exist between the firm and its supply chain parties, since the shared nature of the process ensures the transparent flow of information from one step to another, and reduces confusion arising from information inconsistencies (Antons and Breidbach, 2018). Additionally, ITINF can enhance supply chain data management, enabling the firm to collect and store customer-related information, and supports the shareability and reusability of information that are necessary for collaboration processes (Cho, 2014). ITINF enables a firm to quickly develop, deploy, and support necessary system components for the processes involved in supply chain collaboration, providing a sharable platform for data warehousing, data mining, and reporting (Ravichandran, 2018). Therefore, we propose the following hypotheses:

H2a. ITINF has a positive impact on supplier collaboration.

H2b. ITINF has a positive impact on customer collaboration.

Previous studies have argued about the importance of IT knowledge shared among line managers in determining the value of IT (Tallon, 2008). OMITK influences the level of alignment between the IT and other functional areas of a firm, enabling effective information sharing and relationship building across the firm's internal business functions (Wunderlich *et al.*, 2013). From the perspective of organizational capability, a firm with a high level of internal communication and collaboration is better able to secure a higher level of external collaboration (Zhao et al., 2011). Similarly, Zhang et al. (2018)_ENREF_76 find that information sharing between internal departments is related to external co-operation with partners. The effectiveness between internal business functions facilitates the firm's understanding of its supplier and customers (Boon-itt *et al.*, 2017). Therefore, we propose the following hypotheses:

H3a. OMITK has a positive impact on supplier collaboration.

H3b. OMITK has a positive impact on customer collaboration.

3.2 Relationships between supply chain collaboration and quality performance

The literature suggests that collaboration and managing inter-firm processes positively influences firms' performance (Prajogo *et al.*, 2018; Yu *et al.*, 2021). Collaboration with suppliers facilitates a service firm's ability to respond to demand changes, and can enable greater efficiency in the allocation of resources required in order to improve service performance (Heirati *et al.*, 2016). Because services are hard to evaluate in advance of the purchase, service supply is closely intertwined with the focal firm's service delivery processes (Harvey, 2016). Supply collaboration provides a supplier with a thorough understanding of the firm's business processes, which is needed in order for suppliers to be able to offer the most suitable service assets and staff to meet customer's needs (van der Valk and Rozemeijer, 2009). Moreover, collaboration with customers enables a service firm to respond to customer requirements in a quick, accurate and dependable way, increasing service reliability (Beverungen *et al.*, 2019). Because customer perceptions result from their evaluations of the actual service against their expectations (Devaraj *et al.*, 2002), collaboration processes makes customers develop more appropriate expectations of service. Customer collaboration and interaction can help customers to better understand their own needs, and can simultaneously facilitate the firm’s ability to customize service content and procedures according to individual requirements (Tan et al., 2013). This argument is in line with research that customer collaboration provides a service firm with an economical way to achieve a closer fit between a service's features and customer needs (Sklyar et al., 2019). To this end, we argue that promoting supply chain collaboration enhances the capacity of a service firm to access greater levels of diverse resources and the capabilities to meet the customers' needs and drive a high-quality performance. Therefore, we propose the following hypotheses:

H4a. Supplier collaboration has a positive impact on quality performance.

H4b. Customer collaboration has a positive impact on quality performance.

Service firms need to attempt alignment or collaboration with suppliers having special resources and technological knowledge to implement service strategy (Boon-itt *et al.*, 2017). Supplier collaboration provides a platform for firms to interact with suppliers. In fact, for some firms (such as sourcing and logistics service providers), supplier management is their core process as their aim is to source goods and services from suppliers (Baltacioglu *et al.*, 2007). At the operational level, supplier collaboration is a key process that facilitates the planning and cooperation of purchases, buffer stock, capacity and the resource and order management process (Akkermans and Voss, 2013). By developing a high level of strategic collaboration with suppliers, service firms are able to identify and eliminate non-value-added activities and subsequently strengthen delivery reliability capabilities (Rosenzweig *et al.*, 2011). Because of knowledge sharing and complementary resource endowments are originated from the collaboration, a supplier can help improve the firm’s service capability (Wang *et al.*, 2018). Therefore, strategic collaboration synchronizes core competencies and capabilities of suppliers to jointly achieve improved service capabilities (Liu *et al.*, 2015). Since service demand is heterogeneous and services are produced and consumed simultaneously (Lusch *et al.*, 2007), service firms need to efficiently manage resources and service capacity to meet customer demands (Aitken *et al.*, 2016). A service firm's ability to identify and manage tangible resources (such as facilities, labor and inventory) and intangible resources (such as skills, experience and knowledge) leads to improved interaction with customers (Moeller, 2008). The intensity and richness of the interaction enables the deep understanding between a service firm and its customers so as to improve collaboration between them(Antons and Breidbach, 2018). Therefore, we propose the following hypothesis:

H4c. Supplier collaboration is positively related to customer collaboration.

