Asia Pacific Journal of Marketing and Logistics

Article information:

For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

*Related content and download information correct at time of download.

Flexibility, collaboration and relationship quality in the logistics service industry: An empirical study

Abstract

Purpose – This paper aims to examine the relationship between competitive capabilities, including flexibility and collaboration between logistics service providers (LSPs) and their customers, and relationship quality, as measured by trust, dependence and commitment.

Design/methodology/approach – A total of 309 logistics managers were invited to participate in this study and structural equation modeling was performed to analyze the measurement and structural models.

Findings – The results show that both flexibility and collaboration positively influence trust and dependence. Moreover, dependence does not appear to influence commitment. Finally, we hypothesize and find that trust plays an important role in the research model and positively increase commitment.

Research limitations/implications – The main limitation of this study is that this study used a cross-sectional survey approach to collect data on all research variables. Compared with longitudinal data, cross-sectional data might not be able to demonstrate completely the temporal sequence of the antecedents and consequences, which might result in spurious cause–effect inferences.

Practical implications – Our findings offer several important implications for LSPs. First, our findings imply that LSPs need to make their customers want to share useful information related to operations and logistics. Second, flexibility plays an important role in forming customers' trust in logistics service industry.

Originality/value – Little research has done on combining a resource-based view and relationship marketing together in logistics service context. Therefore, this study advances the resource-based view and relationship marketing and adds value to the literature by demonstrating the applicability of the observed relationships among LSPs.

Keywords: Flexibility, Collaboration, Logistics Service Provider, Relationship Quality

1. Introduction

Owing to the proliferation of the lean philosophy in industries and the emergence of many professional logistics service providers (LSPs), the outsourcing of logistics operations in recent years has grown rapidly in the business environment, making the logistics service industry increasingly competitive (Wallenburg, 2009; Yu, et al., 2017). To differentiate themselves and survive among competition, LSPs need to implement effective competitive strategies to outperform their competitors (i.e., competitive capabilities) and obtain sustainable competitive advantages (Davis, et al., 2008; Huemer, 2012).

The resource-based view (RBV) is one of the dominant approaches to the analysis of sustained competitive advantage (Lin and Wu, 2014; Wang and Sengupta, 2016). According to the RBV, valuable, inimitable, nontransferable and nonsubstitutable (or unique) resources owned by a firm determine competitive advantages (Lin and Wu, 2014). In the context of logistics service industry, both flexibility and collaboration facilitated by communication between LSPs and their customers have been identified as important competitive capabilities that form a firm's core capabilities in gaining competitive advantages (Hartmann and De Grahl, 2011; Liao, et al., 2010; Yu, et al., 2017). Specifically, flexibility is critical, because with unanticipated adjustments and/or quick requests from customers, LSPs require

flexibility to deal with a variety of changes in fast-paced markets. Such a high level of

flexibility creates value for LSPs' customers and makes LSPs different from the

competition (Hartmann and De Grahl, 2011; Olavarrieta and Ellinger, 1997; Wong

and Karia, 2010; Yu, et al., 2017). Additionally, collaboration between LSPs and their

customers is essential, because effective collaboration generates useful information

between the two, helping LSPs better understand their customers and resulting in

customers more willing to work together (Qu and Yang, 2015). Indeed, when

collaboration becomes more frequent, a shared goal (e.g., maximizing profit) between

LSPs and their customers is more likely to be built. Such a tight relationship decreases

threats from competition and thereby grants competitive advantages (Hartmann and

De Grahl, 2011; Qu and Yang, 2015; Wong and Karia, 2010).

The competitive capabilities formed by both a high level of flexibility and

effective collaboration between LSPs and their customers may foster a better

relationship with customers (Liao, et al., 2010; O'Cass, et al., 2015; Qu and Yang,

2015; Yu, et al., 2017). This relationship quality improvement can be described by

relationship marketing (RM), which is defined as all marketing activities directed

toward proactively creating, developing, and maintaining committed, interactive, and

profitable exchanges with valuable customers or partners over time (Harker, 1999;

Morgan and Hunt, 1994). The major concept in RM theory is that firms make

relational investments (e.g., flexibility and collaboration) in relationships with valuable customers to promote the level of customer dependence, trust, and commitment (i.e., relationship quality), which in turn consolidates long-term relationships with customers (Bandara, et al., 2017; Morgan and Hunt, 1994; Nelson Oly Ndubisi, et al., 2014; O'Cass, et al., 2015; Sirdeshmukh, et al., 2002).

However, little research has done on combining a resource-based view and relationship marketing together in logistics service context. Therefore, the main contribution of this study is to advance the resource-based view and relationship marketing and to add value to the literature by demonstrating the applicability of the observed relationships among LSPs. Specifically, drawing on RBV and RM, this study views the levels of flexibility and collaboration of LSPs as being a result of competitive capabilities. These competitive capabilities enable LSPs to respond more quickly to changing needs or special requests from customers and to collaborate with customers effectively and efficiently to solve emergent problems, which in turn enhance levels of relationship quality measured by dependence, trust, and commitment of customers.

For the purposes of this study, we concentrate on building an integrated model based on the view of RBV and RM theories to explain the influences of flexibility and collaboration on relationship quality. Specifically, on the basis of RBV, we have

identified flexibility and collaboration facilitated by communication as factors in gaining competitive capabilities for LSPs. These factors, from the RM perspective, are viewed as relational investments (i.e., antecedents) that form trust and dependence with LSPs, resulting in creating higher customer commitment. We develop hypotheses, build the proposed model by combining RBV and RM, and finally test the effects of flexibility and collaboration on relationship quality. For the scope of this study, this study focuses on the context of Taiwan for three reasons. Frist, although there is a proliferation of studies on RBV and RM in the last few years, this research type has been limited in a developing country such as Taiwan. Second, the studies on RBV and RM have not yet reached an in-depth analysis in Taiwan. Finally, the objective of this study is to build an integrated model based on the view of RBV and RM theories rather than to make a comparison across different countries. Therefore, this study focuses on the context of Taiwan to understand how LSPs leverage their resources to maintain the good relationship with their customers.

The rest of this paper is organized as follows. Section 2 gives a concise and relevant literature review about concepts of research variables and explains the development of hypothesized relationships among variables in our research model. Section 3 delineates the research methodology that includes measurement of research variables, design of the questionnaire and sampling plan. Section 4 shows the tests of

research hypotheses. Section 5 concludes the research findings and identifies future research directions.