3.3 The moderating effects of environmental dynamism

Environmental dynamism refers to the 'amount and unpredictability of change in customer tastes, production or service technologies, and the modes of competition in the firm's principal industries' (Miller and Friesen, 1983: 233). With increasing competition and advances in technology, firms are facing environments that are extremely dynamic (Van Vaerenbergh *et al.*, 2014). From the DCV perspective, firms with the capabilities that can extend, modify, change, and create business capabilities in response to environmental dynamism plays a fundamental role in changing operational routines and in ensuring that the firm can change its overall operations and have new sets of decision options (Keiningham *et al.*, 2014). The fit between the firm's supply chain collaboration capability and the competitive environment demands will positively affect the firm's competitive position (Flynn *et al.*, 2017). Supply chain collaboration capability that senses the market changes and respond to shifts will be more valuable for firms to improve their quality performance in a dynamic environment. Drawing upon the DCV perspective, it can be argued that supply chain collaboration appears to have a stronger positive impact on quality performance when firm's environmental changes are greater. For service firms, demand uncertainty hinders the precise assessment of customer preferences (Harvey, 2016). When demand uncertainty is high, firms monitor markets to reduce prediction errors and modify supply chain activities to rapidly meet market demand to ensure customer satisfaction and service quality (Fehrer *et al.*, 2018). Supply chain collaboration allows accurate identification of customer needs, saves time capturing the knowledge held by customers, and avoids mistakes in designing the service in which help to offer services that effectively address customer problems (Hoyer *et al.*, 2010). Therefore, service firms will further prompt supply chain collaboration to reinforce quality performance in a highly dynamic environment. Therefore, we propose the following hypotheses:

H5a. The greater the degree of environmental dynamism, the stronger the positive impact of supplier collaboration on quality performance.

H5b. The greater the degree of environmental dynamism, the stronger the positive impact of customer collaboration on quality performance.

4. Research methodology

4.1 Survey development

The purpose of this study is to understand the relationships of IS capabilities, supply chain collaboration, quality performance. A web-based survey was developed in several stages. Initially, the survey questions were developed involving IS capabilities, supply chain collaboration, quality performance, and business environment based on an extensive review of the literature. Next, a pre-test was conducted with MBA class at a leading UK Business School to collect feedback and suggestions for improvement and clarity from the MBA executives. Finally, as a result of the pre-test, a number of changes to the instrument were made to refine the questionnaire.

4.2 Sample and data collection

The data were collected via a web survey sent to 1,158 service firms in the UK, sampled from the Dun and Bradstreet (D&B) database. Respondents were asked to report on their firm's IS capabilities, supply chain collaboration, quality performance, and business environment. To ensure that the respondent had the expertise to accurately respond to the questions, the survey was sent to senior managers with titles such as 'Vice President,' 'Manager,' 'Director' or 'Head', and with the functional area of 'Operations'. Sample analysis showed 98% of the total respondents identified themselves as Operations Managers, Operations Directors, Head of Operations, or Operations Executives, thus indicating that the respondents were knowledgeable upper-management professionals in the operations function of their organizations. Further sample characteristics are provided in Table I.

The survey was then administered following the procedures consistent with the web survey implementation of Dillman *et al.* (2014): (a) Personalization: all operations contacts were personally contacted, by including titles, names, specific positions, and firm names. In order to increase personalization, the emails were sent to their individual business email account. (b) Initial email invitation included the uniform resource locator of the web questionnaire and instructions on how to access it, along with a description of the research and the importance of response, was emailed to each manager. The detailed and specific instruction about how to access and complete the survey was included to facilitate the efforts of those respondents who may have been unfamiliar with the web survey. All emails were sent from the official university email account of the author, in order to increase credibility. (c) Multiple contacts: sending multiple contacts to potential respondents of a web survey is the most effective way to improve response rates. Since it is relatively inexpensive to send additional contacts via email, a researcher can often leave the final decision on the number of follow-ups to send until well into the fielding process. In this study, a four follow-up contact strategy was used following the advice provided by Wygant et al. (2005). After two weeks of the initial invitation, three reminder emails were sent to the respondents.

A total of 1,158 questionnaires were originally sent to the respondents. After removing 18 surveys returned due to company policies not to respond, a total of valid 156 responses were received (13.68% response rate). Tan and Wisner (2003) noted the increasing level of survey fatigue among practitioners may lead to low response rates in the fields of OM. The response rate for this study is comparable to or better than other survey-based studies in OM, e.g., 6.3% in Li *et al.* (2005), 13.5% in Huo *et al.* (2014), and is consistent with response rates of UK-based studies in OM, e.g., 10.3% in Carey *et al.* (2011). To ensure a representative sample, the authors tested for non-response bias, and gathered objective data.

Table I here.

4.3 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. Background variables (firm age and annual sales) were used to test late-response bias (Green, 1991), no statistically significant differences were found between early and late respondents.

4.4 Common method bias

Since data were collected from a single person at a single point in time, strong efforts have been made to design and test the questionnaire thoroughly to minimize the possibility of common method bias. Both procedural remedies and *ex post* empirical testing were engaged. Firstly, Harman (1976)'s single-factor test was applied. All measuring items were analyzed together, and no single factor accounted for the majority of the variance (greater than 50%). In addition, the un-rotated factor analysis demonstrated four factors with eigenvalues higher than 1, consistent with the findings of exploratory factor analysis. The result of exploratory factor analysis (EFA)_ENREF_93 shows that five distinct factors with eigenvalues greater than 1 explain 86.721% of the total variance. However, the first factor in the EFA accounts for only 38.993%, which is not the majority of the total variance. Moreover, using AMOS 21, we apply confirmatory factor analysis (CFA)_ENREF_66 to conduct Harman's single factor test again. The model fit indices of the single factor model (CMIN/DF=12.531 p<.001, NNFI=0.395, CFI=0.476, and RMSEA=0.273) are much worse than the suggested values (O'Leary-Kelly and Vokurka, 1998). Despite the fact that this study was based on a single source of informants, the results of the single-factor test indicated that common method bias was not considered an issue for this data set. Furthermore, we created a model that includes a method factor to test the common method variances following Podsakoff et al. (2003) and Liang et al. (2007). In the model, all the items load on their original construct and the unmeasured method factor, respectively. Every indicator is converted to a single-indicator construct, which makes the method factor and all the original constructs second-order constructs. The comparison of loading on original constructs and method factor reveals the variance from common method. The average square of original factor loading is 0.86, while the average square of method factor loading is 0.002, and all the method factor loadings are not significant. This suggests that common method bias is not a serious concern in our study.

4.5 Measures

The survey scales were either established or developed from the relevant literature. Specifically, ITSCA is represented in the survey by measuring the extent of implementation of 18 different types of process-level IT applications used in the service industry (Tsikriktsis *et al.*, 2004; Ray *et al.*, 2005; Rai *et al.*, 2006; Sengupta *et al.*, 2006; Thun, 2010). Consistent with prior IS and OM research (e.g., Banker *et al.*, 2006; Heim and Peng, 2010; Kulp *et al.*, 2004; Saldanha *et al.*, 2013), the extent of implementation (adoption) of each type of IT application is measured on a 2-point scale indicating whether or not it is currently used based on the data provided by operations managers. For each firm, therefore, the values of IT applications (sum of the number of applications) represent the extent of implementation (Hitt *et al.*, 2002). Constructs and supporting literature have detailed in Appendix (Table A3).

It has been widely noted that larger firms may have more resources and may be in a better position to enjoy performance gains due to their ability to garner economies of scale (e.g., Hitt *et al.*, 2002; Rai *et al.*, 2006; Chen *et al.*, 2009). To account for such relationships, firm size was controlled for by including the number of employees. Further, since the salient features of industries can shape how IS are used within focal firm business processes to achieve performance impacts (Melville *et al.*, 2004), industry type was also controlled.