2. Literature review and hypothesis development

2.1 The resource-based view

Initiated by Wernerfelt 1984 and Barney 1986, RBV has become an important approach to the analysis of sustained competitive advantages (Barney, 1986; Wernerfelt, 1984). It suggests that the critical resources and capabilities that the firm owns determine competitive advantages (Barney, 1986; Wernerfelt, 1984). These critical resources and capabilities must be valuable, scarce, nonsubstitutable, and difficult and costly to imitate (Barney, 1986; Wernerfelt, 1984). Several resources, including tangible components (e.g., all assets and property) and intangible components (e.g., capabilities, organizational processes, information, knowledge), have been found to gain competitive advantages (Barney, 1986; Wang and Sengupta, 2016; Wernerfelt, 1984). Importantly, these resources must be heterogeneous in nature, not perfectly mobile, and have superior productivity (Barney, 1986; Wernerfelt, 1984). As a result, these resources create competitive capabilities that can be regarded as abilities to use critical resources to generate sustainable competitive advantages.

2.2. Flexibility, collaboration and communication between logistic service

providers and their customers

In the context of logistics services, both flexibility and collaboration facilitated by communication between LSPs and their customers are critical because, from the RBV perspective, they can be regarded as a core and competitive capability of LSPs to generate competitive advantage (Hartmann and De Grahl, 2011; Yu, et al., 2017). Therefore this study focuses on flexibility, collaboration, and communication as the fundamental determinants of competitive advantages.

Flexibility between LSPs and customers is defined as a behavioral capability of LSPs to respond effectively and efficiently to unanticipated changing needs or special requests from customers (Ivens, 2005; Nagarajan, et al., 2013). Since the business environments in different industries are changing dramatically, and thereby the logistics service market has become very competitive, LSPs need to be able to demonstrate their flexibility in adapting to changes or requests from customers (Ford and Håkansson, 2013; Ivens, 2005; Nagarajan, et al., 2013).

Collaboration between LSPs and customers is becoming more of a necessity and has been emphasized in supply chain management literature as a key factor in forming successful customer relationships (Cao and Zhang, 2011; Hingley, et al., 2015; Qu and Yang, 2015). Collaboration between LSPs and customers is defined as the act of interacting and working together to achieve a specific logistics goal. Collaboration

involves relationship-specific assets and intense interactions. Such an involvement makes relationships between LSPs and customers closer, with more open communication, and more functionally interdependent, leading to a shared goal of creating beneficial outcomes for all participants. Therefore prior studies have identified multiple benefits of collaboration, such as knowledge sharing and creation, combinations of complementary capabilities, and operational efficiency (Cao and Zhang, 2011; Flynn, et al., 2010). For example, through collaboration, firms are able to access complementary resources in partner organizations and leverage these resources to enhance their core capabilities (Cao and Zhang, 2011; Dyer and Singh, 1998; Nelson Oly Ndubisi, et al., 2014).

Strong collaborative partnerships may create a high level of flexibility in logistics services (Chu, et al., 2012; Nagarajan, et al., 2013). Specifically, through close collaboration and intense interactions with customers, LSPs may get more information about customers' internal operations and the challenges in the markets, know better about emergent needs and special requests in logistics services, and thus invest in proper and effective areas to enhance flexibility by creating joint planning and joint problem solving to benefit customers (Chu, et al., 2012; Hartmann and De Grahl, 2011; Liao, et al., 2010; Sabath and Fontanella, 2002; Sezen and Yilmaz, 2007; Wong and Karia, 2010; Yu, et al., 2017). As a result, LSPs can plan accordingly or

invest in relationship-specific assets to acquire a greater capacity to satisfy sudden

changes of orders or special requests from customers, resulting in maintaining and

enhancing the relationship (Artz 1999). Indeed, prior studies (e.g., Liao, Hong and

Rao (2010) and Hartmann and de GrahL (2011)) support the positive relationship

between collaboration and flexibility. Thus we hypothesize the following:

H1. Collaboration with customers positively influences LSP flexibility capability.

Communication between LSPs and customers plays a key role in developing

collaboration and flexibility capabilities (Chu, et al., 2012; Yu, et al., 2017) and is

defined as the act of exchanging information and conveying intended messages

between LSPs and customers. Through communications with customers, LSPs obtain

more information and accumulate in-depth knowledge about corporate culture,

competitive strategy, processes of customer firms, and so forth. All the information

and knowledge obtained through communication help LSPs collaborate with

customers more effectively on jointly planning and forecasting logistics service needs

in the future and make proper suggestions to customers about appropriate logistics

service choices (Deepen, et al., 2008; Hartmann and De Grahl, 2011). Indeed, prior

studies have supported the relationship between communication and collaboration

(Anderson and Narus, 1990; Hartmann and De Grahl, 2011; Metcalf, et al., 1992).

Furthermore, the information and knowledge obtained through communication

also enable LSPs to better understand customers. This understanding can help LSPs plan and invest in necessary assets to flexibly respond to sudden changing needs and special requests in logistics services from customers (Sezen and Yilmaz, 2007; Yu, et al., 2017). Hartmann and de Grahl (2011) argue that without useful information, flexibility is difficult for LSPs to create. Hartmann and de Grahl (2011) provide empirical findings to support the positive relationship between information and the flexibility of firms. On the basis of the preceding arguments, we develop the following hypotheses:

H2. Communication with customers positively affects LSP collaboration capability.

H3. Communication with customers positively affects LSP flexibility capability.

2.3. The relationship marketing, dependence, trust and commitment

Since Morgan and Hunt (1994) proposed the well-supported commitment-trust RM model, many RM studies have used this model as the foundation of the framework. These studies have identified that dependence, commitment, and trust are all important to improve relationship quality (i.e., strength of relationship between buyers and sellers) (Kwon and Suh, 2004; Morgan and Hunt, 1999; Sirdeshmukh, et al., 2002; Spekman and Carraway, 2006).

In the context of logistics services, dependence between LSPs and customers can be regarded as the extent to which customers need to maintain relationships with

their outsourced LSPs to achieve the desired performance and flexibility in logistics operations (Frazier, 1983; Sukresna, et al., 2016). Tellefsen and Thomas (2005) argue that the existence of dependence occurs when dependent firms receive critical benefits from the relationship and/or cannot easily find alternative suppliers (Sezen and Yilmaz, 2007; Sukresna, et al., 2016; Tellefsen and Thomas, 2005). Because logistics outsourcing has become a trend and firms are more internally self-insufficient in logistics operation capability due to the lack of advanced logistics techniques and skilled personnel, firms are relying more on logistics services provided by LSPs. As a result, dependence has become crucial.

Trust between LSPs and customers is defined as the extent to which a firm is confident about its supply chain partners in the reliability and competence (Singh and Teng, 2016). Dependence between LSPs and customers may result in trust development, because dependence involves intensive interactions between LSPs and their customers (Sezen and Yilmaz, 2007). These interactions become more frequent when firms are confident in LSPs' capabilities (e.g., operational capability, flexibility, and collaboration) and believe LSPs will be beneficial for them (Gao, et al., 2005; Handfield and Bechtel, 2002; Wang, et al., 2015). This belief generated by dependence makes trust between LSPs and customers stronger. Prior studies have suggested that trust can be evaluated by two components: benevolence and credibility

(Doney and Cannon, 1997; Handfield and Bechtel, 2002). When firms have a high level of trust, the perceived risks will decrease while confidence may increase (Ganesan, 1994; Gao, et al., 2005). Therefore, to minimize risks, the dependent firm may intend to maintain or increase dependence and would not take risky actions to jeopardize its relationship with its trustable LSP (Handfield and Bechtel, 2002; Sezen and Yilmaz, 2007). Thus there is a positive relationship between dependence and trust. We posit the following hypothesis:

H4. Dependence of customers on LSPs positively affects their trust in LSPs.

Both dependence and trust between LSPs and customers are key antecedents of commitment (Andaleeb, 1996; Gao, et al., 2005; Jiang, et al., 2011; Morgan and Hunt, 1994). Commitment between LSPs and customers is defined as the extent to which a firm is willing to and agrees to utilize its resources (e.g., time, energy and human resources) to work with its supply chain partners (Dubey et al., 2017). When firms are highly dependent on LSPs (i.e., high level of dependence), the costs to switch to other LSPs will be high, making the firms more willing to work with the original LSPs (Jiang, et al., 2011; Morgan and Hunt, 1994). Therefore dependence is positively associated with commitment. Also, when trust is developed between LSPs and their customers, it may save time and effort for their customers in working with the LSPs, because customers will believe that their LSPs can fulfill their expectations.

For example, if a firm trusts an outsourced LSP, it is not necessary for the firm to monitor the LSP's behavior or set certain safeguards, which in turn leads to attachment and a desire to continue the relationship (Andaleeb, 1996; Jiang, et al., 2011), suggesting a positive relationship between trust and commitment. Thus we posit the following hypotheses:

H5. Trust in an LSP positively affects customer commitment.

H6. Dependence on an LSP positively affects customer commitment.

When LSPs are capable of a high level of flexibility, customers' trust is more likely to be developed, because flexibility is a crucial competitive capability today (Hartmann and De Grahl, 2011; Ivens, 2005; Wang, et al., 2015; Yu, et al., 2017). An LSP having this capability makes customers believe that the LSP can flexibly respond to their sudden changes and/or special request, which will fulfill their needs (Chang and Huang, 2012). As a result, if the LSP is capable of being flexible, trust is more likely to be formed (Ivens, 2005).Therefore we posit the following hypothesis:

H7. LSPs' capability to be flexible positively affects customer trust.

The collaboration between LSPs and their customers plays an important role in influencing both dependence and trust (Gao, et al., 2005; Handfield and Bechtel, 2002). If LSPs can engage in effective collaboration with their customers in forecasting, planning and arranging logistics service needs in an optimal manner,

customers are more able to plan and implement their routine and non-routine demands

in logistics operations efficiently (Ivens, 2005). Ultimately, customers become more

dependent on LSPs' services.

Moreover, through intensive and transparent collaboration, customers will get to

know their LSPs better with regard to corporate culture, processes, and attitude

toward the relationship (Ivens, 2005). When LSPs and customers understand each

other very well, trust will increase, suggesting a positive relationship between

collaboration and trust (Artz, 1999; Wong and Karia, 2010). Thus we posit the

following hypotheses:

H8. LSPs' capability to collaborate positively affects customer dependence.

H9. LSPs' capability to collaborate positively affects customer trust.

2.4. Conceptual model

In this study, we combine the viewpoints of both the RBV and RM theories to

develop an integrated model that can link flexibility and relationship quality. The

definition of all the constructs is summarized in Table 1. The proposed research model

is depicted in Figure 1.

Please Insert Table 1 Here

Please Insert Figure 1 Here

3. Research methodology

3.1. Sample and data collection

The population of this study is all LSPs in Taiwan. We had accessed to the largest database of yellow pages listings all the LSPs in Taiwan. A total of more than 500 LSPs had been identified. In an effort to enhance the generalizability of this study, an attempt was made to (1) randomly select our subjects and (2) increase the sample size. Therefore, simple random sampling was adopted.

Additionally, to obtain the valid responds, all the subjects were selected by using three criteria. First, LSPs need to locate in Taiwan due to the scope of this study. Second, all LSP subjects are reachable via phone and/or email so that we can contact them to collect data. Three, All LSP subjects still have customers and are running at the time of data collection because this study focuses on RM. Without customers, RM does not exist.

A total of 314 logistics managers from different companies in Taiwan were invited to fill out the questionnaires. The consent form has been given to and signed by subjects who confirm that the data provided is accurate and complete. We removed 5 responses because they were significantly incomplete, resulting in a sample size of 309.

To assure the content validity of the questionnaire, this study developed the questionnaire in five steps: (1) all measurement scales were adapted from existing

scales in the germane literature; (2) all measurements were translated into Chinese. Several dialects are spoken in Taiwan, including Mandarin, Taiwanese, Hakka, and aboriginal languages. We used Mandarin in this study, which is comprehensible to virtually all Taiwanese. (3) To secure conceptual equivalence, the original 22 items questionnaire was translated into Chinese by the authors who have received a doctoral degree in the United States, and was translated back into English by bilingual people who were blind to the original English version. (4) The comparison was made with the original version in terms of general meaning of the sentences, complexity levels, forms, semantic similarity of words. (5) corrections were made for the discrepancies to make sure the equivalence between the two language versions. The reliability and validity of the measurement scales are all considered in this study.

In the questionnaire, we first ask a respondent to provide certain basic background information about his/her company and identify the major LSP that the company purchased services from in previous year. The remaining question items regarding the research constructs are answered based on his/her perceptions about the LSP.

Table 2 shows the basic profile of the sample. Most of the subjects' companies were in the manufacturing industry (47.9%), followed by the trading industry (16.5%), the service industry (14.2%), the retail industry (9.4%), the wholesale industry (6.5%),

and other industries (4.9%); 0.6% had missing information. Since most of Taiwanese

LSPs are in the manufacturing industry, the sampling result is representative.