4.6 Reliability and validity analysis

CFA was used to check convergent validity, following the two-step procedure suggested by Anderson and Gerbing (1988). CFA was conducted by corelating the constructs (ITINF, OMITK, supplier collaboration, customer collaboration, and quality performance). The measurement model shows a good model fit: comparative fit index (CFI) = 0.988, X^2/df is<5 (1.309), root mean square error of approximation (RMSEA) is<0.08 (0.045). The non-normed fit index (NNFI) of 0.984, the incremental fit index (IFI) of 0.988 and goodness-fit-index (GFI) of 0.917 further confirm that the measurement model is acceptable. Moreover, as shown in Table II, the standardized coefficients, which range from 0.778 to 0.981, and the significant t-value ($p < 0.001$) exceed the required cut-off values of 0.5 and 2 respectively (O'Leary-Kelly and Vokurka, 1998). The average variance extracted (AVE) values range from 0.760 to 0.841 higher than the suggested value (0.50) in the literature (Chin, 1998). The composite reliability and Cronbach's alpha values are all above 0.863. Therefore, we can claim that the reliability of each construct is acceptable.

Table II here.

Discriminant validity was tested by the AVE comparison method (Fornell and Larcker, 1981). If the square root values of AVE for both the constructs that make up the pair are higher than the intercorrelation between any two constructs in the model, then the latent construct explains its assigned item that it shares with other constructs. Table III shows that the square roots of AVE (bold numbers in diagonal) are greater than the correlations among the constructs (off-diagonal values). The result provides evidence of good discriminant validity.

Table III here

5. Data analysis and results

In this section, we use the structural equations modelling (SEM) method to test the baseline model (H1ab, H2ab, H3ab and H4abc), and adopt the hierarchical regression method to obtain the moderation results (H5ab).

5.1 Structural model

Figure 2 here.

Figure 2 shows the overall results for the structural model (numbers show above the arrow represent the standardized regression weight). There is a good model fit, with acceptable values - X^2/df = 1.427; CFI = 0.981; RMSEA = 0.053; GFI = 0.984; IFI = 0.983; NNFI = 0.924. The path coefficients indicate that ITSCA has a significant effect on supplier/customer collaboration (H1a and H1b are supported). ITINF has a significant effect on supplier collaboration and a marginal effect on customer collaboration (H2a and H2b are supported). OMITK has a significant effect on supplier/customer collaboration (H3a and H3b are supported). Moreover, the results show that both supplier collaboration and customer collaboration have significant effects on quality performance (H4a and H4b are supported). The results further show that supplier collaboration has a significant effect on customer collaboration (H4c is supported).

5.2 Moderation analysis

To test the moderating effect of environmental dynamism, we used the hierarchical linear regression method. The multiple methods (SEM and regression analysis) have been used in previous survey-based studies (e.g., Li et al., 2018; Tse et al., 2019; Yu et al., 2020). The impact of the moderator variable was assessed using a four-stage regression: 1) control variables (industries and firm size); 2) main effect variables (supplier collaboration and customer collaboration); 3) moderator (environmental dynamism); and 4) the interaction effect. The results are shown in Table IV. Each construct is mean-centered to avoid the issue of multicollinearity.

Table IV here.

The results show that the moderating effect of environmental dynamism on the relationship between supplier collaboration and quality performance is not significant (H5a is not supported). However, the change of R^2 is significant (ΔR^2=0.024, p=0.034) when environmental dynamism interacts with customer collaboration. This suggests that environmental dynamism will strengthen the effect of customer collaboration on quality performance (β=0.309, p=0.001). H5b is supported. Moderating effect of environmental dynamism on the relationship of customer collaboration and quality performance showed in Figure 3.

Figure 3 here.

6. Discussion

This study aims to empirically investigate the relationship between IS capabilities, supply chain collaboration and quality performance in services. A research model was developed and tested using survey data from UK service firms. The results provide a number of important findings that have both theoretical and managerial implications.