Additionally, approximately 80% of the companies were younger than 30 years old,

22.7% were less than 10 years old, 34.3% were between 11 and 20 years old, and

22.3% were between 21 and 30 years old. More than half of the companies were small

and medium enterprises with registered capital less than $1.6 million (47.6%) and

between $1.6 million and $3.2 million (15.9%). More than half of the companies had

fewer than 200 employees; 54.0% of them had fewer than 100 employees, and 13.9%

had between 101 and 200 employees.

<u>Please Insert Table 2 Here</u>

3.2. Measures

Measurement scales were adapted from existing scales in the germane literature.

The scale for communication was adapted from Deepen et al.'s (2008) four items, that

for flexibility was based on Hartmann and de Grahl's (2011) four items, and that for

collaboration was adapted from Sinkovics and Roath's (2004) four items. The scale

for dependence contains four items adapted from Kim and Hsieh (2003) study. The

scale for trust was adapted from the studies of Ganesan (1994) and Jiang, Henneberg

and Naude (2012). The five items used to measure commitment were adapted from

the scales in Ivens and Pardo's studies (2007). All items were seven-point Likert

scales ranged from 1 (strongly disagree) to 7 (strongly agree). To assure that all

questionnaire items are readable, one marketing scholar and one logistics manager in

the manufacturing sector were invited to comment on the draft of the questionnaire.

On the basis of their suggestions, we made adjustments to the wording of the

questionnaire to assure all items are readable. Table 3 shows all questionnaire items.

Please Insert Table 3 Here

4. Results

4.1. Reliability and validity

Confirmatory factor analysis was performed to assess the reliability and validity

of the measurement scales. The result indicates that the measurement model had a

good model fit with χ^2/d.f.=2.50, p<0.000, NFI=0.90, NNFI=0.93, RMR=0.069,

CFI=0.94, GFI=0.86, AGFI=0.82, and RMSEA=0.07. Note that the significant χ^2 can

be ignored due to its sensitivity to the sample size and large number of items (Bagozzi

and Yi, 1988).

The second item of the dependence construct (DEP2), the first item of the trust

construct (TRU1), and the last item of the commitment construct (COMM5) were

removed due to their poor factor loadings. As shown in Table 3, the Cronbach α

coefficients were all higher than 0.7 (ranging from 0.841 to 0.923), indicating a good

reliability of the measurement scales (Nunnally, 1978). In addition, the construct

composite reliabilities (CCRs) were above 0.6 (ranging from 0.843~0.925), indicating

a well-accepted reliability of the scales (Bagozzi and Yi, 1988; Fornell and Larcker,

1981). Moreover, table 3 shows that the standardized factor loadings were above the

recommended threshold value of 0.5 (Hair, et al., 2010), indicating convergent

validity of the measurement scales (Bagozzi and Yi, 1988).

Table 4 indicates that the average variance extracted (AVE) values for all scales

exceed 0.5, demonstrating a high degree of reliability and that the variance captured

by the construct was greater than the variance due to measurement error (Fornell and

Larcker, 1981). Furthermore, the square roots of the AVE values were higher than the

off-diagonal elements in the corresponding rows and columns, supporting the

discriminant validity of measurement scales and suggesting that all constructs in the

proposed model were adequate

<u>Please Insert Table 4 Here</u>

Collecting data through self-reported survey might cause common method bias

that inflates or deflates inter-correlations among construct measures. To inspect the

possible common method bias, a Harman's single-factor test was performed

(Podsakoff, et al., 2003). We used a single-factor confirmatory factor model by loading all questionnaire items into the only latent factor. Then we compared the fit of the measurement model against the fit of the single-factor model. The result shows that the single-factor model fit (χ^2= 2706.85 with $d.f.$ = 230) was significantly worse than the measurement model fit (χ^2= 539.7 and $d.f.$ = 215), suggesting that the common method bias is not a serious concern in this study (Podsakoff, et al., 2003).

4.2. Structural model estimation and hypothesis testing

Structural equation modeling (SEM) was used to test the proposed research model. The statistical software used in this study is LISREL 8.5. The model fitting process generated the following results: χ^2= 556.36, $d.f.$ = 221 ($\chi^2/d.f.$ = 2.517), GFI=0.86, AGFI=0.83, RMR=0.057, RMSEA=0.07, CFI=0.94, NFI=0.90, NNFI=0.93. All goodness-of-fit indices are above or below the recommended threshold values of a good model fit with the exception of GFI, which is a little lower than the recommended value of 0.90. Thus, overall the proposed research model fits the sample data well. Estimates of the path coefficients and the squared multiple correlations (R^2) of the endogenous constructs in the model are shown in Figure 2. The hypothesis testing results are summarized in Table 5. Except for H_6, all research hypotheses were statistically significant at an alpha of .05. The support of H_1 indicates that LSPs' good collaboration with customers positively enhances their flexibility in

helping their customers (β = .19, t = 2.63, p < .05). Moreover, the support of both H_2 and H_3 shows that LSPs' communication capability would positively lead to a high level of flexibility and collaboration capability (γ = .76, t = 12.21, p < .05 for H_2; γ = .65, t = 8.23, p < .05 for H_3).

H_4–H_6 reveal the relationships among the relationship quality elements of dependence, trust, and commitment. Dependence on LSPs was found to positively influences customers' trust in LSPs (β = .35, t = 6.13, p < .05). Also, H_5 was supported (β = .82, t = 11.28, p < .05), suggesting that when customers have a high level of trust in LSPs, their commitment to the relationship is strengthened. However, the impact of dependence on commitment (H_6) was insignificant at an alpha of .1.

H_7–H_9 are concerned with linking competitive capabilities of LSPs to perceived relationship quality. The support of H_7 indicates that flexibility capability may result in higher trust levels (β = .47, t = 7.03, p < .05). H_8 and H_9 were both supported (β = .51, t = 7.45, p < .05 for H_8; β = .21, t = 3.08, p < .05 for H_9), suggesting that the collaboration capability of LSPs could positively influence dependence and trust. The support of all three hypotheses confirms our proposition that competitive capabilities would enhance the effective implementation of a relationship marketing strategy, which in turn would lead to good relationship quality with customers in the long run.

Please Insert Table 5 Here

In sum, the findings indicate that RBV and RM are complimentary in the context of logistics services. RBV suggest that flexibility and collaboration between LSPs and customers are important to form competitive capabilities. RM theories suggest that trust, dependence and commitment between LSPs and customers are essential factors in relationship quality. The results of this study show that both flexibility and collaboration (i.e., RBV) positively influence trust and dependence (i.e., RM). Also, trust plays an important role in the research model and positively increase commitment between LSPs and customers. Therefore, all the factors together create a comprehensive model that explains the relationship for RBV and RM, and adds value to the literature by demonstrating the applicability of the observed relationships among LSPs.