6.1 Theoretical implications

First, our results indicate that IS capabilities have positive effects on supply chain collaboration. This finding further supports the process-based investigation of RBV and the argument that the effect of IS capabilities on firms' performance is felt through their influence in the area of enabling organizational processes (e.g., Wade and Hulland, 2004; Mithas *et al.*, 2011; Aydiner *et al.*, 2019; Sundram *et al.*, 2018). Although previous studies have demonstrated the importance of IT/IS in SCM (e.g., Yu, 2015; Asamoah *et al.*, 2021), to date there have been limited empirical studies assessing how IS capabilities influence supplier and customer collaboration in services. Our finding shows the values of IS capabilities in a service supply chain context. In today's highly competitive and uncertain environment, service firms are making greater investments in IT (Mariani and Borghi, 2019) and competing on SCM processes (Boon-itt *et al.*, 2017). Therefore, this study reinforces the importance of IS capabilities in enhancing information sharing and building strategic collaboration with suppliers and customers in service supply chains. Drawing on the RBV, IT scholars argue that firm performance differentials depend on differences in IT capabilities rather than IT investments (Yu *et al.*, 2017). This is an important point for service firms when they consider investing in IT for SCM.

Second, as an important source of sustained competitive advantages, supply chain collaboration can enhance quality performance in services. Although such relationships have attracted considerable attention in the traditional manufacturing setting (Huo *et al.*, 2015; Prajogo *et al.*, 2018), empirical studies in service contexts remain limited. Our finding provides empirical support to the notion that supplier collaboration and customer collaboration in service contexts also lead to performance improvements

(Boon-itt *et al.*, 2017; Ju *et al.*, 2021). This study takes a step toward answering a call in the literature for recognizing how the conceptual meaning and magnitude of supply chain collaboration and integration in manufacturing supply chains can be applied to services. The results show that similarities can be established in the conceptualization of supply chain collaboration. This means that service supply chains have a common understanding towards the measures or components that constitute supply chain collaboration. The results show that similarities can be established for the effect of supply chain collaboration on quality performance, which reinforces the importance of supplier collaboration and customer collaboration, as key capabilities that have access to valuable resources from suppliers and customers, could be a source of competitive advantages (Asamoah *et al.*, 2021). Moreover, supplier collaboration has a positive effect on customer collaboration. This finding adds to the scant literature on the nature of relationship between supplier management and customer management (He *et al.*, 2014). Previous research has posited that supplier-side digitization serves as a prerequisite for on customer-side digitization. Without increasing supplier-side digitization, a firm may over-promise customers and fail to deliver (Barua *et al.*, 2004). Our results about the direct relationship between supplier collaboration and customer collaboration can support and extend the evolutionary argument of supply chain integration (Poirier and Quinn, 2003; Stevens and Johnson, 2016). Specifically, our empirical evidence shows that at the stage of external collaboration, the first step may be supplier collaboration, and then is customer collaboration because of the positive effect of supplier collaboration on customer collaboration.

Third, our results reveal that environmental dynamism enhances the impact of customer collaboration on quality performance in services. Our findings comprehensive studies on environmental dynamism, and support the influence of environmental dynamism also works its way down to the process level. This result adds to the mixed empirical findings in the literature on the moderating effect of environmental dynamism on the relationship between customer collaboration and operational performance. Inconsistent with the findings of Wong *et al.* (2011) that environmental dynamism will not strengthen the associations between customer integration and production cost and product quality. This study finds that environmental dynamism significantly moderates the effect of customer collaboration on quality performance in services. This finding is consistent with the fundamental principles of the DCV (Eisenhardt and Martin, 2000), which posits that customer collaboration can further service as a dynamic capability allow service firms to improve quality performance in highly dynamic markets. This result is consistent with previous service research on the role of customer collaboration as a dynamic and influential resource in service value creating (Akaka and Vargo, 2014), and further supports the SCM literature that collaboration with customers can provide better visibility to market changes and facilitate gaining knowledge that can be used for competitive advantage (Yu *et al.*, 2020). Surprisingly, we find no moderating effect of environmental dynamism on the relationship between supplier collaboration and quality performance. The insignificant moderating effect of environmental dynamism highlights the fundamental role of supplier collaboration in quality performance in services. Despite different degree of environmental dynamism, supplier collaboration essentially impacts on quality performance of service firms.

6.2 Managerial Implications

First, supplier collaboration and customer collaboration are not synonymous with IT capability. Rather, IT capability is a separate construct that promotes supplier collaboration and customer collaboration. This is noted as occasionally firms presume that having IT in place automatically assumes external collaboration exists (Sanders, 2007). External collaboration is a result of human interactions which can be supported, but not replaced by IT (Li *et al.*, 2009). This is an important point for managers when they consider leveraging various types of IS capabilities. Based upon the findings of this study, efforts of IS capabilities that particularly promote external collaboration should be given greater consideration.

Second, our study empirically indicates that the lessons learned about the role of supply chain collaboration in SCM research can be applied to the service sector. Therefore, the findings will help managers in service firms to recognize the operational impact of building the level of collaboration with their suppliers and customers. Both supplier collaboration and customer collaboration are valuable assets for a service company to improve quality performance. Managers are suggested to emphasize the positive role of supplier collaboration in quality improvement, besides customer collaboration.

Third, customer collaboration further helps service firms achieve improved quality performance by optimizing environmental dynamism. The effect of customer collaboration is even more significant when firms' environments becoming more dynamic. Service firms can expect environments to become more unpredictable and dynamic due to increasing consumer awareness, rapid innovation of new operations processes, and rapid changes in technology (Ostrom *et al.*, 2021). The dynamic and competitive environments require service providers to invest more in improving their dynamic capabilities such as customer collaboration, which in turn leads to improved quality. As a critical dynamic capability, customer collaboration plays the important role in helping service providers survive in an increasingly dynamic and competitive marketplace in a post-COVID-19 world.

7. Conclusions

With the growing importance of IT, supply chain collaboration, and firm performance, it is essential to improve our understanding of these constructs and their interrelationships. This study contributes to the literature by proposing and empirically testing an IS capabilities – supply chain collaboration – quality performance model from a combined perspective of RBV and DCV. Specifically, the study contributes to the IS and SCM literature by examining the individual role of IS capabilities to both suppliers and customers in improving supply chain collaboration with suppliers and customers. It contributes to the SCM literature by investigating the joint effects of supplier collaboration and customers collaboration on quality performance in services. Our results, based on analysis of 156 UK service firms, provide evidence that in service contexts IS capabilities lead to supplier collaboration and customer collaboration, which in turn contribute to improved quality performance. Moreover, customer collaboration is even more significant for operations working in highly dynamic environments. The findings also provide some guidelines for managers to direct their managerial actions to IS capabilities and supply chain collaboration.

Although this study makes significant contributions to the literature and practices, it has some limitations and opportunities that can be addressed in future research. First, the method of data collection in this study was a survey, which is consistent with a number of survey studies of supply chain collaboration (Li *et al.*, 2019). However, a cross-sectional survey by its nature, limits the depth of understanding of the value of IS capabilities, since the three dimensions of IS capabilities are complex and develop over time. Second, cause-effect relations cannot be inferred due to the static nature of the survey. Future longitudinal studies would supply valuable information regarding the evolution of IS capabilities, supply chain collaboration, and their interactions to determine how they improve firm performance over time. Third, we used limited items to measure supply chain collaboration; future research could include more items, which would provide greater insight into these aspects and the relationships among them. Finally, the scope of the survey was limited to UK service firms, future research could account for country- or culture-specific differences in service characteristics.