5. Discussion and managerial implications

The findings proffer an integrated model to understand the influence of flexibility and collaboration on relationship quality in the context of logistics service industry. The support of the influences of communication on collaboration and flexibility asserts that enhancing communication capability is an important beginning step to implementing a successful relationship marketing strategy for LSPs. The influence of collaboration on flexibility was also supported, suggesting that, in

addition to communication capability, collaboration capability would also lead to flexibility capability in logistics service industry. In our analysis, the direct effect of communication capability on flexibility is .650, and the indirect effect through collaboration capability is .144 ($t = 2.63$, statistically significant at $\alpha = .05$), indicating that collaboration is a critical mediator between communication capability and flexibility capability.

5.1. The relationship between trust, dependence, and commitment

We found interrelationships among the three relationship quality elements of perceived trust, dependence, and commitment. Our findings show that dependence is positively associated with trust. This finding suggests that when the level of dependence is high, it is likely that LSPs' customers will trust them more. Moreover, the relationship between trust and commitment was also supported, suggesting that LSPs' customers are more willing to maintain the relationship when the customers are more confident with LSPs. However, inconsistent with previous studies' findings, dependence is not associated with commitment, implying that a high level of dependence does not lead to high commitment. A plausible explanation for this finding is that dependence on LSPs might come from different sources, such as a contract, lack of other LSPs, and/or other economic benefits provided by other competitors. When a contract is terminated, other LSPs may offer better economic

benefits, making customers switch to them. As a result, a high level of perceived

dependence does not guarantee a high level of commitment, resulting in an

insignificant relationship between dependence and commitment in logistics service

industry.

5.2. The relationship between competitive capabilities and relationship quality

Also of concern is the relationship between competitive capabilities and

perceived relationship quality. By combining the RBV and RM theories, this study

views critical competitive capabilities as key antecedents of relationship quality. The

results show that the influences of collaboration and flexibility on perceived trust

were both supported, indicating that both collaboration and flexibility positively

influence trust. These findings suggest that if LSPs can collaborate well with their

customers, the customers will gradually recognize the LSPs' professional ability and

believe that the LSPs always consider customers' interests, which in turn will increase

trust. Furthermore, in the dynamic business environment, customers are usually

subject to unanticipated changes in their business operations. If LSPs can be more

flexible in accommodating customers' unanticipated requests for logistics operation

changes by adjusting their resources and activities accordingly, the customers will

recognize the LSPs' professional ability, which in turn will also escalate trust. The

support of the impact of collaboration on dependence shows that collaboration may

result in higher dependence. By examining the path coefficients shown in Figure 2, we found that the total effect of flexibility on trust is .470, which is greater than that of collaboration on trust (.389), indicating that flexibility is a very important capability for LSPs.

5.3. Managerial implications

Our findings offer several important implications for LSPs. First, on the basis of the findings, communication between LSPs and their customers is the key driver in developing flexibility and collaboration capabilities. This finding implies that LSPs need to make their customers want to share useful information related to operations and logistics. Specifically, an LSP can create an information-sharing platform to simplify information exchange between the LSP and its customers. Also, the LSP can send field representatives to its customers' offices frequently to create an easy communication platform for the customers.

Second, flexibility plays an important role in forming customers' trust in logistics service industry. Therefore LSPs need to focus on handling unanticipated requests and/or dealing with the emergent needs of their customers. Third, to collaborate with customers more closely, LSPs should find a way to interact with customers more frequently. For example, they can hold meetings with their important customers on a regular basis to discuss the possibility of developing innovative

logistics services that benefit customers' business. Moreover, trust is one of the key determinants of commitment. Hence LSPs should raise customers' trust by providing relationship benefits and avoiding opportunistic behavior. Furthermore, LSPs may improve their flexibility and collaboration capabilities to boost customers' trust. Finally, though dependence does not directly influence commitment, it does indirectly impact commitment through trust. Thus, LSPs need to continuously improve their logistics service performance to escalate customers' switching costs.

5.4 Theoretical Implications

The contributions of this study are threefold. First, this study focuses on an important but previously neglected two theories in the context of logistic services: RBV and RM. This study advances the RBV and RM, and adds value to the literature by demonstrating the applicability of the observed relationships among LSPs, and by suggesting that these two theories are complementary in understanding the relationship between competitive capabilities and relationship quality. Second, although previous studies have examined the factors of collaboration, trust, dependence commitment, communication, and trust (e.g., Yu et al., 2017; Sukresna, et al., 2016), little research has been done to empirically test all these factors together in the same model in LSPs context. This study, therefore, fills this research gap by building the research model that considers flexibility and collaboration, trust and

commitment. The findings contribute to academia and to future research by aiding in understandings of the importance of both flexibility and collaboration in influencing trust and dependence. Finally, the present study also enhances previous studies' findings by delineating a more detailed role of trust. Specifically, the antecedents and consequences of trust have been found in this study. Both flexibility and collaboration positively influence trust, which in turn increases commitment.

5.4. Conclusion, limitations, and future research

This research mainly aims at the logistics service industry to understand the influence of flexibility and collaboration on the relationship quality elements of trust, dependence, and commitment. Drawing on the RBV and RM theories, a research model was developed and was tested using SEM. The results show the relationships among communication, collaboration, and flexibility capabilities and further confirm the relationships among the relationship quality elements. All hypotheses were supported, except for H_6, suggesting that collaboration and flexibility capabilities indeed are positively associated with relationship quality in the logistics service business context.

Although the findings of our study are informative, a few limitations bear mentioning. First, this study used a cross-sectional survey approach to collect data on all research variables. Compared with longitudinal data, cross-sectional data might not

be able to demonstrate completely the temporal sequence of the antecedents and consequences, which might result in spurious cause–effect inferences. Further research may be needed to design a longitudinal sampling plan that runs across business years or quarters. Second, the data were collected from logistics managers and employees in Taiwan. As a result, they cannot fully represent the global logistics service market. To better understand the applicability of the proposed model, a more representative sample that covers areas in different countries is required.

This study may serve as a preliminary investigation of the relationship between competitive capabilities and relationship quality for LSPs. We believe that this study provides a big picture of the relationship quality for LSPs and thereby hope that the findings may inspire further research to study deeper in related issues.

References

Andaleeb S.S., (1996), "An experimental investigation of satisfaction and commitment in marketing channels: The role of trust and dependence", *Journal of Retailing,* Vol. 72, No. 1, pp. 77-93.

Anderson J.C., and Narus J.A., (1990), "A model of distributor firm and manufacturer firm working partnerships", *Journal of Marketing,* Vol. 54, No. 1, pp. 42-58.

Artz K.W., (1999), "Buyer-Supplier Performance: The Role of Asset Specificity, Reciprocal Investments and Relational Exchange", *British Journal of Management,* Vol. 10, No. 2, pp. 113–126.

Bagozzi R.P., and Yi Y., (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science,* Vol. 16, No. 1, pp. 74-94.

Bandara S., Bandara S., Leckie C., Leckie C., Lobo A., Lobo A., Hewege C., and Hewege C., (2017), "Power and relationship quality in supply chains: The case of the Australian organic fruit and vegetable industry", *Asia Pacific Journal of Marketing and Logistics,* Vol. 29, No. 3, pp. 501-518.

Barney J.B., (1986), "Strategic factor markets: Expectations, luck, and business strategy", *Management Science,* Vol. 32, No. 10, pp. 1231-1241.

Cao M., and Zhang Q., (2011), "Supply chain collaboration: Impact on collaborative advantage and firm performance", *Journal of Operations Management,* Vol. 29, No. 3, pp. 163-180.

Chang K.-H., and Huang H.-F., (2012), "Using influence strategies to advance supplier delivery flexibility: The moderating roles of trust and shared vision", *Industrial Marketing Management,* Vol. 41, No. 5, pp. 849-860.

Chu P.-Y., Chang K.-H., and Huang H.-F., (2012), "How to increase supplier flexibility through social mechanisms and influence strategies?", *Journal of Business & Industrial Marketing,* Vol. 27, No. 2, pp. 115-131.

Davis D.F., Golicic S.L., and Marquardt A.J., (2008), "Branding a B2B service: Does a brand differentiate a logistics service provider?", *Industrial Marketing Management,* Vol. 37, No. 2, pp. 218-227.

Deepen J.M., Goldsby T.J., Knemeyer A.M., and Wallenburg C.M., (2008), "Beyond expectations: an examination of logistics outsourcing goal achievement and goal exceedance", *Journal of Business Logistics,* Vol. 29, No. 2, pp. 75-105.

Doney P.M., and Cannon J.P., (1997), "An examination of the nature of trust in buyer-seller relationships", *Journal of Marketing,* Vol. 61, No. 2, pp. 35-51.

Dubey, R., Altay, N., and Blome, C., (2017), "Swift trust and commitment: The missing links for humanitarian supply chain coordination?", *Annals of Operations Research*, https://doi.org/10.1007/s1047

Dyer J.H., and Singh H., (1998), "The relational view: Cooperative strategy and sources of interorganizational competitive advantage", *Academy of Management Review,* Vol. 23, No. 4, pp. 660-679.

Flynn B.B., Huo B., and Zhao X., (2010), "The impact of supply chain integration on performance: A contingency and configuration approach", *Journal of Operations Management,* Vol. 28, No. 1, pp. 58-71.

Ford D., and Håkansson H., (2013), "Competition in business networks", *Industrial Marketing Management,* Vol. 42, No. 7, pp. 1017-1024.

Fornell C., and Larcker D.F., (1981), "Structural equation models with unobservable variables and measurement error: Algebra and statistics", *Journal of Marketing Research,* Vol. 18, No. 1, pp. 382-388.

Frazier G.L., (1983), "On the measurement of interfirm power in channels of distribution", *Journal of Marketing Research,* Vol. 20, No. 2, pp. 158-166.

Ganesan S., (1994), "Determinants of long-term orientation in buyer-seller relationships", *Journal of Marketing,* Vol. 58, No. 2, pp. 1-19.

Gao T., Sirgy M.J., and Bird M.M., (2005), "Reducing buyer decision-making uncertainty in organizational purchasing: can supplier trust, commitment, and dependence help?", *Journal of Business Research,* Vol. 58, No. 4, pp. 397-405.

Hair J.F., Black W.C., Babin B.J., and Anderson R.E., (2010). *Multivariate data analysis: A global perspective*, Upper Saddle River, NJ: Pearson Prentice Hall, Place.

Handfield R.B., and Bechtel C., (2002), "The role of trust and relationship structure in improving supply chain responsiveness", *Industrial Marketing Management,* Vol. 31, No. 4, pp. 367-382.

Harker M.J., (1999), "Relationship marketing defined? An examination of current relationship marketing definitions", *Marketing Intelligence & Planning,* Vol. 17, No. 1, pp. 13-20.

Hartmann E., and De Grahl A., (2011), "The flexibility of logistics service providers and its impact on customer loyalty: An empirical study", *Journal of Supply Chain Management,* Vol. 47, No. 3, pp. 63-85.

Hingley M., Lindgreen A., and Grant D.B., (2015), "Intermediaries in power-laden retail supply chains: An opportunity to improve buyer–supplier relationships and collaboration", *Industrial Marketing Management,* Vol. 50, pp. 78-84.

Huemer L., (2012), "Unchained from the chain: Supply management from a logistics service provider perspective", *Journal of Business Research,* Vol. 65, No. 2, pp. 258-264.

Ivens B.S., (2005), "Flexibility in industrial service relationships: The construct, antecedents, and performance outcomes", *Industrial Marketing Management,* Vol. 34, No. 6, pp. 566-576.

Jiang Z., Henneberg S.C., and Naudé P., (2011), "Supplier relationship management in the construction industry: the effects of trust and dependence", *Journal of Business & Industrial Marketing,* Vol. 27, No. 1, pp. 3-15.

Kwon I.W.G., and Suh T., (2004), "Factors affecting the level of trust and commitment in supply chain relationships", *Journal of Supply Chain Management,* Vol. 40, No. 1, pp. 4-14.

Liao Y., Hong P., and Rao S.S., (2010), "Supply management, supply flexibility and performance outcomes: an empirical investigation of manufacturing firms", *Journal of Supply Chain Management,* Vol. 46, No. 3, pp. 6-22.

Lin Y., and Wu L.-Y., (2014), "Exploring the role of dynamic capabilities in firm

performance under the resource-based view framework", *Journal of Business Research,* Vol. 67, No. 3, pp. 407-413.

Metcalf L.E., Frear C.R., and Krishnan R., (1992), "Buyer-seller relationships: an application of the IMP interaction model", *European Journal of Marketing,* Vol. 26, No. 2, pp. 27-46.

Morgan R.M., and Hunt S., (1999), "Relationship-based competitive advantage: the role of relationship marketing in marketing strategy", *Journal of Business Research,* Vol. 46, No. 3, pp. 281-290.