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Figure 1. Research model

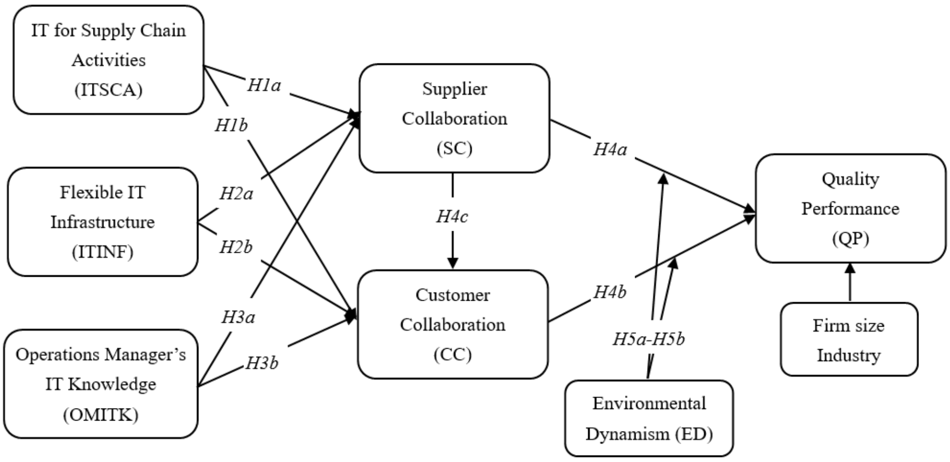
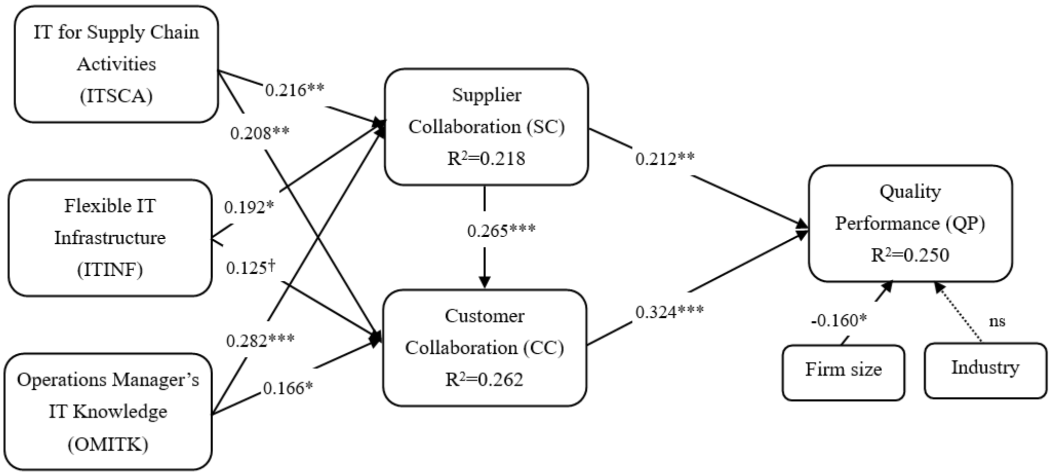