Morgan R.M., and Hunt S.D., (1994), "The commitment-trust theory of relationship marketing", *Journal of Marketing,* Vol. 58, No. 3, pp. 20-38.

Nagarajan V., Savitskie K., Ranganathan S., Sen S., and Alexandrov A., (2013), "The effect of environmental uncertainty, information quality, and collaborative logistics on supply chain flexibility of small manufacturing firms in India", *Asia Pacific Journal of Marketing and Logistics,* Vol. 25, No. 5, pp. 784-802.

Nelson Oly Ndubisi P., Chong Tan Y., and Oly Ndubisi N., (2014), "Evaluating supply chain relationship quality, organisational resources, technological innovation and enterprise performance in the palm oil processing sector in Asia", *Journal of Business & Industrial Marketing,* Vol. 29, No. 6, pp. 487-498.

Nunnally J., (1978). *Psychometric methods,* New York: McGraw-Hill, Place.

O'Cass A., Ngo L.V., and Siahtiri V., (2015), "Marketing resource-capability complementarity and firm performance in B2B firms", *Journal of Business & Industrial Marketing,* Vol. 30, No. 2, pp. 194-207.

Olavarrieta S., and Ellinger A.E., (1997), "Resource-based theory and strategic logistics research", *International Journal of Physical Distribution & Logistics Management,* Vol. 27, No. 9/10, pp. 559-587.

Podsakoff P.M., MacKenzie S.B., Lee J.-Y., and Podsakoff N.P., (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology,* Vol. 88, No. 5, pp. 879.

Qu W.G., and Yang Z., (2015), "The effect of uncertainty avoidance and social trust on supply chain collaboration", *Journal of Business Research,* Vol. 68, No. 5, pp. 911-918.

Sabath R.E., and Fontanella J., (2002), "The Unfulfilled Promise of Supply Chain Collaboration ", *Supply Chain Management Review,* Vol. 6, No. 4, pp. 24-29.

Sezen B., and Yilmaz C., (2007), "Relative effects of dependence and trust on flexibility, information exchange, and solidarity in marketing channels", *Journal of Business & Industrial Marketing,* Vol. 22, No. 1, pp. 41-51.

Singh, A., and Teng, T.C., (2016), Enhancing supply chain outcomes through

Information Technology and Trust, Computer in Human Behavior, Vol. 54, pp. 290-300.

Sirdeshmukh D., Singh J., and Sabol B., (2002), "Consumer trust, value, and loyalty in relational exchanges", *Journal of Marketing,* Vol. 66, No. 1, pp. 15-37.

Spekman R.E., and Carraway R., (2006), "Making the transition to collaborative buyer–seller relationships: An emerging framework", *Industrial Marketing Management,* Vol. 35, No. 1, pp. 10-19.

Sukresna I.M., Hamilton J., and Tee S., (2016), "Channel relationships from the perspectives of manufacturers and their connecting distributors in Indonesia", *Asia Pacific Journal of Marketing and Logistics,* Vol. 28, No. 3, pp. 525-546.

Tellefsen T., and Thomas G.P., (2005), "The antecedents and consequences of organizational and personal commitment in business service relationships", *Industrial Marketing Management,* Vol. 34, No. 1, pp. 23-37.

Wallenburg C., (2009), "Innovation in logistics outsourcing relationships: proactive improvement by logistics service providers as a driver of customer loyalty", *Journal of Supply Chain Management,* Vol. 45, No. 2, pp. 75-93.

Wang H.-M.D., and Sengupta S., (2016), "Stakeholder relationships, brand equity, firm performance: A resource-based perspective", *Journal of Business Research,* Vol. 69, No. 12, pp. 5561–5568.

Wang M., Jie F., and Abareshi A., (2015), "Evaluating logistics capability for mitigation of supply chain uncertainty and risk in the Australian courier firms", *Asia Pacific Journal of Marketing and Logistics,* Vol. 27, No. 3, pp. 486-498.

Wernerfelt B., (1984), "A resource☐based view of the firm", *Strategic Management Journal,* Vol. 5, No. 2, pp. 171-180.

Wong C.Y., and Karia N., (2010), "Explaining the competitive advantage of logistics service providers: A resource-based view approach", *International Journal of Production Economics,* Vol. 128, No. 1, pp. 51-67.

Yu K., Cadeaux J., and Song H., (2017), "Flexibility and quality in logistics and relationships", *Industrial Marketing Management*, Vol. 62, pp.211-225.
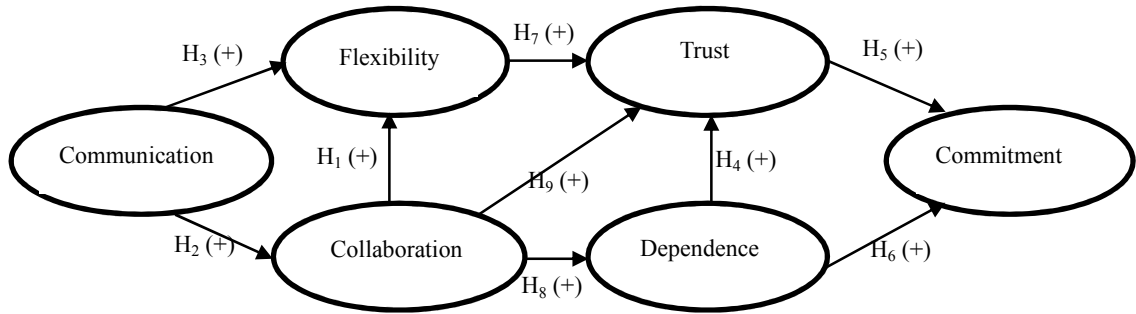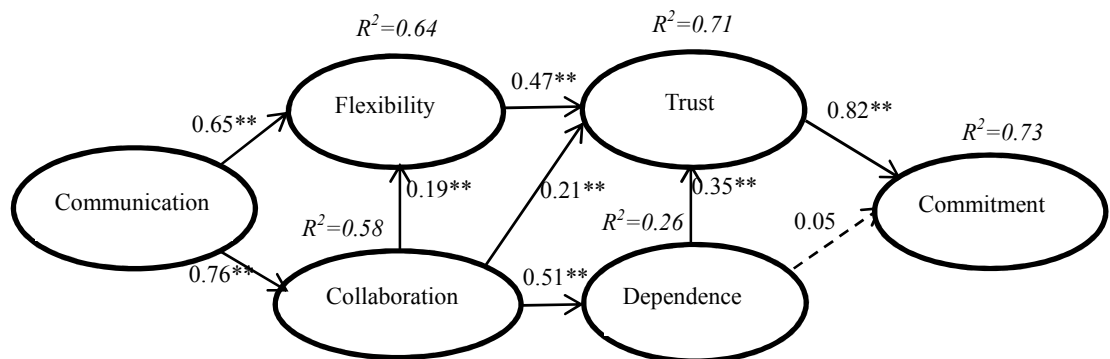
Fig. 1. Research framework.

Note: **p-value <0.05; dashed-line: non-significant path

Fig. 2. Estimates of the SEM model.

Table 1. Definitions of Constructs

Constructs	Definition	Literature
Flexibility between LSPs and customers	A behavioral capability of LSPs to respond effectively and efficiently to unanticipated changing needs or special requests from customers	Ivens (2005) Nagarajan, et al., (2013)
Collaboration between LSPs and customers	The act of interacting and working together to achieve a specific logistics goal.	Cao and Zhang (2011) and Flynn, et al., (2010)
Communication between LSPs and customers	The act of exchanging information and conveying intended messages between LSPs and customers.	Chu, et al., (2012) and Yu, et al., (2017)
Dependence between LSPs and customers	The extent to which customers need to maintain relationships with their outsourced LSPs to achieve the desired performance and flexibility in logistics operations.	Sukresna, et al., (2016)
Trust between LSPs and customers	The extent to which a firm is confident about its supply chain partners in the reliability and competence.	Singh and Teng (2016),
Commitment between LSPs and customers	The extent to which a firm is willing to and agrees to utilize its resources (e.g., time, energy and human resources) to work with its supply chain partners	Dubey et al., (2017)

Table 2. Profile analysis of the investigated sample.

Variable	Frequency	Variable	Frequency
Industry		**Capital (NT$)**	
Manufacturing	148 (47.9%)	< 50 million	147 (47.6%)
Trading	51 (16.5%)	50-100 million	49 (15.9%)
Service	44 (14.2%)	100 million -1 billion	66 (21.4%)
Retailing	29 (9.4%)	>$1 billion	44 (14.2%)
Wholesale	20 (6.5%)	*n.a.*	3 (0.9%)
Other	15 (4.9%)		
n.a.	2 (0.6%)	**Number of employees**	
		<100	167 (54.0%)
Year of business		101-200	43 (13.9%)
<10 years	70 (22.7%)	201-500	39 (12.6%)
11 - 20 years	106 (34.3%)	501-1000	14 (4.5%)
21 - 30 years	69 (22.3%)	>1000	40 (12.9%)
31 - 40 years	31 (10.0%)	*n.a.*	6 (2.1%)
41 - 50 years	14 (4.5%)		
> 50 years	10 (3.2%)	**Revenue last year (NT$)**	
n.a.	9 (3%)	< 50 million	87 (28.2%)
		50-100 million	50 (16.2%)
		100 -1000 million	93 (30.1%)
		>1000 million	76 (24.6%)
		n.a.	3 (0.9%)

Note: *n* = 309; NT$, new Taiwan dollars; US$1 =NT$32.4034 in 2015 on average; *n.a.* represents missing values.

Table 3. Summary measures from the confirmatory factor analysis.

Construct	Standardized Factor loadings	Cronbach's α	CCR[a]	AVE[b]
Communication(COMM)		0.923	0.925	0.758
The information exchange is working very well.	0.83			
The information exchange takes place in time.	0.88			
Both sides can fully rely on information exchanged.	0.90			
The way of information exchange is very suited for solving problems according to both parties' interests.	0.87			
Flexibility (FLE)		0.900	0.900	0.690
The LSP is flexible in response to requests we make.	0.84			
The LSP flexibly handles unanticipated problems.	0.83			
The LSP handles sudden service changes well.	0.86			
The LSP readily adapts to unforeseen changes in services.	0.79			
Collaboration (COL)		0.908	0.909	0.711
The LSP exploits unique opportunities in the market with us.	0.78			
We find synergistic ways to do business together.	0.87			
The LSP works together to develop new ideas with us.	0.86			
We continually share proprietary information mutually.	0.86			
Dependence (DEP)		0.841	0.843	0.644
The total cost of switching to a new LSP is prohibitive.	0.71			
Other LSPs couldn't provide comparable services. [c]	-[c]			
The benefits from this LSP are difficult to be replaced.	0.85			
We would suffer greatly if we lost this LSP.	0.84			
Trust (TRU)		0.892	0.898	0.686
The LSP's representatives are frank in dealing with us.	-[c]			
When making important decisions, the LSP is concerned about our welfare.	0.80			
The LSP responds with understanding when we share our problems with it.	0.89			
We can count on the LSP to consider how its decisions and actions will affect us in the future.	0.80			
We are confident with the LSP's ability to fulfil our agreements.	0.82			
Commitment(COM)		0.902	0.908	0.714
We intend to maintain our relationship with this LSP as long as possible.	0.93			
We try hard not to hurt the relationship with the LSP.	0.89			
We would to invest more into this relationship.	0.85			
Our cooperation with this LSP is frictionless.	0.69			
We don't seek for alternative LSPs at all. [c]	-[c]			

a: Composite Construct Reliability;

b: Average Variance Extracted;

c: Items are removed for further analyses based on the results of confirmatory factor analysis.

Table 4. Squared correlations between constructs and construct AVEs.

	(1)	(2)	(3)	(4)	(5)	(6)
Communication (1)	**0.758**					
Flexibility (2)	0.593	**0.690**				
Collaboration (3)	0.563	0.462	**0.711**			
Dependence (4)	0.240	0.102	0.250	**0.644**		
Trust (5)	0.608	0.490	0.504	0.384	**0.686**	
Commitment (6)	0.518	0.336	0.360	0.314	0.672	**0.714**

Table 5. Standardized path parameter estimates.

Path	Standardized Estimate	t-Value
Collaboration → Flexibility (H$_1$)	0.19	2.63[**]
Communication → Collaboration (H$_2$)	0.76	12.21[**]
Communication → Flexibility (H$_3$)	0.65	8.23[**]
Dependence → Trust (H$_4$)	0.35	6.13[**]
Trust → Commitment (H$_5$)	0.82	11.28[**]
Dependence → Commitment (H$_6$)	0.05	0.86
Flexibility → Trust (H$_7$)	0.47	7.03[**]
Collaboration → Dependence (H$_8$)	0.51	7.45[**]
Collaboration → Trust (H$_9$)	0.21	3.08[**]

χ^2= 556.36, *d.f.* = 221 (χ^2/*d.f.* = 2.517), GFI=0.86, AGFI=0.83, RMR=0.057, RMSEA=0.07, CFI=0.94, NFI=0.90, NNFI=0.93

[**] p-value < 0.05