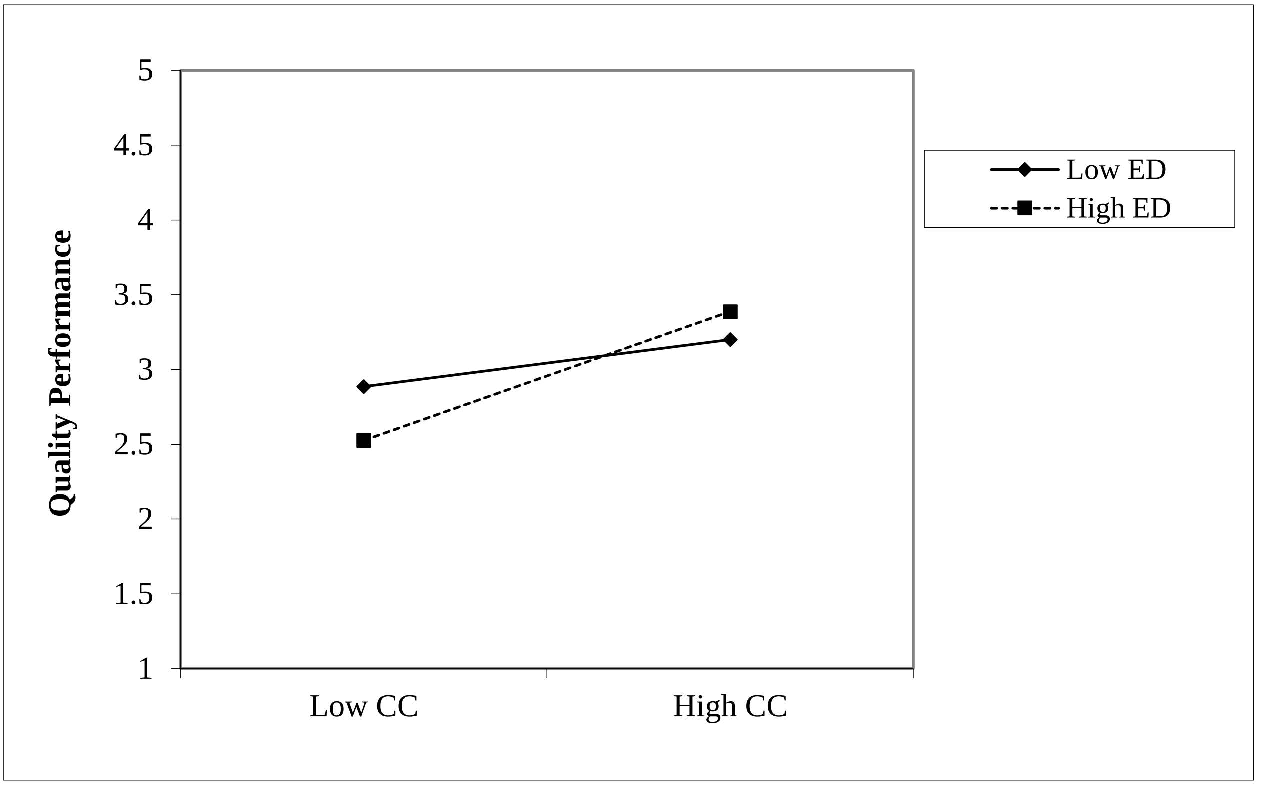
Figure 2. Results of structural model



†p < 0.1; *p< 0.05; ** p< 0.01; *** p< 0.001

NS–not significant, the dotted lines represent insignificant paths

Figure 3. Moderating effect of ED on relationship between Customer Collaboration and Quality performance



Tables

Table I. Sample characteristics

	Frequency	%
Industry		
1 Education	7	4.5
2 Hotels and restaurants	11	7.1
3 Banks, insurance companies, and other financial institutions	12	7.7
4 Wholesale and retail trade	35	22.4
5 Business activities including real estate and renting	40	25.6
6 Transport, storage and communications	23	14.7
7 Health and social work	14	9.0
8 Other services	14	9.0
Total	*156*	*100.0*
Firm Size		
Less than 100	15	9.6
100 – 199	39	25.0
200 – 499	45	28.8
500 – 999	32	20.5
1000 or more	25	16.0
Total	*156*	*100.0*
Titles		
Operations Manager	38	24.4
Operations Director	68	43.6
Head of Operations	21	13.5
Executive/VP - Operations	26	16.7
Other	3	1.9
Total	*156*	*100.0*

Table II. Construct loading and reliability index

Construct	Indicator	Item loadings [a]	T-value*	Cronbach's alpha	Composite reliability	AVE
ITINF	ITINF1[b]	0.862	-	0.863	0.863	0.760
	ITINF2	0.881	6.397			
OMITK	OMITK1[b]	0.886	-	0.928	0.932	0.820
	OMITK2	0.981	19.119			
	OMITK3	0.845	14.878			
SC	SC1[b]	0.855	-	0.888	0.890	0.731
	SC2	0.778	11.471			
	SC3	0.926	13.887			
CC	CC1[b]	0.917	-	0.940	0.940	0.840
	CC2	0.916	18.599			
	CC3	0.918	18.700			
QP	QP1[b]	0.885	-	0.962	0.955	0.836
	QP2	0.893	19.934			
	QP3	0.954	19.670			
	QP4	0.953	19.591			
	QP5	0.884	16.319			

[a] Item loading is also known as the standardised regression weight.
[b] Fixed parameters
*All item loading significant at 0.01 level.

Table III. Discriminant validity – AVE comparison

	ITINF	OMITK	SC	CC	QP
ITINF	***0.872***				
OMITK	0.321	***0.906***			
SC	0.336	0.38	***0.856***		
CC	0.294	0.348	0.458	***0.917***	
QP	0.221	0.252	0.316	0.433	***0.914***

Note: The diagonal elements are the square root of AVE.

Table IV. Results of moderating effect test

	Quality Performance			
	Step 1	**Step 2**	**Step 3**	**Step 4**
	β	β	β	β
Control variables				
Firm Size	-0.074	-0.112	-0.109	-0.107
Industry	-0.107	-0.085	-0.103	-0.087
Main effect				
Supplier collaboration (SC)		0.233**	0.248**	0.272**
Customer collaboration (CC)		0.354***	0.453***	0.445***
Moderator				
Environmental dynamism (ED)			-0.132	-0.057
Moderating effect				
SC × ED				-0.044
CC × ED				0.309**
$\triangle R^2$	0.020	0.247	0.006	0.075
Overall R^2	0.020	0.267	0.272	0.347
F	1.531	13.717***	11.226***	11.234***
F Change	1.531	25.414***	1.194	8.462***
Max VIF				3.148

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